HAMDARD UNIVERSITY BANGLADESH

EEE

Department of Electrical & Electronic Engineering

UNDERGRADUATE CALENDAR

2022

Faculty of Science, Engineering and Technology

HAMDARD UNIVERSITY BANGLADESH

Preface

Our previous departmental information booklet was published in 2012. Nine years have passed. In these years, Electrical and Electronic Engineering Technologies have advanced rapidly. A significant change in the technologies, inventions and applications demands awareness of the future generation. To cope with the rapidly changing scenarios in this field, updating the course curricula, expanding laboratory facilities and revising teaching and/or research materials are regular activities of EEE department. Despite being limited by financial and logistic resources, the department constantly tries to revise, renew and introduce courses so that our students remain at par with students of other standard universities in the world. The syllabus presented in this course calendar is the part of this ongoing change to meet the needs of present EEE students so that they can meet their carrier requirements in national and international forums.

The syllabus and the course offering listed in this catalog are prepared by the teachers of the department with the help, cooperation, and feedback from our alumni and some renowned faculties abroad. Course catalogs of many universities of USA, Canada, UK, Australia, Singapore, and India have been consulted in preparing the syllabus of this calendar. It is different from our previous syllabus in many aspects. Students can now choose their field of specialization from any of the four cluster of elective courses, i.e., Electrical Power, Electronics, Communication, and Intelligent System and Information Technology without sacrificing the fundamental and basic study of core courses of electrical and electronic engineering. As a result of this and other major changes in course contents, the laboratory materials have also been changed with more design-oriented classes having emphasis on both practical and simulation components. The department has developed many facilities for such changes to be incorporated effectively and effort is also underway to improve the situation further.

Previously the syllabus was designed for 143 credit hours. In this new updated syllabus, a total credit hour of 154.5 are to be achieved to obtain the bachelor degree from the department. Changes are made in teacher's profile of the department. After the approval of the Academic Council, the update of the syllabus is finalized. All the teachers of the department have contributed to update the contents of different courses. Moreover, Prof. Dr. Mofazzal Hossain has given us worthwhile direction for preparing the OBE curriculum.The editorial committee has paid extensive effort to revise and update the booklet. They deserve the special thanks from the department.

Students and relevant individuals are advised to be in touch with their advisors and the department office to learn about any change made by the department in any course and in the rules and regulations of the university.

Md. Salim Raza
Head, Department of Electrical and Electronic Engineering

January, 2022
Gazaria, Munshigonj-1510

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Outcome-Based Curriculum

Part A

1. **Title of the Academic Program:** Electrical and Electronic Engineering

2. **Name of the University:** Hamdard University Bangladesh

3. **Vision of the University:**

Hamdard University Bangladesh envisions fostering national development by establishing an excellent higher education institution responsive to society's need, actively contributing to knowledge and being able to develop capable leaders to face the challenges of the twenty-first century.

4. **Mission of the University:**

Mission 1: Development of enlightened human beings with appropriate knowledge and skills capable of transcending them into professionally sound and enthusiastic entrepreneurs contributing their respective shares to national, regional and global development in human welfare.

Mission 2: Creation and advancement of knowledge through teaching and research, and innovation in modern science and natural medicine and disseminate results for the welfare of the nation, in particular and the world, at large.

Mission 3: Culmination of the cultural values and rich heritage of Sonargaon, Vikrampur and Bangladesh with other cultures to promote world harmony and peace.

5. **Name of the Program Offering Entity (Department/Faculty/Institute):**
   Department of Electrical and Electronic Engineering

6. **Vision of the Program Offering Entity:**
   To produce skilled, knowledgeable and responsible Electrical and Electronic Engineers who can shoulder the needs and challenges of a sustainable society with integrity.

7. **Mission of the Program Offering Entity:**
   i. To provide quality engineering education by appointing competent faculty members.
   ii. To establish and maintain state-of-the-art facilities for the concurrent buildup of knowledge and hard skills.
   iii. To cater ethical values, leadership quality, sustainability and habit of life-long learning among the graduates.
   iv. To develop an effective industry-academia interface for the innovation and entrepreneurship.

8. **Objectives of the Program Offering Entity:** The specific objective of the EEE department are:

i. Develop the hard skills of the students in power system, renewable energy, electronics, VLSI, DSP and wireless communication.
ii. Develop the communication skills, ethical values, and concerns of environment and sustainability among the students.
iii. Work with alumni and industry to have their feedback for continuous quality improvement
iv. Motivate students for research, innovation and enterprenurship through life-long learning.

9. **Name of the Degree:** B.Sc. in EEE

10. **Description of the Program:**

Undergraduate Program

In the Hamdard University of Bangladesh for an undergraduate degree, two Programs have been designed; one for regular/day shift, and another for Evening shift. There are two semesters per year which are known as Spring and Fall. Overall there are eight semesters in total to earn 154.5 credits in achieving the Bachelor of Science in Electrical and Electronic Engineering. The curriculum covers the fundamental aspects of Electrical and Electronic technology, emphasizes basic principles and teaches the students the use of these principles to develop optimal design solution for real-life engineering problems. Importance is given on Mathematics, Physics, Chemistry, Economics, Basic Mechanical Engineering and Basic Electrical Engineering in the first year. The other three years are devoted to the Electrical Machines and Drives, Analog Electronics, Digital Electronics, Power Electronics, Electromagnetic Fields, Special Programming Techniques, Electrical Circuits, Electrical Measurement and Instrumentation, Power Transmission and Distribution, Control System Engineering, Communication Engineering, Switch Gear and Protection, Power Station and Economy, Microwave Engineering and Antenna Design, Microprocessors and Microcomputers, VLSI, Signal Processing and other recent topics of Electrical and Electronic engineering. In the last semester, each student is assigned to a project/industrial attachment to give the real-life industry exposures.

Postgraduate Program

At present, the department does not offer any postgraduate degree. But it is working relentlessly to open the program. The postgraduate course will be offered soon.

Research Facilities

The Department of Electrical and Electronic Engineering has many advanced instruments and equipment with laboratories for study of various Electrical and Electronic Engineering problems. At present Electrical and Electronic Engineering Department has following Laboratory facilities:

⇒ Electrical Circuit Lab
⇒Analog Electronics Lab
⇒ Digital Electronics Lab
⇒ VLSI Design Lab
⇒Measurement and Instrumentation
⇒ Microprocessor and Hardware Interfacing Lab
⇒ Power Electronics Lab
⇒ Power System Analysis Lab
⇒Digital Signal Processing Lab

Lab
⇒ Electrical Machine Lab
⇒ Communication Engineering Lab
⇒ Control Engineering Lab
⇒ Computer Language, Simulation and Numerical Processing Lab
⇒Embedded System Design and Robotics Lab

11. Graduate Attributes(based on need assessment):

The graduate attributes are narrower statements that describe what students are expected to learn during graduation. These attributes are related to knowledge, skills and attitudes that students acquire during their study period.It is anticipated that the B.Sc. in EEE program students will achieve the following graduate attributes during graduation.

i. Apply knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialization in solving electrical and electronic engineering problems.
ii. Design electrical and electronic engineering systems and components that meet specified needs using modern engineering and IT tools.
iii. Communicate effectively with relevant stakeholders with integrity and work in a culturally diverse multidisciplinary team.
iv. Engage in research, innovation, and entrepreneurship through the life-long learning.

12. Program Educational Objectives (PEOs):

PEO1	Graduates will be able to solve real field engineering problems by applying knowledge, hard skills, and knowledge of sustainability.
PEO2	Graduates will serve the nation with integrity, innovation, entrepreneurship through life-ling learning.
PEO3	Graduates will work in a multidisciplinary team and uphold the region's cultural heritageat home and abroad.

13. Program Learning Outcomes (PLOs):

PLO01	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO02	Identify, formulate, research literature & analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PLO03	Design solutions for complex engineering problems and design systems, components, or processes with appropriate consideration for public health and safety, cultural, societal, and environmental considerations
PLO04	Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PLO05	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering problems, with an understanding of the limitations.
PLO06	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems.

PLO07	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts.
PLO08	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PLO09	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PLO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO11	Demonstrate knowledge and understanding of engineering management principles and economic decision making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO12	Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

14. Mapping of mission of the university with PEOs:

PEOs	Mission 1	Mission 2	Mission 3
PEO1	√		
PEO2	√	√	
PEO3			√

15. Mapping of PLOs with the PEOs:

PLOs	PEO1	PE02	PE03
PLO1	√		
PLO2	√		
PLO3	√	√	
PLO4	√		
PLO5	√		
PLO6		√	
PLO7		√	
PLO8		√	
PLO9			√
PLO10		√	√
PLO11		√	
PLO12		√	

16. Mapping of courses with the PLOs:

Courses	PLO 01	PLO 02	PLO 03	PLO 04	PLO 05	PLO 06	PLO 07	PLO 08	PLO 09	PLO 10	PLO 11	PLO 12
General Education Courses (Group I: General Compulsory Courses)												
ENG 111					√					√		√
ENG 127	√	√			√	√			√			
BAN 211						√						
ACT 215										√	√	
MGT 417										√	√	
HUM 321						√		√				
HUM 217	√	√										
General Education Courses (Group II: Natural Science Courses)												
PHY 111	√	√										
PHY 121	√											
PHY 122					√					√		
CHE 215	√											
CHE 216					√					√		
General Education Courses (Group III: Mathematics)												
MAT 115					√				√	√		
MAT 125	√				√							
MAT 213	√											
MAT 217	√											
MAT 219	√				√							
MAT 323	√	√			√							
General Education Courses (Group IV: Interdisciplinary Courses)												
MEC112			√	√	√				√	√		
CSE 121	√	√										
CSE 122			√	√	√				√	√		
EEE 313	√	√	√									
EEE 314			√	√	√				√	√		
ENS 121						√	√					√
Core Courses												
EEE 111	√	√										
EEE 121	√	√	√		√				√	√		
EEE 122					√					√		
EEE 211	√	√	√		√				√	√		
EEE 213	√	√										
EEE 221	√	√	√		√				√	√		
EEE 222	√		√		√				√	√		
EEE 223	√	√										
EEE 224	√				√				√	√		
EEE 225	√		√		√				√	√		
EEE 227	√	√										
EEE 311	√	√										
EEE 312	√				√							
EEE 315	√	√	√	√	√				√	√		

EEE 316			√		√				√	√		
EEE 318			√	√	√				√	√		
EEE 321												
EEE 322			√	√	√				√	√		
EEE 323	√	√	√	√	√				√	√		
EEE 324			√		√				√	√		
EEE 325	√	√										
EEE 327	√	√										
EEE 328			√		√					√		
EEE 411	√	√	√		√				√			
EEE 412	√				√					√		
EEE 413	√	√										
EEE 415	√	√	√		√							
EEE 416			√	√	√				√	√		
Elective Course (Group I: Power Group)												
EEE 431	√	√										
EEE 432		√			√				√	√		
EEE 433	√	√	√		√							
EEE 434			√	√	√				√	√		
EEE 435	√	√										
EEE 437	√	√		√			√					
EEE 439	√	√	√	√	√							
EEE 441	√	√										
EEE 442	√									√		
EEE 443	√											
EEE 444	√											
EEE 445	√	√			√							
EEE 447	√	√	√		√		√					
EEE 449	√		√									
EEE 451	√	√	√		√				√	√		
EEE 452			√	√	√				√	√		
Elective Course (Group II: Electronics)												
EEE 453	√	√										
EEE 457	√		√									
EEE 458			√						√	√		
EEE 459	√	√										
EEE 461	√	√										
EEE 462	√	√	√	√	√							
EEE 463	√	√										
EEE 465	√	√										
EEE 467	√	√										
Elective Course (Group III: Communication)												
EEE 473	√	√										
EEE 474	√				√				√	√		
EEE 475	√	√	√	√	√				√	√		
EEE 477	√	√	√	√	√	√	√		√			
EEE 478			√		√				√	√		

EEE 479	√	√										
EEE 481	√	√										
EEE 483	√	√	√	√	√				√	√		
EEE 484			√		√				√	√		
EEE 485	√	√	√	√	√				√	√		
EEE 487	√	√										
EEE 489	√	√										
Elective Course (Group IV: Intelligent System and Information Technology)												
CSE 321	√	√										
CSE 323	√	√							√	√		
CSE 324			√	√	√				√	√		√
CSE 411	√											
CSE 412		√			√				√	√		
CSE 413	√	√										
CSE 415	√	√	√		√				√	√		
CSE 417	√	√	√									
CSE 419	√	√										
CSE 420	√	√	√		√				√	√		√
CSE 421	√	√										
CSE 423	√	√	√	√								
CSE 425	√	√	√		√							
CSE 426	√									√		

Part B

17. Structure of the Curriculum

a) **Duration of the program:**

Years: 4 Semesters: 8

b) **Admission Requirements:**

(i) For Regular Students

Every applicant, without any exception, must fulfill the admission requirements as laid by the University. A higher secondary certificate or its equivalent in Science with Mathematics and Physics is the basic educational requirement. Minimum qualifying GPA to be eligible to apply is 2.5 individually in SSC/’O' level or equivalent and HSC/’A' level or equivalent examinations. For 'O’ and ‘A’ level students, their Average B grade will be considered for admission. For all other foreign certificates, the University as per rules of the Bangladesh Government/University Grants Commission of Bangladesh will determine equivalent.

(ii) For Diploma Students

The Diploma (three/four years) students in the field of Electrical/Electronics/ Computer/Telecommunication/Power/Mechanical having Minimum CGPA of 2.5 (Average grade C+) may also get admission at the Evening section and will be consider as part time student. They will get Maximum 24 credits waiver from the General Education Courses (GEC) courses.

To apply for B.Sc. in EEE credit waiver, a student must have an average of C+ or better and courses must have been taken within the past 6 years. Student having (three/four years) Diploma in the field of Electrical/ Electronics/ Computer/ Telecommunication/ Power/ Mechanical having Minimum CGPA of 2.5 (Average grade C+) will get Maximum 24 credits waiver from General Education Courses (GEC) under this waiver policy.

(iii) For Credit Transfer Student

Credit transfer from an educational institution with a system similar to the University may be considered. Such candidates will have to apply with required documents and are subject to credit transfer rules of this University. The total credits transferred by a student from other universities will not exceed 50 credits for undergraduate program (B.Sc. in EEE).

c) **Total minimum credit requirement to complete the program:** 154.5 Credits
d) **Total class weeks in a semester:** 18 weeks
e) **Minimum CGPA requirements for graduation:** CGPA 2.5
f) **Maximum academic years of completion:** 6 years
g) Category of Courses:

i. General Education Courses:

General Education Courses (Group I: General Compulsory Courses)

Course Code	Course Title	Credits Hours
ENG 111	English For Technical Communication	3.0
ENG 127	Developing English Language Lab	1.5
BAN 211	History of Emergence of Bangladesh	3.0
ACT 215	Financial and Managerial Accounting	3.0
MGT 417	Industrial and Operational Management	3.0
HUM 321	Engineering Professional Ethics	3.0
HUM 127	Fundamental of Economics	3.0

General Education Courses (Group II: Natural Science Courses)

Course Code	Course Title	Credits Hours
PHY 111	Electricity and Magnetism	3.0
PHY 121	Optics, Modern Physics, Wave and Oscillation	3.0
PHY 122	Physics Lab	1.5
CHE 215	Chemistry	3.0

CHE 216	Chemistry Lab	1.5

General Education Courses (Group III: Mathematics)

Course Code	Course Title	Credits Hours
MAT 115	Differential and Integral Calculus	3.0
MAT 125	Linear Algebra and Complex Variables	3.0
MAT 213	Statistics and Probability	3.0
MAT 217	Ordinary and Partial Differential Equations	3.0
MAT 219	Coordinate Geometry and Vector Analysis	3.0
MAT 323	Numerical Analysis	3.0

General Education Courses (Group IV: Interdisciplinary Courses)

Course Code	Course Title	Credit Hours
MEC 112	Engineering Drawing	1.5
MEC 311	Mechanical Engineering Fundamentals	1.5
CSE 121	Structured Programming Language	3.0
CSE 122	Structured Programming Language Lab	1.5
EEE 313	Measurements and Instrumentation	3.0
EEE 314	Measurements and Instrumentation Lab	1.5
ENS 121	Environmental Science and Sustaianbility	3.0

ii. Core courses

Course Code	Course Title	Credit Hours
EEE 111	Electrical Circuits I	3.0
EEE 121	Electrical Circuits II	3.0
EEE 122	Electrical Circuits Lab	1.5
EEE 211	Electronic Circuits I	3.0
EEE 213	Energy Conversions I	3.0
EEE 221	Electronic Circuits II	3.0
EEE 222	Electronic Circuits Lab	1.5
EEE 223	Energy Conversions II	3.0
EEE 224	Energy Conversions Lab	1.5
EEE 225	Signals and Linear Systems Analysis	3.0
EEE 227	Electromagnetic Fields and Waves	3.0
EEE 311	Communication Theory	3.0
EEE 312	Communication Theory Lab	1.5
EEE 315	Digital Electronics	3.0
EEE 316	Digital Electronics Lab	1.5
EEE 318	Electrical and Electronic Circuit Simulation Lab	1.5
EEE 321	Power System I	3.0
EEE 322	Electrical Services Design	1.5
EEE 323	Digital Signal Processing	3.0

EEE 324	Digital Signal Processing Lab	1.5
EEE 325	Electrical Properties of Materials	3.0
EEE 327	Industrial and Power Electronics	3.0
EEE 328	Industrial and Power Electronics Lab	1.5
EEE 411	Microprocessor and Embedded System	3.0
EEE 412	Microprocessor and Embedded System Lab	1.5
EEE 413	Solid State Devices	3.0
EEE 415	Control Systems	3.0
EEE 416	Control Systems Lab	1.5

iii. Elective Courses

Elective Course (Group I: Power Group)

Course Code	Course Title	Credit Hours
EEE 431	Power System II	3.0
EEE 432	Power System Lab	1.5
EEE 433	Control Systems II	3.0
EEE 434	Control Systems II Lab	1.5
EEE 435	Electrical Power Transmission and Distribution	3.0
EEE 437	Power Plant Engineering	3.0
EEE 439	Advanced Electrical Machines	3.0
EEE 441	High Voltage Engineering	3.0
EEE 442	High Voltage Engineering Lab	1.5
EEE 443	Power System Protection and Reliability	3.0
EEE 444	Power System Protection and Reliability Lab	1.5
EEE 445	Power System Operation and Control	3.0
EEE 447	Renewable Energy	3.0
EEE 449	Smart Grid Power System	3.0

Elective Course (Group II: Electronics)

Course Code	Course Title	Credit Hours
EEE 451	VLSI Design	3.0
EEE 452	VLSI Design Lab	1.5
EEE 453	Analog Integrated Circuits	3.0
EEE 457	Digital System Design	3.0
EEE 458	Digital System Design Lab	1.5
EEE 459	Compound Semiconductor Devices	3.0
EEE 461	Biomedical Instrumentations	3.0
EEE 462	Biomedical Instrumentations Lab	1.5
EEE 463	Optoelectronics	3.0
EEE 465	Semiconductor Technology	3.0
EEE 467	Nano-science and Technology	3.0

Elective Course (Group III: Communication)

Course Code	Course Title	Credit Hours
EEE 473	Digital Communication	3.0
EEE 474	Digital Communication Lab	1.5
EEE 475	Antenna and Propagation	3.0
EEE 477	Microwave Engineering	3.0
EEE 478	Microwave Engineering Lab	1.5
EEE 479	Digital Signal Processing II	3.0
EEE 481	Digital Image Processing	3.0
EEE 483	Cellular and Optical Fiber Communication	3.0
EEE 484	Cellular and Optical Fiber Communication Lab	0.75
EEE 485	Radar and Satellite Communications	3.0
EEE 487	Telecommunication Engineering	3.0
EEE 489	Radio and Television Engineering	3.0

Elective Course (Group IV: Intelligent System and Information Technology)

Course Code	Course Title	Credit Hours
CSE 321	Computer Architecture	3.0
CSE 323	Computer Networks	3.0
CSE 324	Computer Networks Lab	0.75
CSE 411	Software Engineering	3.0
CSE 412	Software Engineering Lab	1.5
CSE 413	Intelligent System	3.0
CSE 415	Data Structure and Algorithm	3.0
CSE 417	Introduction to IOT	3.0
CSE 419	Artificial Intelligent	3.0
CSE 420	Artificial Intelligent Lab	0.75
CSE 421	Multimedia Communication	3.0
CSE 423	Simulation and Modeling	3.0
CSE 425	Web Programming	3.0
CSE 426	Web Programming Lab	0.75

iv. Capstone course/Internship/Thesis/Projects/Portfolio

Course Code	Course Title	Credit Hours
EEE 400	Thesis/ Project/Internship	6.0

18. Year/Level/Semester/Term wise distribution of courses:

1st Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 111	Electrical Circuits I	3.0	

MEC 112	Engineering Drawing	1.5	
MEC 311	Mechanical Engineering Fundamentals	1.5	
PHY 111	Electricity and Magnetism	3.0	
MAT 115	Differential and Integral Calculus	3.0	
ENG 111	English For Technical Communication	3.0	
HUM 127	Fundamental of Economics	3.0	
	Total :	***18.0***	

2nd Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 121	Electrical Circuits II	3.0	EEE 111
EEE 122	Electrical Circuits Lab	1.5	
CSE 121	Structured Programming Language	3.0	
CSE 122	Structured Programming Language Lab	1.5	
PHY 121	Optics, Modern Physics, Wave and Oscillation	3.0	
PHY 122	Physics Lab	1.5	
MAT 217	Ordinary and Partial Differential Equations	3.0	MAT 115
ENG 127	Developing English Language Lab	1.5	ENG 111
	Total :	***18***	

3rd Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 211	Electronic Circuits I	3.0	EEE 121
EEE 213	Energy Conversions I	3.0	EEE 121
CHE 215	Chemistry	3.0	
CHE 216	Chemistry Lab	1.5	
MAT 125	Linear Algebra and Complex Variables	3.0	MAT 115
MAT 219	Coordinate Geometry and Vector Analysis	3.0	MAT 115
BAN 211	History of Emergence of Bangladesh	3.0	
	Total :	***19.5***	

4th Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 221	Electronic Circuits II	3.0	EEE 211
EEE 222	Electronic Circuits Lab	1.5	
EEE 223	Energy Conversions II	3.0	EEE 213
EEE 224	Energy Conversions Lab	1.5	
EEE 225	Signals and Linear Systems Analysis	3.0	
EEE 227	Electromagnetic Fields and Waves	3.0	MAT 217
MAT 213	Statistics and Probability	3.0	EEE 121, MAT 219
HUM 321	Engineering Professional Ethics	3.0	

	Total :	***21.0***	

5th Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 311	Communication Theory	3.0	EEE 221, EEE 225
EEE 312	Communication Theory Lab	1.5	
EEE 322	Electrical Services Design	1.5	MEC 112, EEE 121
EEE 325	Electrical Properties of Materials	3.0	EEE 221
EEE 315	Digital Electronics	3.0	EEE 221
EEE 316	Digital Electronics Lab	1.5	
EEE 318	Electrical and Electronic Circuit Simulation Lab	1.5	EEE 121, EEE 221
MAT 323	Numerical Analysis	3.0	CSE 121, MAT 125
ACT 215	Financial and Managerial Accounting	3.0	
	Total :	***21***	

6th Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 321	Power System I	3.0	EEE 223, MAT 323
EEE 323	Digital Signal Processing	3.0	EEE 225
EEE 324	Digital Signal Processing Lab	1.5	
EEE 327	Industrial and Power Electronics	3.0	EEE 221
EEE 328	Industrial and Power Electronics Lab	1.5	
EEE 411	Microprocessor and Embedded System	3.0	EEE 315, CSE 121
EEE 412	Microprocessor and Embedded System Lab	1.5	
MGT 419	Industrial and Operations Management	3.0	
	Total :	***19.5***	

7th Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE 413	Solid State Devices	3.0	EEE 221, EEE 325
EEE 415	Control Systems	3.0	EEE 323, EEE 327
EEE 416	Control Systems Lab	1.5	
EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Lab: I/II/III/IV	1.5	

EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Lab: I/II/III/IV	0.75	
EEE ***	Technical Elective Lab: I/II/III/IV	0.75	
EEE 400	Thesis/ Project/Internship	3.0	
	Total :	***19.5***	

8th Semester

Course Code	Course Title	Credit Hours	Pre-requisite
EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Lab: I/II/III/IV	1.5	
EEE ***	Technical Elective Courses: I/II/III/IV	3.0	
EEE ***	Technical Elective Lab: I/II/III/IV	0.75	
EEE ***	Technical Elective Lab: I/II/III/IV	0.75	
EEE 400	Thesis/ Project/Internship	3.0	
	Total :	***18.0***	
	Grand Total	**154.5**	

*** All the students of the department will have to undertake Thesis/Project/ Internship in their field of specialization, and they have to submit their Thesis/Project/ Internship work in accordance with the regulation of Hamdard University Bangladesh.

Part C

19. Description of all courses of the program:

19(a). General Education Courses (Group I: General Compulsory Courses)

Course Code: ENG 111 Course Title: English For Technical Communication Credits: 3

Rationale of the Course:
This is an upper-intermediate level course where you will learn about the skills that are required for your development in learning English. The course **English For Technical Communication** is offered to the students requiring a semi-mastery level skill in reading, writing, speaking, and listening. The aim of this course is to provide knowledge of English language in terms of grammar, composition and spoken English.

Course Objectives:
The course objectives are to diagnose the students' level of English skills at the beginning. Then, the instructor will set the teaching method and technique to develop students' skills in English language. As the students are all from Science, Engineering and Technology faculty, the students' need will be focused during the time of teaching and learning.

Course Contents:
General discussion: Introduction, various approaches to learning English.
Grammatical Problems: Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.
Reading Skill: Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories.
Writing Skill: Principles of effective writing; Organization, planning and development of writing; Composition, precise writing, amplification.
General strategies for the writing process: Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.
Approaches to Communication: Communication today, business communication, different types of business communication.
Listening Skill: The phonemic systems and correct English pronunciation.
Speaking Skill: Practicing dialogue; Story telling; Effective oral presentation.
Report Writing: Defining a report, classification of reports, structure of a report, and writing of reports.

Course Learning Outcomes: At the end of the course the students will be able to

CLO1	**Define** Introduction, various approaches to learning English. **Understand** Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.
CLO2	**Explain** Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories. Principles of effective writing; Organization, planning and development of writing

CLO3	**Discuss** Composition, precise writing, amplification. Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.
CLO4	**Create** Communication today, business communication, different types of business communication. The phonemic systems and correct English pronunciation.
CLO5	**Identify** and **apply** Practicing dialogue; Story telling; Effective oral presentation. Defining a report, classification of reports, structure of a report, and writing of reports.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1												√
CLO2												√
CLO3										√		√
CLO4					√							√
CLO5												√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam/Viva Voce/ Presentation
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture	Assignment / Class Test/ Midterm Exam/ Final Exam

Course Code: ENG 127 Course Title: Developing English Skills Lab Credits: 3

Rationale of the Course:

This course is designed to equip students with the necessary skills to perform effectively and competently in the social and academic contexts. This is done through the integration of the four language skills (listening, speaking, reading and writing). The course focuses on enhancing the students' abilities to use the language by exploiting a variety of materials in varied situations. Appropriate consideration is given to the development of higher-level grammatical construction, vocabulary expansion and extensive reading activities which are intended to increase students' lexical density.

Course Objectives:

The course objectives are to analyze the students' level of English skills at the beginning. Then, the instructor will set the teaching method and technique to develop students' skills in English language. As the students are all from Science, Engineering and Technology faculty, the students' need will be focused during the time of teaching and learning.

Course Contents:

Grammar and Vocabulary:

- Tense, article, preposition.
- subject-verb agreement, clause, conditional and sentence structure.
- correct and precise diction, affixes.
- level of appropriateness. Colloquial and standard, informal and formal.

Listening:

- Listening for main ideas/ key information.
- Listening for specific details.
- Listening and understanding both implicit and explicit messages.
- Listening and responding to texts (i.e., following instructions, answering questions, reacting to texts, etc.).
- Listening and note-taking.

Speaking:

- Understanding social conventions (i.e., formal/informal speech, turn taking etc.).
- Guided conversations (involving different functions and situations, e.g., greetings, requesting, apologizing, etc.).
- Impromptu talks.
- Reporting news items.
- Role-plays and simulations.
- Preparing and presenting talks on a given theme.
- Interviews.
- Story telling.
- Informal debates and group discussions.
- Public speaking.

Reading:

- Reading strategies (skimming, scanning, predicting, inference, etc.).
- Speed reading.
- Active reading (highlighting, getting information from text quickly finding your way around texts noting key words, following main arguments, interacting with the text and summarizing).
- Reading to improve linguistic skills and expand vocabulary; understanding overall discourse to relate structure and meaning to the analysis and comprehension of the text.
- Extensive reading (reading outside class books selected by teachers).
- Reading journal articles.

Writing:

- Paraphrasing.
- Summarizing.
- Organizing an essay: thesis statement, Supporting sentences, logical order and conclusions.
- Writing essays following different modes of writing: argumentative essay and research essay.
- Business Letters: Sales Letter, Order Letter, Complaint Letter, Letter of Recommendation, Letter of Resignation.

Course Learning Outcomes: At the end of the course the students will be able to

CLO1	Pronounce speech sounds appropriately.
CLO2	Identify the distinct qualities of English phonology.
CLO3	Develop soft skills, such as oral presentation skills, communication skills, group discussion skills and interview skills thereby enhancing employability skills

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√			√	√						
CLO3									√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam/Viva Voce/ Presentation

Course Code: BAN 211 Course Title: History of Emergence of Bangladesh Credits: 3

Rationale of the Course:

History of Emergence of Bangladesh has been designed for the purpose of learning the entire history of Bangladesh, to understand present Bangladesh in the light of history and to provide them with basic knowledge of current politics and economy of the country in the focus of B.Sc. level students. This course will intensify students understanding of multifarious interconnection of historical events which lead to the formation of Bangladesh, current trend in political and economic development thereby improving critical thinking along with their written and oral communication skills, quantitative skills and technical literacy. It will also enhance their understanding of current phenomena in the light of history which will make them responsible global citizen.

Course Objective:
The course intends to equip students with factual knowledge and analytical skills that will enable them to learn and critically appreciate history, politics, and economy of Bangladesh. It will trace the historical root of Bangladesh as an independent state focusing on the social, economic and political developments that have taken place since its independence.

Course Content:

S/N	Content of Course
1	Sources of History, History in Nation Building, Ancient Geography and trade links with other world, Pala and Sena dynasties, Muslim conquest of Bengal, socio-economic and cultural changes, Unification of Bengal, The development of Bengali Language and Literature.
2	The independent Sultanate in Bengal, Bengal under the Mughals, The Nawabi Rule in Bengal (1700-1765). British CLOonial Rule and Response, Introduction of Zamindari system and its decline, changes of socio-economic condition, Resistance movements, English education and its impact.
3	Revival of statehood in Bengal, the growth of Indian National Congress, the creation of New Province of East Bengal and Assam, Muslim League (1906), Bengal Pact (1923).
4	Foundation of Awami League, Language Movement of 1952, United Front and Fall of Muslim League, the Military Rule of Ayub Khan, Economic Disparity between the two regions, cultural suppression of West Pakistan, 6-point Movement, Mass Upsurge in 1969, Rule of Yahya Khan, Election of 1970, the War of Independence and the Emergence of Bangladesh.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the history, geography, trade, socio-economic and cultural changes, Language and Literature, the independent Sultanate, Bengal under the Mughals, British CLOonial Rule and Response, Introduction of Zamindari system, Resistance movements.
CLO2	**Understand** the revival of statehood in Bengal, the growth of Indian National Congress, the creation of New Province of East Bengal and Assam, Muslim League, foundation of Awami League and Language Movement, Economic Disparity between the two regions, 6-point Movement, Mass Upsurge, Election of 1970, the War of Independence and the Emergence of Bangladesh

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1						√						
CLO2						√						

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Presentation/ Midterm Exam/ Final Exam

Course Code: ACT 215 Course Title: Financial and Managerial Accounting Credits: 3

Rationale of the Course:
Accounting is the process of organizing, analyzing, and communicating financial information that is used for decision-making. Financial information is typically prepared by accountants—those trained in the specific techniques and practices of the profession. This course explores many of the topics and techniques related to the accounting profession. While many students will directly apply the knowledge gained in this course to continue their education and become accountants and business professionals, others might pursue different career paths. However, a solid understanding of accounting can for many still serve as a useful resource. In fact, it is hard to think of a profession where a foundation in the principles of accounting would not be beneficial. Therefore, one of the goals of this course is to provide a solid understanding of how financial information is prepared and used in the workplace, regardless of your particular career path.

Course Objective:
The course has an objective to offer students the knowledge of the main financial and managerial accounting principles, concepts as well as the basic understanding of how financial statements are created and published. Moreover this course helps students progress and understand other finance-based courses, and make a solid foundation for further accounting based courses. It will give students a foundation of both financial and managerial accounting concepts.

Course Content:
Introduction: Definition of Accounting and Its Functions-Users of Accounting Data-The Work of an Accountant-Ethics in Financial Reporting-Generally Accepted Accounting Principles (GAAP)-Understanding of Accounting Principles: Accounting Concepts, Assumptions and Conventions-The Basic Accounting Equation/Balance Sheet Equation-Financial Transactions and their Effect on Accounting Equation -Understanding of Different Financial Statements and Summary of the Accounting Cycle. **The Recording Process:** The Account- Mechanics of Double-Entry Accounting-Transactions Illustrating the Rules of Debit and Credit-The Account and the Equation-Steps in the Recording Process-Meaning of Journal-Various Kinds of Journal-Journalizing Business Transactions-Meaning of Ledger–Importance of Ledger–Posting Mechanism–Accounts and their Balances-Definition of Trial Balance–Trial Balance and Accounting Accuracy-Preparation of Trial Balance. **Adjusting the Accounts and Preparing the Statements:** Need for Adjustments at the End of Accounting Period-Accrual Vs. Cash-Basis Accounting-Recognizing Revenues and Expenses-Types of Adjusting Entries-Adjusting the Accounts-The Adjusted Trial Balance-Preparing Statements from the Adjusted Trial Balance-The Adjustment Process-Cash Flow Statement-The Classified Balance

Sheet/Classification of Balance Sheet Items- Owner's Equity on the Balance Sheet. **Completing the Accounting Cycle:** Definition of Worksheet-Steps in Preparing Worksheet-Preparing Financial Statements from Worksheet-Preparing Adjusting Entries from a Worksheet-Preparing Closing Entries-Posting Closing Entries-Preparing Post-Closing Trial Balance. **Accounting for Merchandising Operations:** Merchandising Operations-Recording Purchases of Merchandise-Recording Sales of Merchandise-Completing the Accounting Cycle-Forms of Financial Statements: Multiple-Step and Single-Step Income Statements and Classified Balance Sheet-Determining Cost of Goods Sold Under a Periodic System-Periodic Inventory System- Classifying Inventories- Determining Inventory Quantities-Inventory Costing-Inventory Errors-Estimating Inventories-Worksheet for Merchandising Company. **Accounting Information Systems:** Basic Concepts of Accounting Information Systems-Computerized Accounting Systems vs. Manual accounting systems. **Accounting for Receivables:** Types of Receivables-Accounts Receivables-Notes Receivables-Statement Presentation and Analysis. **Accounting for Plant Assets, Natural Resources, and Intangible Assets:** Determining the Cost of Plant Assets-Depreciation-Depreciation Methods-Expenditures for Useful Life-Plant Assets Disposals-Exchange of Plant Assets-Natural Resources-Accounting for Intangible Assets. **Accounting for Current Liabilities and Payroll Accounting:** Accounting for Current Liabilities - Contingent Liabilities - Payroll Accounting.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the conceptual basis of accounting, the basic accounting rules for recording business operations, assets and liabilities, the methodology of preparing accounting reports, and the requirements for their contents.
CLO2	Explain the basic accounting rules for recording business operations.
CLO3	Analyze managerial accounting analytical tools for internal control, pricing and developing different budgets for financial planning purposes as well as to get essential skills in capital budgeting techniques.
CLO4	Compare between the profitability ratios and investment analysis

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2											√	
CLO3										√	√	
CLO4										√	√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam

CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: MGT 417 Course Title: Industrial and Operational Management Credits: 3

Rationale of the Course:

This course reviews the management of operations in manufacturing, service, and government organizations. Topics include a review of the activities and responsibilities of operations management, the tools and techniques available to assist in running the operation, and the factors considered in the design of the system.

Course Objective:

Develop an understanding of engineering costing and project management principles to help optimise business processes and boost productivity. Cultivate the specialist knowledge and entrepreneurial skills, coupled with human resource management or business finance concepts, to craft impactful global strategies that power the business of tomorrow.

Course Content:

Introduction: Introduction, evolution, management function, organization and environment. Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning. Personnel Management: Scope; Importance; Need hierarchy; Motivation; job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict. Cost and Financial Management: Elements of costs of products depreciations; Break-even analysis; Investment analysis; Benefit cost analysis. Management Accounting: Cost Planning and control; Budget and budgetary control; Development planning process; Project management; Network models for project time estimation; Estimation of confidence level; Simplex method for minimization of project time; Project effort analysis methods; Marketing Management: Concepts; Strategy; Sales promotion; Patent laws. Technology Management: Management of innovation and changes; Technology life cycle; Case studies.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the fundamentals of operations management.
CLO2	Explain the cost and financial management
CLO3	Analyze management accounting and project management.
CLO4	Compare between quantitative and qualitative analysis techniques to improve understanding of operations.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2											√	
CLO3											√	
CLO4										√	√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: HUM321 **Course Title:** Engineering Professional Ethics **Credit:** 3 Hours

Rationale of the Course:
The purpose of engineering ethics is to identify specific ethical issues that may arise in order to avoid a potential problem. Past ethical or technical issues can help engineers to learn from both previous failures and successes.

Course Objective:
This course will develop students' knowledge of professional and ethical responsibilities of engineers. The students will also be able to identify and deal with the morally complex situations integrated in their professional lives after the successful completion of course.

Course Content:
Definition of scope of ethics, different branches of ethics, social change and the emergence of new technologies, history and development of ethics, science and technology – necessity and application, study of ethics in engineering, applied ethics in engineering. Human quality of an engineer, obligation of an engineer to the clients, attitude of an engineer to other engineers, measures to be taken in order to improve the quality of engineering profession. Ethical expectations: Employers and employees, inter-professional relationship, professional organization, maintaining a commitment of ethical standards, desired characteristics of a professional code, institutionalization of ethical conduct.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Describe** and Classify the individual attitude and organizational behavior.
CLO2	**Interpret** the professional aspects of ethics from constitution
CLO3	**Debate** and Recognize conflicts in an ethical way at national and international level
CLO4	**Implement** the acquired knowledge of ethical skills in given situations by controlling his/her temperament

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1						√		√				

CLO2						√		√				
CLO3						√		√				
CLO4						√		√				

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exams
CLO4	Lecture Tutorial	Final Exams and Mini project

Course Code: HUM 217 **Course Title: Fundamentals of Economics** **Credits: 3**

Rationale of the Course:
this course aims to give knowledge of fundamental concept of economics and interrelates with the engineering and the economics subjects. This course provides knowledge necessary for the selection and control of a market.

Course Objective:
This course examines the basic concepts of economics. It also correlates between the engineering and economics. It's objective is also to enhance the management skill of an engineer.

Course Content:
Introduction to economics. Economics and engineering. Different economic systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus. Theory of production and cost. Theory of the firm and market structure. Optimization.

Introducing macroeconomics. National income accounting, the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision making. Fiscal policy and monetary policy- money and interest rate, income and spending.

Economics of development and planning.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**State** economics and **Explain** Economics and engineering relation and Different economic systems.
CLO2	**Discuss** Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus and **solve** Fundamental economic problems.
CLO3	**Examine** macroeconomics sectors and **solve** related mathematical problems.

CLO4	**Describe** Economics of development and planning.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture,Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture,Discussion	Final Exam, Class Test, Assignment.

19(b). General Education Courses (Group II: Natural Science Courses)

Course Code: PHY 111 **Course Title: Electricity and Magnetism** **Credits: 3**

Rationale of the Course:

Physics is a fundamental science that endeavors to explain all the natural phenomena that occur in the universe. Its power lies in the use of a comparatively small number of assumptions, models, laws and theories to explain a wide range of phenomena, from the incredibly small to the incredibly large. Physics has helped to unlock the mysteries of the universe and provides the foundation of understanding upon which modern technologies and all other sciences are based.

Course Objective:

The subject Physics evolved from an interesting laboratory experiment to a technology with applications in all aspects of life. In part 1 of this course, the basics of the Coulomb's Law, Gauss's law, Biot-Savart law, Maxwell's equation can be understood. In Part 2, we will use this framework to understand the Magnetism: such as The Hall Effect, Ampere's law, The Faraday's Laws of electromagnetic induction. In Part, we will learn Mechanics such as Motion along a straight line. In Part 4, we will focus our study on Modern Physics, especially on Quantum physics. Although much have changed in the last 20 years - Physics has been reached at a very advanced level- yet the simple but powerful concepts that you will learn in this introductory course will still provide you the background for your future study and experiments.

Course Content:

Introduction to Charge and Electricity: Introduction to Electricity, Charge, Conductors and Insulators, Coulomb's Law. **The Electric Field and Electric Potentials:** Gauss's law, Potential and Field Strength, Potential due to a dipole. **Capacitance and Dielectrics:** Energy stored in Electric Field, Poisson's Equation, Atomic view of Dielectric. **The Magnetic Field:** Magnetic force on a current, Ampere's Law, Biot-Savart law. Hall effect, Hall voltage, magnetic field in a current carrying coil. Faraday's Law, Lenz' Law, Maxwell'sequation. **Modern Physics:** Galilean relativity and Einstein' special theory of relativity; Lorentz transformation equations, Length contraction, Time dilation, Einstein law,related math, Photoelectric effect. **Quantum Physics:** Conception of Quantum physics, characteristics of Quantum physics, De Broglie equation, Heisenberg Uncertainty Principle, Schrodinger time independent equation, Probability for finding a particle along any axis.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** electricity, charge, Capacitance, Position and **Understand** various laws of physics like Coulomb's Law Gauss's law Ampere's Law, Biot-Savart law, Faraday's Law, Lenz' Law.
CLO2	**Apply** knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
CLO3	**Apply** the concepts of modern physics, Elementary quantum mechanics and nuclear physics to various fields of engineering.
CLO4	**Evaluate** typical simple and moderately complex problems of selected topics and of the linked topics of science/engineering courses.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: PHY 121 Course Title: Optics, Modern Physics, Wave and Oscoillation Credits: 3

Rationale of the Course:

Studying physics strengthens quantitative reasoning and problem solving skills that are valuable in areas beyond physics. Students who study physics or engineering physics are prepared to work on forefront ideas in science and technology, in academia, the government, or the private sector.

Course Objective:

The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses. ϖ Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, Waves in one dimension, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics. ϖ The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits. ϖ Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his career.

Course Content:

Oscillations: Oscillations, SHM, Two body oscillation, reduced mass, damped oscillation, forced oscillation, resonance, group and phase velocities. Optics: Reflection and Refraction: Smith-Helmholtz Equation and Langrange Law. Defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration. Interference: Fresnel bi-prism, interference in thin films, Newton's rings, interferometers, Diffraction: Diffraction from a circular aperture, resolving power of optical instruments. Polarization: Brewster's law, Malus law, polarization by double refraction . Thermal Physics: Heat & Thermodynamics: Heat, Thermal expansion, Heat and temperature, Absorption of heat by solids and liquids, First Law of Thermodynamics and its applications, Translational K.E, Distribution of molecular speeds, Molecular specific heats of an ideal gas, Degree of freedom, Maxwell's distribution of molecular speeds, Second law Thermodynamics, Thermodynamic functions, Maxwell relations, clausius and clapeyron equation.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Simple Harmonics Motion of the particles, concept of Two body oscillation, damped oscillations, resonances, , group and phase velocities.
CLO2	**Explain** different theories of light (Reflection, Refraction, Interference, Dispersion, Diffraction, Polarization).
CLO3	**Explain** Smith-Helmholtz Equation and Langrange Law, Defects of images, coma, distortion, curvature.
CLO4	**Explain** different Thermodynamics law and their applications, Maxwell's distribution of molecular speeds, Maxwell relations, Clausius and Clapeyron equation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture / Group Discussion	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: PHY 122 **Course Title: Physics lab** **Credits: 1.5**

Rationale of the Course:

The introductory physics laboratories have the following purposes and goals such as To provide an experimental foundation for the theoretical concepts introduced in the lectures, To familiarize students with experimental apparatus, the scientific method, and methods of data analysis so that they will have some idea of the inductive process by which the ideas were originated, To introduce the methods used for estimating and dealing with experimental uncertainties, including simple ideas in probability theory and the distinctions between random (statistical) and systematic "errors." The laboratory is not a contest whose object is to get the "right answer." The purpose is to learn how to gain knowledge by looking at reality, not an attempt to make reality conform to preconceptions.

Course Objective:

By the end of this course, students should be able to:

1. CLOlect data and revise an experimental procedure iteratively and reflectively,
2. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
3. Extend the scope of an investigation whether or not results come out as expected,
4. Communicate the process and outcomes of an experiment,
5. Conduct an experiment CLOlaboratively and ethically.

Course Content:

Experiment	Experiment Name
Experiment 01	Using Slide Caliper/ Vernier Calipers, measure the following: (a) Length of a metal sample in inch and centimeter and calculate the ratio between the CGS and FPS units (b) The volume of a Cylinder
Experiment 02	Using Slide Caliper/ Vernier Calipers, measure the following: (c) Volume of a metallic round Bob (d) Volume of a Cubic metal (e) Ratio between two spheres
Experiment 03	Using Screw Gauge, measure the following (a) Diameter, Radius and area of a metallic Wire (b) Diameter, Radius and area of a metallic Cylinder
Experiment 04	Using a simple pendulum, measure the following (a) Graph of Length versus squire of time period (b) Value of g
Experiment 05	Determine the spring constant of a spring
Experiment 06	Using the Searle's Apparatus, Calculate the following (a) Young's Modulus (Y) of a solid metallic wire (b) Rigidity Modulus (n) of a solid metallic wire (c) Poisson's Ratio of a short wires
Experiment 07	Using a Simple Balance, Measure the following: (a) Specific gravity of a sample heavier than water and insoluble in water (b) Specific gravity of a sample heavier than water and soluble in water
Experiment 08	Using a Simple Balance, Measure the following: (c) Specific gravity of a sample lighter than water and insoluble in water (d) Specific gravity of a sample lighter than water and soluble in water
Experiment 09	Using a Sono-meter, Measure the following: (a) Velocity of sound in a Laboratory in normal temperature using Tuning Fork and Vertical CLOumn (b) Velocity of sound in a Laboratory in different temperature using Tuning Fork and Vertical CLOumn
Experiment 10	Using a Sono-meter, Measure the following: (c) Variation of Frequency of a Tuning Fork using Sono-meter and hence find the unknown frequency of a tuning fork. (d) Verify the laws of transverse variation of a stretched string
Experiment 11	Using a Plane Mirror, Measure the following: (a) Verification of Snell's Laws of Reflection (b) Location of Image position of a sample by no-parallax tech
Experiment 12	Verification of Ohm's Law using (a) Ammeter-Voltmeter (b) Tangent Galvanometer
Experiment 13	Measurement of Unknown Resistance of a sample wire using (a) CLOor Code (b) Meter bridge (c) Digital meter (d) Analog meter Measurement of Resistively of a sample wire using Meter bridge
Experiment 14	Using a Spherical/Simple Glass Sample, Measure the following: (a) The relation between the focal length and radius of curvature using Spherical

	Mirrors (b) Verification of Total Internal Reflection using Plane Glass (c) Verification of Critical angle using Plane Glass Sample

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Verify** the theoretical laws of physics and determination of several physical parameters using hardware tools.
CLO2	**Write** comprehensive reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: CHE215 **Course Title: Chemistry** **Credits: 3**

Rationale of the Course:

Chemistry is specifically designed for students who are not pursuing a program to learn more about the physical, inorganic and organic parts. We investigate these interrelationships by studying the underlying processes in terms of their industrial pollution and chemistry.

Course Objective:

Chemistry has a huge part in electrical writing. We rely heavily on computers now-a-days in order to help us with our work. Silicon lies at the heart of today's ubiquitous computing technologies, but that was not always so. Vacuum tubes were once the cutting edge of electronics, essential components in early radios, televisions and even computers. Scientists had been interested in the peculiar characteristics of silicon and other semiconductors since the late 19th century. These materials were neither highly conductive metals nor non-conducting insulators, but somewhere in between - hence the name. Unlike metals, their resistivity did not increase with temperature. However, they did respond to exposure to light, even producing a current. They also had the peculiar ability to restrict an electric current to passing in one direction, transforming (or rectifying) AC current into DC current.

Course Content:

S/N	Content of Course
1	**Element, Atoms & Electrons**: Dalton's atomic theory, Millikan's experiment, Energy levels, Energy changes.. **Bohr's Model of Atom**: Energy levels, Orbits, Quantum numbers, Stationary states, Ground & Excited states. **The Aufbau Method and Electron Structures**: Aufbau method, Orbital energy, Pauli Exclusion Principle, Hund's rule.e

2	**Chemical Changes:** Physical & Chemical changes, Equations for chemical reactions, different types of reaction. **Acids, Salts and Bases**: Acids, salts and bases, PH-scale, ionic nature, chemical reactions, reaction characteristics of acid, salts and bases.
3	**The Mole**: Mole, Moles of compounds, moles & equations, the Empirical formulae & molecular formulae of compound, percentage compositions. **The Periodic Table**: Origin, modern concept, electronic structure and different groups of periodic table. **Periodicity of Physical Properties**: Periodicity of ionization energies, atomic volume, radius, valences, electro negativity, melting and boiling points. **Groups of Periodic table**: Nature of the elements and reactions of the different groups of the periodic table
4	**Alkanes and Cycloalkanes**: Isomerism in alkanes, Nomenclature of organic compound, alkyl group, Cycloalkanes, Stereoisomerism in cycloalkanes, **Alkenes & Alkynes**: Structure, nomenclature, physical properties, preparations and different reactions of alkenes, **Benzene and the Concept of Aromacity**: Different structure, Resonance energy, Nomenclature & sources of Aromatic hydrocarbons,

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Element, Atoms & Electrons, Bohr's Model of Atom, The Aufbau Method and Electron Structures
CLO2	**Analyze** Chemical Changes, molarity and normality, The Periodic Table and its Physical Properties, Groups of Periodic-table
CLO3	**Analyze** the covalent Bond and the Geometry of Molecules, Alkanes and Cycloalkanes, the Alkenes & Alkynes, Benzene, Atomicity

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam

Course Code: CHE216 **Course Title: Chemistry Lab** **Credits: 3**

Rationale of the Course:
The purpose of the laboratory component of the course is several-fold. It reinforces the material that the students have learned in class and it gives you a chance to apply your knowledge. The students will learn some important experimental techniques that are necessary for you to become an effective chemist.

Course Objective:
The objective of this course is to reinforce the understanding of some common laboratory concepts and techniques while gaining knowledge in data treatment by reporting. In the first part, it will cover an extensive range of titration methods which is based on acids and bases. And, in second part it will cover the determination of different elements from various compounds.

Course Content:

Experiment	***Topics***	***Hrs***	***CLOs***
Experiment 01	Standardization of Sodium Hydroxide (NaOH) solution with standard Oxalic Acid (HOOC-COOH.2H2O) solution.	2	CLO1, CLO2
Experiment 02	Standardization of Hydrochloric Acid (HCI) with standard Sodium Hydroxide (NaOH).	2	CLO1, CLO2
Experiment 03	Standardization of Hydrochloric Acid (HCI) with standard Sodium Carbonate (Na2CO3) solution.	2	CLO1, CLO2
Experiment 04	Standardization of Sodium Thiosulphate solution with a standard Potassium Dichromate solution	2	CLO1, CLO2
Experiment 05	Estimation of Copper Contained in Supplied solution by Iodometric Method.	2	CLO1, CLO2
Experiment 06	Determination of Ferrous Iron by a standard Potassium Dichromate solution	2	CLO1, CLO2
Experiment 07	Standardization of Potassium Permanganate (KMnO4) solution with standard sodium Oxalate (NaOOC-COONa) solution.	2	CLO1, CLO2
Experiment 08	Determination of Ferrous Ion in a solution by standard KMno4 solution.	2	CLO1, CLO2
Experiment 09	Determination of Na2CO3, content of washing Soda.	2	CLO1, CLO2
Experiment 10	Determination of Chromium in Chromium (III) Salt		
Experiment 12	Determination of Amonia in a Amonium Salt	2	CLO1, CLO2
Experiment 13	Determination of Organic Nitrogen (the Kjeldahl Procedure)	2	CLO1, CLO2
Experiment 14	Determination of Silver in a Silver Alloy	2	CLO1, CLO2

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.

CLO2	**Demonstrate** experiments based on titration based on acid and base as well as Determination of Ferrous Iron, Ferric and Copper from different compounds

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√					√		
CLO2					√					√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Experiment	Report writing
CLO2	Experiment	Report writing / Final Exam

19(c). General Education Courses (Group III: Mathematics)

Course Code: MAT115 Course Title: Differential and Integral Calculus Credits: 3

Rationale of the Course:
After completing this course, the Students will be able to know about differential and integral Calculus and be able to draw graphs of different curves. They will have the idea of differentiation and Integration. This will also lead the students to calculate area and volume of regular and irregular shape and enhance the student's ability to the entrance the deep course and knowledge of Mathematics. Mathematics is key to Engineering and Calculus is a key to Mathematics.

Course Objective:
Differentiation is an important concept in mathematics and, together with its inverse, Integration, is one of the two main operations in calculus. The principles of integration were formulated independently by Isaac Newton and Gottfried Leibniz in the late 17th century. Through the fundamental theorem of calculus, which they independently developed, integration is connected with differentiation. Integrals and derivatives became the basic tools of calculus, with numerous applications in science and engineering. This course contains what is integral and integration, different types of integration and their application in science & Technology. This course also describe about various coordinate system. Basically it will help us to know some related topics which is closely related to engineering science.

Course Content:
Function, Limit and Continuity: Functions, domain, range, odd, even, absolute value function, Limits, continuity. **Differentiability**: Successive differentiation of various types of functions, evaluation of indeterminate forms of L' Hospital's rule, Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders, Cauchy's form of remainders. **Partial Differentiation**: Expansion of functions, Partial differentiation, Euler's theorem. **Coordinates**: Tangent and normal, Subtangent and subnormal in cartesian and polar co-ordinates. **Application of derivatives**: Determination of maximum and minimum values of functions. Curvature. Asymptotes, Curve tracing. **Inegration as anti-derivative**: Integration by the method of substitution, Standard integrals, Integration by successive reduction. **Definite integrals:** properties and use in summing series, Walli's formulae. Improper integrals, **Beta function and Gamma function**. **Application of integration**: Area under a plane curve and area of a region enclosed by two curves in cartesian and polar co-ordinates, Volumes and surface areas of solids of revolution.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Function, basic rules of differentiation and integration, Beta Function and Gamma Function.
CLO2	**Apply** Derivatives applied in rate of change, geometrically and physically application field of derivatives.
CLO3	**Apply** Determination of area, volume of regular and irregular shape and of solid geometry.
CLO4	**Evaluate** Rolle's theorem, Mean value theorem, Leibnitz thorem, Taylor and Maclaurin's series and their real life application.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2					√							
CLO3									√	√		
CLO4									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: MAT 125 Course Title: Linear Algebra and Complex variables Credits: 3:00

Rationale of the Course:

Linear algebra is fundamental in modern presentations of geometry, including for defining basic objects. It is used in engineering, physics, mathematics, astrophysics, and many other fields. It provides powerful tools for doing mathematical analysis, and often yields pleasing and unanticipated answers.

Course Objective:

This course equip the students with methods of solving a general system of linear equations and familiarize them with the concept of Eigen values and diagonalization of a matrix which have many applications in Engineering. This helps to understand the basic theory of functions of a complex variable and conformal Transformations and determine harmonic conjugates, check for analyticity by Cauchy-Riemann equations. It also expands analytic functions in Taylor and Laurent series, Cauchy's Theorem and the Cauchy Integral Formulas to evaluate complex integrals.

Course Content:

System of Linear Equations: Linear equations, System of linear equations (homogeneous and non-homogeneous)and their solutions, Application of Matrices and determinants for solving system of linear equations. **Vector Spaces**: Notions of groups and fields, Abstract vector space, subspace. Sum and direct sum of sub spaces, Linear dependence, independence and combination of vectors. **Basis and Dimension of vector spaces.** Row and CLOumn space of a matrix; rank of matrices. Solution spaces of systems of linear equations. **Linear Transformations**: Linear transformations. Kernel and image of a linear transformation and their properties Rank and Nulity of a linear transformation, Matrix representation of linear transformations. **Eigen values and Eigenvectors:** Eigen values and eigenvectors. Diagonalization. **Derivatives:** Limit continuity and differentiability of functions of a complex variable, analytic functions and their properties, harmonic functions. **Complex integrals:** Line integral over rectifiable curves, Cauchy’s theorem for simple contours, Cauchy’s integral formula, theorems of Liouville and Morera, fundamental theorem of algebra. Zeros, singularities, poles, and residues. Taylor’s and Laurent’s series, expansion of functions. Cauchy’s residue theorem.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** basis, dimensions, image, kernel, nullity, rank of matrix, linear transformations, singularities, analytic function, harmonic function, conformal mapping, zeros, poles, essential singularity etc. Understand system of linear equations, how to diagonalize a matrix, represent linear transformations by matrices and vice- versa.
CLO2	**Apply** Cauchy's Theorem and the Cauchy Integral Formulas to evaluate complex integrals.
CLO3	**Apply** characteristic polynomials to compute eigenvalues and eigenvectors.
CLO4	**Evaluate** real definite Integrals as application of Residue Theorem.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√				√							
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Class Test / Final Exam

Course Code: MAT 213 **Course Title: Statistics and Probability** **Credits: 3:00**

Rationale of the Course:
This course is designed to provide fundamental concepts of statistics and basic concepts of probability, probability distribution. Also this course describes the sampling technique, Index number, Survey Methodology and statistical hypothesis testing to test the validity of data.

Course Objectives
This course provided some elementary ideas about the basic concepts in statistical theory and probability theory with their applications. In part 1 of this course, the basics of the statistical data, data description, statistical measures and measures of dispersion can be understood. In Part 2, we will use this framework to understand the Measures of Dispersion, Linear Regression & Correlation, Sampling and Test of Significance. In Part 3, we will learn the fundamental probability concepts, theory of distribution of random variables, the concept of Bayes’ theorem, Probability distribution and Survey Methodology. In Part 4, we will discussed include displaying and describing statistical inference, confidence intervals and hypothesis tests with applications in the real world, Forecasting and Time series Analysis, Index Numbers. The

objective of this course is to provide an understanding for the undergraduate science and engineering students. After taking this course, students will be able to use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, to perform simple and sophisticated analyses for large samples.

Course Contents:

Introduction: Meaning and scope, variables and attributes, CLOlection, source of data, methods of data CLOlection, level of measurements, Nominal, ordinal, interval & ratio level data and the presentation of statistical data.

Data description: Constructing a Frequency Distribution, class interval and midpoints, Relative frequency distribution, graphical presentation, Histogram, frequency polygon.

Statistical Measures: Introduction, the population means, the sample mean, arithmetic mean, weight mean, the median, the mode, the Geometric Mean, median and mode of a grouped data.

Measures of Dispersion: Introduction, measure of dispersion, range, mean deviation, variance and standard deviation.

Linear Regression & Correlation: Introduction, coefficient of correlation**,** the coefficient of determination, testing, linear correlation, measures of correlation and significance of correlation coefficient, Regression Analysis, least Square principles drawing the regression line, the standard error of estimate.

Sampling and Test of Significance: Population and sample, Census and sampling, Methods of sampling, Sampling error and non-sampling error, Test of hypothesis, Null hypothesis, Different types of tests and tests of significance.

Probability: Definition of probability and related concepts, Laws of probability, Discrete and random variables, Mathematical expectations, Conditional probability, Joint probability, Function and probability density function, Marginal density function.

Probability distribution: Probability distribution and expectations, Discontinuous probability distribution, e.g. Binomial, Position and negative binomial, Continuous probability distributions, e.g. normal and exponential, Stochastic processes, Discrete time, Markov chain and continuous time Markov Chain, Birth-death process in queuing.

Survey Methodology: Purposive, simple random and stratified random sampling, Introduction to systematic, Two stage cluster and double sampling, Ratio and regression methods of estimation. Forms and schedules of statistical inquiry.

Demography: Birth and death rates, Growth rates, Components of population growth rates, Migration population projection, Life table, Construction of life table.

Forecasting and Time series Analysis: Introduction, components of time series, Time series analysis, Trend projection methods.

Index Numbers: Introduction, Types of index number, Weighted and Un-weighted indices, chain index, CPI, TRT, FRT.

Course Learning Outcomes: At the end of the Course, the Student will be able to:

CLO1	**Define** primary and secondary data, Frequency distribution, mean, median and mode, probability, discrete and continuous random variables, Conditional and joint probability distribution and Understand various Figure of statistical data, basic statistical concepts and measures, the basic knowledge on fundamental probability concepts, including random variable, probability of an event, additive rules and conditional probability and perform hypotheses testing.
CLO2	**Apply** the concepts of mean, median and mode, quartile deviation, mean deviation, Standard deviation, Box plot, Karl Pearson’s and Bowley’s coefficient of Skewness.

CLO3	**Apply** the concepts of probability independents and depends events, Bayes' Theorem, Binomial, Poisson and normal distribution, Moment generating function, some sampling Distributions, Test of Significance such as Hypothesis testing, Coefficient of rank correlation, Forecasting Methods, Components of Time Series, trend equation, Types of Index Numbers such as Unweighted, weighted, Laspeyre's, Fisher's, etc.
CLO4	**Evaluate** typical simple and moderately complex problems of selected topics and of the linked topics of all science and engineering courses.

Mapping of Course Learning Outcomes to Program Learning Outcomes:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture/ Group Discussion	Class Test /Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Assignment/ Class Test / Final Exam

Course oCde: MAT 217 Course Title: Ordinary and Partial Differential Equations Credits: 3

Rationale of the Course:

Ordinary and partial differential equations is a branch of Applied Mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Along with fields like engineering physics and engineering geology, both of which may belong in the wider category engineering science, engineering mathematics is an interdisciplinary subject motivated by engineers' needs both for practical, theoretical and other considerations out with their specialization and to deal with constraints to be effective in their work. Historically, this course consisted mostly of applied analysis, most notably: differential equations; ordinary differential equation, and partial differential equations.

Course Objective:

The subject Ordinary and Partial Differential Equations Students should learn a particular set of mathematical facts and how to apply them; more importantly, such a course should teach students how to think logically and mathematically. To achieve these goals, this text stresses mathematical reasoning and the different ways problems are solved. Students will be able to apply the concepts and methods described in the syllabus. They will be able to solve problems using the differential equation. They will know a number of applications. The text and class discussion will introduce the concepts, methods, applications, and logical arguments. Students will practice them and solve problems on daily assignments, and they will be tested on quizzes, midterms, and the final.

Course Content:

Ordinary differential equations and their solutions: Classification of differential equations, Solutions, Implicit solutions, Singular solutions, Initial value problems, Boundary value problems, Direction fields, Phase line.

Solution of first order equations: Variables separable equations, Linear equations, Exact equations, Special integrating factors, Homogenous equations.

Modelling with first order ordinary differential equation: Construction of differential equations as mathematical models (exponential growth and decay, heating and cooling, mixture of solutions, series circuit, logistic growth, chemical reaction, falling bodies).

Solution of Higher-order linear ordinary differential equation: Linear differential equations. Basic theory of linear differential equations, Solution space of homogeneous linear equations, Homogeneous linear equations with constant coefficients.

Modeling with second- order equations: Vibration of a mass on a spring, free and un-damped motion, free and damped motion, forced motion, electric circuit problems, motion of a rocket.

First order partial differential equations: Methods for finding general solutions, constant-coefficient advection equation, liner and quasi-linear equations, IVP for conservation laws and applications.

Second order partial differential equations: General equations and classifications, constant coefficient equations. Methods of solutions: separation of variables. Two dimensional heat and wave equations.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** Differential equation, Ordinary differential equation, Partial differential equation, Formation of differential equation, Formation of partial differential equation.
CLO2	**Apply** Separation of Variables, Homogenous equation, Equation reducible to homogenous, Exact equation, Linear Equation, Reducible to Linear Equation, Linear Differential Equations with Constant Coefficients, Linear Differential Equation with right-hand side non zero, Variation of parameter, Method of Successive approximation to solve ordinary differential equation.
CLO3	**Apply** Linear and Non-Linear first-order equation, Standard forms, Linear Equation of higher order, Partial Differential Equations with Constant Coefficients, Equation of second order with variable coefficients, Particular solution with boundary and initial conditions to solve partial differential equations.
CLO4	**Evaluate** mathematical models of physical systems, CR circuit, Wave equations, Boundary value problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: MAT219   Course Title: Coordinate Geometry and Vector Analysis   Credits: 3

Rationale of the Course:

Coordinate Geometry and vector analysis combines the number and shape. In algebra we have 1^{st}, 2^{nd} and higher order equations which have geometrical shape. Geometrical problem can be solved by algebra and algebraic problem can be solved by geometry. So geometrical conception is essential for engineering students. Also the purpose of the course is to provide an understanding of the basic relations of vector analysis, to demonstrate practical applications of vector analysis and to train the engineering student in problem formalization and in methods of solution.

Course Objectives

Geometry etymologically means measurement of earth thanks to the Greeks. It is a branch of mathematics concerned with questions of shape, size, relative position of figures, and the properties of space. Geometry arose independently in a number of early cultures as a practical way for dealing with lengths, areas, and volumes. This course will cover the study of plane Euclidean and coordinate geometry. We will start with a discussion of the fundamental concepts of geometry, which include the properties of points, lines, planes, and angles. Then we will cover inductive and deductive reasoning and how theorems are proved and emphasis will be placed on developing critical thinking skills as they relate to logical reasoning and argument. We will start with a discussion of the fundamental concepts of geometry, which include the properties of three-dimensional Cartesian coordinates, Rectangular, Cylindrical and Spherical coordinates, plane, straight line, sphere, cylinder and cone, coincide. Topics to be covered in this course include, basic vector, coordinate bases, gradient, divergence, and curl, Green’s, Gauss’ and Stokes’ theorems.

Course Content:

Co-ordinates: Cartesian and polar co-ordinates, Transformation of co-ordinates, Translation and rotation of axes, invariants.

Pair of straight lines: General equation of second degree and reduction to standard forms, Properties of pair of straight lines.

General equation of Second degree: Reduction of general equation of second degree to standard form and identification of conic. Polar and parametric equations of conic, Poles, Polars, Chords in terms of middle points, Direction Circle, Eccentric angles and conjugate diameters of conic.

Circles: System of circles, General properties, orthogonally of two circles, limiting circle, radical axis, co-axial circles.

Co-ordinate system: Co-ordinate systems in three dimensional case, Direction cosines and direction ratios, Projection, Angles between two lines.

Plane: Equations of planes, different form of planes and conversions, Angle between two planes and distance of a point form a plane. Equation of sphere, a plane and a sphere, a line and a sphere, plane of contact, tangent planers, polar planes, angle of intersections of two spheres, condition of orthogonally, radical line, plane and centers, co-axial spheres.
Straight line: Equation of lines, relationship between planes and lines, shortest distance between two straight lines.
Applications of Vectors to geometry: Definition of vector, Addition and subtraction of vectors, Dot and cross product of vectors, Vector applications to geometry and mechanics, Vector triple and multiple products. Definition of line, surface and volume integrals.
Vector Calculus: Differentiation of vectors with application, Gradient of a scalar function, Divergence and curl of a vector function, Physical signification of gradient, divergence and curl.
Vector Integral: Line, Surface and Volume Integrals over the fields, Integral forms of Gradient, Divergence and Curl, Vector integration, Independent of path, Green's theorem, Gauss's divergence theorem, Stokes theorem and their applications. Curvilinear coordinates.

Course Learning Outcomes: At the end of the Course, the Student will be able to:

CLO1	**Define** Cartesian and polar co-ordinates, System of circles, Direction cosines and direction ratios, Dot and cross product of vectors, Gradient, divergence and curl, Line, Surface and Volume Integrals.
CLO2	**Understand** the translation and rotation of axes, General equation of second degree and reduction to standard forms, relationship between planes and lines, Vector applications to geometry and mechanics. Differentiation of vectors with application.
CLO3	**Apply** the concepts of translation and rotation of axes, reduction to standard forms, Properties of pair of straight lines, General properties, orthogonally of two circles, Parabola, Ellipse and hyperbola.
CLO4	**Apply** the Projection, Angles between two lines, Angle between two planes and distance of a point form a plane. Equation of sphere, shortest distance between two straight lines, Integral forms of Gradient, Divergence and Curl, Vector integration, Independent of path
CLO5	**Evaluate** Physical signification problem of gradient, divergence and curl and moderately complex problems of selected topics and of the linked topics of all science and engineering courses.

Mapping of Course Learning Outcomes to Program Learning Outcomes:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√				√							
CLO3	√				√							
CLO4	√				√							
CLO5	√				√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture/ Group Discussion	Class Test /Assignment / Midterm Exam

CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Assignment/ Class Test / Final Exam
CLO5	Lecture	Final Exam

Course Code: MAT323 **Course Title: Numerical Analysis** **Credits: 3**

Rationale of the Course:
Numerical analysis is a technique by which the mathematical problems are formulated, so that can be solved with arithmetic. Numerical analysis is the branch of mathematics that is used to find approximations to difficult problems such as finding the roots of non-linear equations, interpolation, numerical differentiation and integration and numerical solutions of the differential equations. Most of the Mathematical problems that arise in science and engineering are very hard and sometime impossible to solve exactly. Thus, an approximation to a difficult Mathematical problem is very important to make it easier to solve. This course is studying the use of Numerical Analysis in modelling and simulation of engineering process.

Course Objective:
The course Numerical Analysis is a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. In part 1 of this course, the basics of the functions, operators, non-linear equations, system of linear equations, differential equations, and integration can be understood. In Part 2, we will use this concept to understand the numerical techniques. In Part 3, student will learn these numerical methods to find the roots of non-linear equations, numerical solutions of ordinary and partial differential equations and solution of system of linear equations, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods. In Part 4, we will focus our study to apply the appropriate numerical techniques for real life problem, interpret the results, and assess accuracy.
To enhance the problem solving skills of engineering students using an extremely powerful problem solving tool namely numerical methods. The tool is capable of handling large system of equations, non-linarites and complicated geometries that are not uncommon in engineering practice and that are often impossible to solve analytically.

Course Content:
Solution of Equation in one variable: Bisection algorithm, Method of false position, Fixed point iteration, Newton-Raphson Method, Error Analysis for iterative method, Accelerating limit of convergence. **Interpolation and polynomial approximation:** Taylor Polynomials, Interpolation and Lagrange polynomial, Iterated interpolation, Extrapolation. **Differentiation and Integration:** Numerical differentiation (Three points-Five points formula for finding derivatives), Richardson's extrapolation, Elements of Numerical Integration, Trapezoidal rule, Simpson's rule, Composite Numerical Integration, Adaptive Quadrature method, Romberg's integration, Gaussian quadrature. **Solutions of linear systems:** Cramer's rule, Gaussion elimination and backward substitution, Gauss-Seidal method, Linear algebra and Matrix inversion, Determinant of a matrix, Pivoting strategies, Direct factorization of matrices. **Iterative technique of Matrix algebra**: Iterative techniques for solving linear systems, LU-Decomposition, Error estimates and Eigenvectors. **Numerical solution of Non-linear system:**

Fixed point for functions of several variables, Newton's method, Quasi-Newton's method. **Initial value problem for O.D.E:** Euler's method, Higher order Taylor's methods, Runge-Kutta methods, Multi-step methods, Variable step size multistep methods, Extrapolation method. **Boundary value problem:** Linear shooting method, shorting method for nonlinear BVP.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** Difference operator, Algebraic and transcendental equations, Interpolation, Extrapolation, Differential Equations, Fundamental theorem of definite integral, Spline, Error analysis.
CLO2	**Apply** the concepts of numerical methods to solve Algebraic and Transcendental equations, Differential Equations in various fields of Science and Engineering.
CLO3	**Apply** mathematical technique to solve interpolation and extrapolation from a data set, linear systems by direct method and iterative techniques, and Non-linear system
CLO4	**Work out** numerical differentiation and integration whenever and wherever routine methods are not applicable.
CLO5	**Evaluate** typical physical problems of science/engineering courses by analyzing them properly.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√				√							
CLO4		√			√							
CLO5		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Class Test / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Assignment / Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/Mini Project/ Final Exam

19(d). General Education Courses (Group IV: Interdisciplinary Courses)

Course Code: MEC 112 **Course Title: Engineering Drawing** **Credits: 1.5**

Rationale of the Course:

An engineering drawing is a type of technical drawing used to define the requirements for engineering products or components. Typically, the purpose of an engineering drawing is to clearly and accurately capture all geometric features of a product or component so that a manufacturer or engineer can produce the required item. It may also describe the process of making the item, may be used to convey engineering ideas during the design process, or may provide a record of an existing item.

Course Objective:

This course is designed to provide Electrical engineering undergraduates with basic understanding of the theory and practice of engineering drawings in hand and software. Students will learn to read and construct all architectural, structural and other drawings by means of discussions and drawing examples related to existing buildings or projects. It includes lettering, plane geometry, different geometric constructions, types of lines, perspective projections, orthographic projections, structural floor plan of a building.

Course Content:

Experiment	Experiment title
Experiment 01	Introduction to traditional drawing tools, instruments and their use.
Experiment 02	Standard engineering lettering and numbering.
Experiment 03	Different Geometric Constructions and type of lines.
Experiment 04	Concept of Dimensioning and sectioning.
Experiment 05	Orthographic projections and isometric drawing of solid geometric figures (horizontal)
Experiment 06	Orthographic projections and isometric drawing of solid geometric figures (vertical)
Experiment 07	Structural drawing – Plan view, Elevation view and Cross sectional view.
Experiment 08	Detail floor Plan for residential, Commercial building.
Experiment 09	Detail floor Plan for Commercial building.
Experiment 10	Introduction & basic instruction for drawing in AutoCAD software.
Experiment 11	Different Geometric Constructions and type of lines in AutoCAD software.
Experiment 12	Drawing of a detailed floor for residential building in the AutoCAD software.
Experiment 13	Drawing of a detailed floor for Commercial building in the AutoCAD software.
Experiment 14	Assignment on design of a floor with specific requirements in A4 paper and implement with the AutoCAD software.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Drawing** on the concept taught in the laboratory and demonstrating the ability to work as an individual and within a team**.**
CLO2	**Design** a floor with specific instructions using AutoCAD Software.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: MEC 311 Course Title: Mechanical Engineering Fundamentals Credits: 1.5

Rationale of the Course:
Fundamentals of Mechanical Engineering is a fundamental inter-disciplinary course for the students of Electrical Engineering students. This course establishes a nexus between two major engineering discipline.

Course Objective:
Throughout the academic life, some notions of Mechanical Engineering are pivotal to the Electrical Engineering students. Hence, there is no denying the conviction that the course curriculum will bring a paradigm shift in their cognitive levels which may lead them to design some electro-mechanical systems in the future.

Course Content:
Study of fuels; Thermodynamic system, state, process and cycle. First and Second Laws of thermodynamics; Steam generating units with accessories and mountings; Study of steam generators and steam turbines. Introduction to internal combustion engines and their cycles; Study of SI engines, CI engines and gas turbines with their accessories. Refrigeration and air conditioning: their applications; Study of different refrigeration methods; Refrigerants; Refrigeration equipment: compressors, condensers, evaporators, expansion devices, other control and safety devices; Psychometrics; Study of air conditioning systems with their accessories. Types of fluid machinery; Study of impulse and reaction turbines: Pelton wheel and Kaplan turbine; Study of centrifugal and axial flow machines: pumps, fans, blowers and compressors; Study of reciprocating pumps.
Source of energy: Conventional and renewable; Introduction to IC engines, Refrigeration and Air conditioning systems. Static's of particles and rigid bodies: Forces in trusses and frames; Relative motion; Kinematics of particles; Newton's Second Law of Motion; Kinematics of rigid bodies. Introduction to Robotics; Plane, rotational and spatial motion with application to manipulators; geometric configurations: Structural elements, linkage, arms and grippers; Motion characteristics.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different laws of thermodynamics.
CLO2	**Analyze** kinematics of particles and Newton's law of motion.
CLO3	**Analyze** different types of psychometrics and machineries.
CLO4	**Explain** different sources of energy e.g., conventional, renewable etc.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										

CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Course Code: CSE 121 Course Title: Structured Programming Language Credits: 3

Rationale of the Course:
The C programming language is one of the most popular and widely used programming languages and is commonly used to program operating systems such as UNIX. It is a general-purpose programming language and one of the main advantages of programming in C is that it allows the programmer to write directly to memory. After completing this course student will have fundamental knowledge and skill in computer programming using C language. After completing this course successfully, students will be able to write simple programs in C and also be able to develop small projects.

Course Objective:
The objective of this course is:

- Introduce students with the computer programming language.
- Teach the students the syntax of C programming
- Teach array and structure data types.
- Teach pointer variables, functions and file processing in C.

Course Content:
Introduction to C: Data types, Keywords, Variables, Operators and Expressions.
Decision Making and Control flow: If, else if, switch statements.
Loops: For loop, Nesting of for loop, while loop, Do-while loop.
Array: One dimensional, Two-dimensional array.
String operation: String variables, String I/O operations, Standard library string functions, Array of pointers to string.
Functions: Scope rules of function, Nesting and recursion of function, call by value and call by reference, Passing array elements to a function.
Structure: Structure elements, Array structures, Structure I/O in C.
File Management in C and Introduction to python.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the basic structure of C programming, declaration and usage of variables.
CLO2	**Understand** the appropriate decision making and looping statements while writing programs in C.
CLO3	**Apply** arrays and functions to solve computational problems.

CLO4	**Apply** appropriate data structures like pointers, structures and user defined functions to solve computational real-life problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3		√										
CLO4		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Course Code: CSE 122 Course Title: Structured Programming Language Lab Credits: 1.5

Rationale of the Course:

Structured Programming Language Lab will substantialize the notions related to the basic programming into practice. Thus, the students will be able to understand the insights of programming adroitly based on what they learned in the related theory course.

Course Objective:

The objective of this course is to verify the theories and concepts taught in CSE 121. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Practice of writing different simple program like area of a circle, temperature conversion etc.
Experiment 02	Implement Branching: The IF statement (break and continue statement), Branching: SWITCH statement, GOTO statement
Experiment 03	Implementation of Looping: FOR statement (break and continue)
Experiment 04	Implementation of Looping: WHILE and DO WHILE statement
Experiment 05	Implementation of Library Functions
Experiment 06	Implement Argument Passing and Value Receiving, Functions: Pass-by-value, Pass-by-reference
Experiment 07	Value Receiving Functions: Command Line Parameter and, Arrays: Initialization, Access, Passing and Receiving

Experiment 08	Arrays: 2D handling, Arrays: String Handling, Structure: Initialization, Access, Passing and Receiving, Structure: Union and Bit-fields
Experiment 09	Implementation of Structures and Sorting and Searching program
Experiment 10	Write program to handle Pointers
Experiment 11	Compiler and Linker, Segment and Memory Model, Video Adapter, Modes, Graphics Initialization, Graphics Functions
Experiment 12	Write program for Text File Handling, Binary File Handling, Data File Management
Experiment 13	Write a program that read an array and write and write in a file
Experiment 14	Write a program that read n numbers from a file and display in output screen

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to write different programs and run them in the compiler as well as apply appropriate modern technologies to an assigned task.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Presentation/ Final Exam

Course Code: EEE 313 Course Title: Measurements and Instrumentation Credits: 3

Rationale of the Course:

Instrumentation is a field of physics that deals with measuring and regulating variables in the process industry, as well as the instruments used to measure and control the process variables and their calibration. Level, pressure, temperature, humidity, flow, pH, force, and speed are examples of industrial process variables. Instrumentation technology refers to the technology used to create and build instruments for measurement and control.

Course Objective:

The objectives of this course are to make the students understand the various measurement techniques available. This subjective course will help them to introduce (working principles and some other important aspects) students to several examples of each of the functional elements of a generalized measurement system. They can be able to understand the errors in measurements and their rectification. It will aid them to find out information on and select the proper instrumentation for making measurements of physical quantities. Finally, it engaged them by introducing the students to the basics of the causes of signal impairment in a measurement device and their mitigation.

Course Content:

Introduction, Applications, functional elements of a measurement system and classification of instruments. Current and potential transformer. Transducers: mechanical, electrical and optical. Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque. Basic elements of DC and AC signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits. Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices using Microcontroller based Data acquCSEion system and applications.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different types of errors, Explain and Demonstrate the construction, configuration and operation of mechanical and electrical instruments used to control dynamics of processes.
CLO2	**Design** A/D and D/A converters for given specifications.
CLO3	**Analyze** the operation of transducers for strain, pressure, temperature and fluid flow measurement.
CLO4	**Design and Analyze** the analog and digital data acquCSEion systems.

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2			√									
CLO3		√										
CLO4		√		√								

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture ,Slides	Mid-Exam, Final Exam, Class Test, Assignment.
CLO2	Lecture ,Slides	Mid-Exam, Class Test, Assignment.
CLO3	Lecture ,Slides	Mid exam, Final Exam, Presentation, Assignment.
CLO4	Lecture ,Slides	Final Exam, Class Test, Presentation, Group project.

Course Code: EEE 314 Course Title: Measurements and Instrumentation Lab Credits: 1.5

Rationale of the Course:

With the numerous amount of processes involved, accurate instrumentation is required to make sure operations run smoothly. Engineers must be aware of many factors such as pressure, fluid level, temperature and more. Inaccurate readings can lead to personnel injuries. This course helps to deal with these problems.

Course Objective:

This course's goal is to validate the theories and concepts taught in EEE 313. Students will do lab experiments as well as simulations. They will be exposed to laboratory equipment and simulation tools, as well as understand experimental procedures. The students will examine their data and draw meaningful inferences based on their comprehension, while keeping in mind the mistakes and uncertainties in their measurements. This course's goal is to validate the theories and concepts taught in EEE 313.

Course Content:

Experiment	Experiment title
Experiment 01	Conversion of Galvanometer to Ammeter of multiple range.
Experiment 02	Conversion of Galvanometer to Voltmeter of multiple range.
Experiment 03	Measurement of unknown resistance/ capacitance using Wheatstone Bridge.
Experiment 04	Study of megger to measure the insulation.
Experiment 05	Study of Earthing and measurement of earth resistance using the Fall of Potential Method.
Experiment 06	Study on Current transformer (CT) and Potential Transformer (PT) to measure high current and high voltage.
Experiment 07	Measurement of energy using a single phase energy meter.
Experiment 08	Power factor measurement using Wattmeter (induction type).
Experiment 09	Introduction to Analog to Digital (A/D) and Digital to Analog (D/A) conversions
Experiment 10	Design of Ac voltmeter using dc voltmeter and rectifier circuit
Experiment 11	Study of differential pressure transducer and signal conditioning of output signal.
Experiment 12	Study of construction of a multimeter & frequency counter.
Experiment 13	Study of distance measurement using ultrasonic transducer
Experiment 14	Study of Precision Rectifiers in Signal Processing

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** functions of the different measuring instruments showing experimental setup.
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Project/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: ENS 121 Course Title: Environmental Science and Sustaianbility Credits: 3

Rationale of the Course:

The human civilization has been facing the climate change impacted phenomena for a couple of decades. Moreover, there have seen an extensive range of challenges like flood, cyclone, sea level rise and storm surge in Bangladesh. But, the root cause of global warming is the emission of green house gas in a large scale. So, the renewable energy and efficient technology are quite required in the present context. In this regard, the course environmental science would be able to create a huge awareness among the students.

Course Objective:

Environmental Science is specifically designed for students who are not pursuing a program to learn more about the physical, biological processes and energy flow that shape our environment. Our planet, and its living and non-living parts, makes up the biosphere, which itself is a complex web of interactions. We investigate these interrelationships by studying the underlying processes in terms of their biology and chemistry.

Course Content:

S/N	Content of Course
1	**Basic concepts:** Environment, ECLOogy, Component of Environment, Hydrologic Cycle / Water Cycle, Climate, Climate change, Global warming, Difference between Environmental Science and Environmental Studies, Difference between Environmental Scientist and Environmentalist, Coastal Region
2	**Atmosphere:** The green house gas and its mechanism, Law of thermodynamics, sources of green house gas, vertical structure of atmosphere, sedimentation Processes in Bangladesh, **Pollution:** Pollutant, Standard, Point Source, Non-point Source **Environmental Issues:** Waste, Sources of Waste, Waste Management, flash flood, landlide and current issues
3	**Climate change and Impacts:** climate change and frequency of cyclone, impacts of the storm surge, sea level rise; impacts of climate change on: agriculture, food security biodiversity and migration; climate change adaptation and mitigation; arsenic contamination; **Sustainable Development:** Sustainable Development: the futute application of sustainable concepts in the context of climate change, sustainable agriculture
4	**Analyze the laws and regulations:** National Conservation Act 1997, National Adaptation Plan for Action 2005, Banngladesh Climate Change Strategy Action Plan 2009

Course Learning Outcomes (CLO): At the end of the Course, the Students will be able to:

CLO1	**Remember** the basic components of the environment, ecology, atmosphere, hydrosphere, lithosphere, and biosphere, green house gas
CLO2	**Understand** the relation between biotic and a-biotic components, climate, climate change, global warming, global environmental change, greenhouse mechanism, sedimentation process, sustainable development.
CLO3	**Analyze** the impacts of sea-level rise, storm surge, cyclone, floods, droughts etc.
CLO4	**Analyze** the present laws and regulations in the context of Bangladesh like Bangladesh Climate change Strategy Action Plan, National Adaptation Programme of Action

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

CLO1							√					
CLO2							√					
CLO3						√	√					
CLO4						√	√					√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Assignment/Final Exam

19(e). Core courses

Course Code: EEE 111 **Course Title: Electrical Circuits I** **Credits: 3**

Rationale of the Course:
Being the fundamental course, this course is designed such that students will be able to develop the paramount notions which will be required onward for the rest of their academic journey, else they might mislay their scattered assumptions, leading to poor engineering performances.

Course Objective:
This is a basic foundation course for the undergraduate students of electrical and electronic engineering. In electrical and electronic engineering, almost every device is modeled through electrical circuits and the device performances are then predicted for either DC or AC excitation. To model any electrical or electronic device or system, the knowledge of electrical circuit and circuit performance under DC excitation is a must. Thus, students should have crystal clear idea about the network theorems and network solution methods. The objective of this course is to teach the students the fundamentals of electrical circuit solution techniques, network theorems and transient analysis of RL and RC circuits under DC excitations.

Course Content:
Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, resistance. Basic laws: Ohm's law, Kirchhoff's current and voltage laws.
Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation.
Circuit Theorem: Nodal and mesh analysis including super-node and super-mesh, source transformation, Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.
Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors.
Responses of RL and RC circuits: Step, impulse and ramp functions. Natural and step responses.
Magnetic quantities and variables: Flux, permeability and reluctance, magnetic field strength, magnetic potential, flux density, magnetization curve.
Laws in magnetic circuits: Ohm's law and Ampere's circuital law, analysis of series, parallel and series-parallel magnetic circuit.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic laws of circuits such as Ohm's law, Kirchhoff's laws.
CLO2	**Solve** linear dc circuits using different methods and circuit theorems.
CLO3	**Analyze** the transient response of RC and RL circuits.
CLO4	**Explain** fundamental properties and laws of magnetic circuits.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Course Code: EEE 121 Course Title: Electrical Circuit II Credits: 3

Rationale of the Course:

Alternating current is important just because of its simple and economical generation, transformation into other values (principle of mutual induction), low-loss energy-transmission even through large distances, the sinusoidal form is not changed by the basic components R, L and C. If direct current is required (e.g., for the operation of the majority of electronic devices), it can easily be produced by rectifying the alternating current. In practice, especially in power electrical engineering, alternating current is used because of many advantages. This is a current whose magnitude and direction varies periodically.

Course Objective:

The objective of this course is to introduce the fundamental knowledge for AC circuit analysis. The students will be able to solve AC circuits using network theorems and different analysis techniques. This course aims to introduce the concepts of three-phase systems, magnetically coupled circuits and resonant circuits. The students will achieve adequate knowledge to analyze and extract different parameters from these circuits.

Course Content:

Definitions of AC voltage, current, power, volt-ampere and various factors including the peak and form factors.

Introduction to sinusoidal steady state analysis: Sinusoidal sources, instantaneous and effective voltage and currents, average power, phasors and complex quantities, impedance, real and reactive power, maximum power transfer, power factor and its improvement

Analysis of single-phase AC circuits: Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in AC circuits, circuits with non-sinusoidal excitations, transients in AC circuits.

Analysis of three phase circuits: three phase supply, balanced and unbalanced circuits, power calculation.

Passive filters: Basic types. characteristic impedance and attenuation, practical composite filters.

Resonance in AC circuits: Series and parallel resonance.

Magnetically coupled circuits.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basics of sinusoids and phasor algebra; and solve AC circuits in phasor domain using techniques such as nodal analysis, mesh analysis and network theorems.
CLO2	**Calculate** RMS value, complex power, real power, reactive power and power factor in AC circuits.
CLO3	**Solve** three-phase balanced and unbalanced circuits in phasor domain.
CLO4	**Solve** magnetically coupled circuits and electrical resonant circuits.

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√										
CLO3		√										
CLO4		√										
CLO5		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid-term Exam, Class Test, Assignment
CLO2	Class Lecture	Mid-term Exam, Final Exam, Class Test, Assignment
CLO3	Class Lecture	Final Exam, Class Test.
CLO4	Class Lecture	Final Exam, Class Test, Assignment

Course Code: EEE 122 Course Name: Electrical Circuit Lab Credit Hours: 1.5

Rationale of the Course:

This course is intended to develop the fundamental tools of linear circuit analysis which will be useful to all engineers. It will help to learn the "alphabet" of circuits, including wires, resistors, capacitors, inductors, voltage and current sources.

Course Objective:

In this course students will perform experiments to verify practically the theories and concepts based in EEE 111 and EEE 121. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment's and their functions.

List of Experiments:

Experiment	Topics
Experiment 01	Introduction to laboratory
Experiment 02	Introduction to PSPICE
Experiment 03	Verification of Kirchhoff's Voltage & Current law
Experiment 04	Maxwell Loop Current Technique using 2-3 Meshes and 1-2 D.C. voltage sources.
Experiment 05	Verification of Superposition theorem using 1-2 D.C. sources.

Experiment 06	Verification of Thevenin's theorem and Norton's theorem
Experiment 07	Verification of maximum power theorem
Experiment 08	Simulating different ac and dc Circuits in PSPICE
Experiment 09	Determination of Equivalent Resistance and Circuit analysis with source and resistance analysis
Experiment 10	AC Transient Analysis of R-L circuits
Experiment 11	AC Transient Analysis of R-L-C circuits
Experiment 12	Steady-State AC Analysis and Frequency Response
Experiment 13	Power measurement of 3 phase system using two wattmeter method
Experiment 14	Determination of phase sequence of a 3 phase system

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO 1	**Build** and measure or simulate different electrical circuits using experimental and simulation tools.
CLO 2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√							
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course Code: EEE 211 **Course Title: Electronic Circuits I** **Credits: 3**

Rationale of the Course:
This is the basic electronics course that will help the students to develop the obligatory knowledge for designing advanced electronic circuits. In addition to that, learning about the biasing of different transistors will be pivotal to many extents.

Course Objective:
Electronics is a science about the devices and processes that use electromagnetic energy conversion to transfer, process and store energy, signals and data in energy, control and computer systems. This science plays an important role in the world progress. Implementation of electronic devices in various spheres of human activity largely contributes to the successful development of complex scientific and technical problems, productivity increase of physical and mental labor, and production improvement in various forms of communications, automation, television, radiolocation, computer engineering, control systems, instrument engineering as well as lighting equipment, wireless technology and others. The goal of this syllabus is to introduce a reader to the basics of electronic engineering. Here, students may get their first knowledge of electronic concepts and basic components. They also familiarize with

the analysis and design of basic transistor amplifier circuits, frequency response and wave shaping characteristics of different circuit elements. After completing this syllabus, the students can proceed to advanced topics in electronics.

Course Content:

Introduction to semiconductors: P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, simplified large and small signal models, iteration and graphical analysis, dynamic resistance and capacitance.

Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode, Zener shunt regulator, clamping and clipping circuits.

Bipolar Junction Transistor (BJT) as a circuit element: Current components, BJT characteristics and regions of operation, BJT as an amplifier, biasing the BJT for discrete circuits, small signal equivalent circuit models, BJT as a switch.

Single stage mid-band frequency BJT amplifier circuits: Voltage and current gain, input and output impedance of a common base, common emitter and common CLOlector amplifier circuits.

Field Effect Transistor (FET): Introduction to Junction Field-Effect-Transistor (JFET).

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) as circuit element: Structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current-voltage characteristics of an enhancement MOSFET, biasing discrete and integrated MOS amplifier circuits, single stage MOS amplifiers, MOSFET as a switch, CMOS inverter.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** the characteristics and operations of semiconductor devices like diodes, BJT, FET.
CLO2	**Demonstrate** applications of diodes in rectifiers, clippers, clampers, logic gates and voltage regulators.
CLO3	**Explain** different characteristics and applications of BJT and MOSFET under DC and AC excitations.
CLO4	**Design** circuits consisting of Diodes, BJT and FET.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4		√			√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Course Code: EEE 213 **Course Title: Energy Conversion I** **Credits: 3**

Rationale of the Course:

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

Course Objective:

To provide a basic background in static and electromechanical energy conversion devices; intended for students with interests in the control of electrical and electromechanical systems with applications to electric energy systems. Electric machines are a technology of choice in many modern energy conversion applications, including propulsion for hybrid-electric vehicles, wind energy generation, and flywheel energy storage systems. Interest in machines is steadily increasing due in large part to the flexibility of controls offered by modern computers and power electronic devices. In this course, the tools required for analysis and design of electromechanical energy conversion are developed. Upon completion of the course, a student's engineering toolbox should contain 1) an understanding of the basic principles of static and electromechanical energy conversion, 2) methods to control static power converters, 3) knowledge of the use of reference frame theory applied to the analysis of rotating devices, 4) an understanding of the steady-state and dynamic characteristics of induction, permanent magnet synchronous, and wound-rotor synchronous machines, and 5) state variable analysis of electromechanical devices and converter supplied electromechanical drive.

Course Content:

Energy Conversion: Review of law of energy conversions, electro-mechanical energy conversions. **DC generator:** Construction, winding, types of losses, no-load voltage characteristics, build-up of a self-excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics, voltage regulation, armature reaction and commutation. **DC motor:** Torque, counter EMF, rotational speed, torque-speed characteristics, starting and speed control, regulation, braking. **Transformer:** Principle, construction of ideal transformer, practical transformer, transformation ratio, no-load and load vector diagrams; actual transformer's equivalent circuit, regulation, short circuit and open circuit tests, parallel operation of transformers, auto transformer, instrument transformers, 3-phase transformers, different connection and their applications.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** the generation action, motor action and transformer action and Understand different factors like armature reaction and commutation, torque, counter EMF, load-voltage characteristic.
CLO2	**Explain** the constructions, operating principles and main features of common Electrical Machines: DC generator, DC motor, transformer.
CLO3	**Discuss** short circuit and open circuit tests, parallel operation of transformers, auto transformer, instrument transformers, 3- phase transformers, different connections and their applications.
CLO4	**Compare** between different machines and mention practical uses.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: EEE 221 **Course Title: Electronic Circuits II** **Credits: 3**

Rationale of the Course:

The electrons in physical objects are affected by various real-world events or interactions. Electronic circuits assist us in detecting, measuring, and manipulating these electronic impulses so that we can use them to improve our lives. At a higher level, we are able see that all necessities, devices, extravagances of advanced life on Soil are made conceivable by Electronic Circuits as it were.

Course Objective:

The objective of this course is to give the students the basis and the importance of electronic circuits in electronic systems. At the end of the course, students will be able to analyze electronic circuits especially Op-Amp based electronic circuits to deal with real life mathematical application and they will understand how to design op-amp based amplifier and Oscillator with feedback. Consequently they learn how to stabilize the amplifier in term of the gain and frequency response. Moreover, they would be able to understand and design the Power amplifier, active filter and voltage regulator as well.

Course Contents:

Frequency response of amplifiers: Poles, zeros and Bode plots, amplifier transfer function, frequency response of single-stage and cascade amplifiers, determining bandwidth of amplifier circuits with 3dB frequencies response. **Introduction to power amplifier:** Class A, Class B, Class C and Push Pull Power Amplifier, efficiency comparison among the different type of power amplifier. **Differential Amplifier:** Basic Circuits of Differential Amplifier, Operation of Differential Amplifier, Common Mode and Differential Mode Signal, Double Ended Input Operation of DA, Voltage Gain of DA, Common Mode Re4jection Ratio (CMMR) with Math, DC Analysis of Differential Amplifier, Overview of Differential Amplifier, Output Offset Voltage and Input Offset Current, AC Analysis of Differential Amplifier with Math and Common Mode Voltage Gain of Differential Amplifier. **Operational Amplifier:** Properties of ideal Op-Amps, schematic model of different type of Operational Amplifier, Voltage Gain of

Operational Amplifier, Open Loop Voltage Gain and Closed Loop Voltage Gain, DC/AC Analysis Of Op-Amp, Bandwidth of an Op-Amp, Slew Rate of an Op-Amp, Feedback Configuration of Op-Amp, Op-Amp with Negative Feedback, Input Resistance With Feedback, Output Resistance with Feedback, Bandwidth with Feedback and Virtual Ground. **Application of Op-Amp:** Inverting Amplifier, Non Inverting Amplifier, Emitter Follower, Summing Amplifier, Sub-tractor, Differentiator and Integrator, Mathematical equation solution with OP-Amp. **Electronic Active Filter:** Types of Filters, Active Filters such as Low Pass Active Filter/ First Order Butterworth Low Pass Filter, Second Order Butterworth Low Pass Active Filter, High Pass Active Filter, Band Pass Active Filter, Band Stop/ Band Rejection/ Band Elimination Filter. **Oscillator design with/without Op-amp**: Oscillator Principle, Frequency Stability, Phase Shift Oscillator, Win Bridge Oscillator Voltage Controlled Oscillator, Blocking Oscillator, Multi-vibrator, Square Wave Generator, Triangular/ Saw-tooth Wave Generator, Comparator, Zero Crossing Detector, Schmitt Tiger, PLL and 555 IC Timer. **Voltage Regulation:** Series Voltage Regulation, Shunt Voltage Regulation, Shunt Voltage Regulator Using Op-Amp, IC 7805.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the frequency response of multistage amplifiers.
CLO2	**Analysis** the performance of power amplifiers.
CLO3	**Design** mathematical applications and signal generator using Op-amp.
CLO4	**Construct and analysis** the Op-Amp based active filter for noise elimination.
CLO5	**Design and performance** analysis of voltage stabilizer.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2		√										
CLO3			√		√				√	√		
CLO4		√	√									
CLO5		√	√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture/ Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/Tutorial	Class Test / Final Exam
CLO5	Lecture/Group Discussion	Assignment/Final Exam

Course Code: EEE 222 **Course Title: Electronic Circuits Lab** **Credits: 1.5**

Rationale of the Course:
Electronic Circuits Lab will substantialize the notions related to electronics into practice. Thus, the students will be able to design some sophisticated projects adroitly based on what they learned in the theory courses prior to the lab.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 211 and EEE 221. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Study of diode characteristics and its applications
Experiment 02	Study of clipping and clamping circuits
Experiment 03	Study of Zener Diode characteristics and its applications
Experiment 04	Study of BJT Amplifiers (with Frequency Response) and Switches
Experiment 05	Study of small signal transistor amplifiers
Experiment 06	Study of Operational amplifier as an inverter, Inverting amplifier, Adder, Integrator, Differentiator, Non-Inverting Amplifier, Voltage follower (Buffer) and Comparator
Experiment 07	Design and implementation of 1st and 2nd order Low-Pass and High-Pass Butterworth Filter
Experiment 08	Study of Operational Amplifier as Triangular wave generator and Astable Multivibrator
Experiment 09	Study of dc characteristics of an enhancement type MOSFET
Experiment 10	Study of Source-Drain characteristic of JFET
Experiment 11	Study of CLOpitts & Hartley oscillators using Op-Amps and Transistors
Experiment 12	Study of Wien Bridge and Voltage-controlled oscillators
Experiment 13	Checking the conversion efficiency and the figure of merit in a Class-A amplifier with DC current flowing through the load
Experiment 14	Checking the characteristics of a complementary symmetry push-pull amplifier

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Demonstrate** experiments based on diodes, transistors and Op-Amps.
CLO3	**Design and implement** a suitable project using diodes, transistors and Op-Amps that fits the course curricula using experimental and simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**

CLO1									√	√		
CLO2	√				√							
CLO3			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO3	Lab demonstration/ Lecture	Mini Project/ Presentation

Course Code: EEE 223 Course Title: Energy Conversions II Credits: 3

Rationale of the Course:

this course aims to give an advanced knowledge of alternating electrical machines starting from the principles of electromechanical conversion to the control of synchronous machines through aspects of design and sizing. Time model in synchronous balanced steady state and Park model for the synchronous machine are established. This course provides knowledge necessary for the selection and control of a synchronous machine and its associated converter.

Course Objective:

This course examines the basic theory, characteristics, construction operation and application of electrical machines. It includes the study of poly phase Induction motors, Single Phase motors, Synchronous Motors, Alternators and Special Machines.

Course Content:

Poly Phase Induction Motors: Principle of rotation of rotor, slip, frequency of rotor current, Relation between torque and rotor power factor, Starting torque of a squirrel-cage motor, Starting torque of a Slip-ring motor, Condition of maximum starting torque, Effect of change in supply voltage on starting torque, Rotor E.M.F and reactance under running conditions, Condition for maximum torque under running conditions Relation between torque and slip, Effect of change in supply voltage on torque and speed, Effect of change in supply frequency on torque and speed, Full load torque and maximum torque, Power stages of Induction motor, Plugging of an Induction Motor, Induction motor operating as a generator, Starting of Induction Motors , Speed Control of Induction Motor, Mathematical problems analysis.

Single Phase Motors: Single phase induction motors, equivalent circuit, starting of induction motors, Capacitor start and run motors, repulsion type motors.

Alternators: Excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation, synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations. Parallel operation: Necessary conditions, synchronizing, circulating current and vector diagram.

Synchronous motor: Operation, starting methods, effect of loading under different excitation condition, effect of changing excitation, V-curves, power developed by motors.

Special Machines: Stepper Motors, Permanent magnet dc motors, Brushless dc Motors, Brushless ac motors, Permanent magnet synchronous motors, Servomotors.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**State** operating Principle of Polyphase & single-Phase Induction motor and explain their characteristics and Solve related mathematical problems.
CLO2	**Discuss** the working principle and characteristics of alternator and solve related mathematical problems.
CLO3	**Examine** the Synchronous motor's construction, operation and their characteristics and solve related mathematical problems.
CLO4	**Describe** the construction and operation of different types of special machines.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture,Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture,Discussion	Final Exam, Class Test, Assignment.
CLO3	Lecture,Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 224 Course Title: Energy Conversions Lab Credits: 1.5

Rationale of the Course:

The Electrical Machines Laboratory is the one of the important Laboratory of Electrical Engineering Department. This Laboratory caters the need of Under Graduate Students to enable them to easily understand the basics and adapt to advanced experiments like modelling of Electrical Machines and special Electrical Machines. Also, the Laboratory is used for research activities in machines using MAGNET Software and to carry out project works in the design of Electrical Machines.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE213 & EEE223. The students will carry out lab experiments. They will gain exposure to machinery equipment in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Determination of the polarity of transformer windings and Observation of the connection of transformer winding of a single phase transformer in series aiding and opposing.
Experiment 02	Study of Single Phase Transformer & Three Phase Transformer and determination of turns ratio
Experiment 03	Determination of the equivalent circuit parameters of a transformer and calculation of efficiency and regulation.
Experiment 04	Study of Operation of Transformers in Parallel
Experiment 05	Study of Characteristics of a DC Shunt Generator
Experiment 06	Study of Speed Control of a DC Shunt Motor and observation of the existence of Back EMF/Generator
Experiment 07	Study of Characteristics of Split phase Induction Motor
Experiment 08	Study of Characteristics of Squirrel case Induction Motor
Experiment 09	Determination of Performance Characteristics of an Induction motor with the help of Circle Diagram.
Experiment 10	Determination of the 'V' Curves of a Synchronous Motor.
Experiment 11	Study of Characteristics of Synchronous Generator under Resistive Load, Inductive Load & Capacitive Load
Experiment 12	To study and obtain the losses and efficiency of a dc shunt generator by hopkinson's test
Experiment 13	To study speed control of separately excited dc shunt motor by ward-leonard method
Experiment 14	Determination of OCC curves of DC Generator

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Measure** various characteristics parameters of Transformers and Energy Converters using experimental setup.
CLO2	**Write** comprehensive reports on the work done in Laboratory and demonstrate the ability to work as an individual or as a team

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 225 Course Title: Signals and Linear System Analysis Credits: 3

Rationale of the Course:

Signals and systems help to predict with some certainty,behaviour of some systems when they are subjected to different input signals. It also helps to design electrical circuits or algorithms that will operate on signals to get the desired output.The importance of Signals and Systems is not restricted only to electrical engineering but it is applicable to all other engineering disciplines, and indeed, in other seemingly unrelated fields such as seismology, economics, sociology, transportation, public and private administration, and political systems.

Course Objective:
Signals and Linear Systems Analysis is a rudimentary course to comprehend digital signal processing properly. So many advanced and sophisticated areas like speech processing, image processing, sensor data processing, analog and digital communication systems are directly contingent upon Signal processing. This course mirrors and assembles the basic concepts for linear and continuous-time signals and systems. Signals and systems course also represents both time and frequency domains. In this course Fourier series, Fourier transform and Laplace Transform are demonstrated precisely for comprehending the magnitude and phase analysis of sinusoidal and non-sinusoidal signals. These above materials of this course carry a significant value to be mastered in Digital signal processing.

Course Content:
Introduction to linear systems and signal classification: signals- classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems- classification. **Properties of Linear Time Invariant (LTI) systems:** Linearity, causality, time invariance, memory, stability, invertibility. Time domain analysis of LTI systems: Differential equations- system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response-convolution integral, determination of system properties; state variable basic concept, state equation and time domain solution. **Frequency domain analysis of LTI systems:** Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation properties, system transfer function, system response and distortion-less systems. **Applications of time and frequency domain analyses:** solution of analog electrical and mechanical systems. **Laplace transformation:** Fourier to Laplace, Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** different types of signals and systems
CLO2	**Understand** the stability of LTI system
CLO3	**Understand** Fourier series, Fourier transform and identify responses of LTI systems under different excitations.
CLO4	**Apply** Fourier transform and Laplace transform in analyzing analog and mechanical signals in time and frequency domain.

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4		√	√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam, Class Test, Assignment
CLO2	Class Lecture	Mid Term Exam, Final-Exam, Class Test, Assignment.
CLO3	Class Lecture	Final Exam, Class Test, Assignment
CLO4	Class Lecture	Final Exam, Class Test, Group assignment

Course Code: EEE 227 Course Title: Electromagnetic Fields and Waves Credits: 3

Rationale of the Course:

Electromagnetic waves influence modern life in a variety of smaller-scale (but more immediate) ways: our mobile phone, Wi-Fi connection, microwave, and medical imaging methods such as x-ray and MRI are all powered by electromagnetic waves. Understanding the characteristics of light, its passage through tissue, scattering and absorption effects, and changes in the state of polarization requires an understanding of EM.

Course Objective:

The goal of this course is to introduce basic electromagnetic and establish the fundamentals of devices in electromagnetic applications, as required by engineers in energy systems, telecommunications, computing and other technologies. Students will become familiar with electromagnetic applications such as capacitors, inductors, transformers, transmission lines, Smith charts, impedance matching circuits, waveguides and antennas, that are used in the designs and implementations of electrical power systems and modern wireless communications systems.

Course Content:

Static electric field: Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density- boundary conditions; capacitance electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries; boundary value problems- Poisson's and Laplace's equations in different coordinate systems. Steady electric current: Ohm's law, continuity equation, Joule's law, resistance calculation. Static Magnetic field: Postulates of magnetostatics, Biot-Savart's law, Ampere's law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries. Time varying fields and Maxwell's equations, Faraday's law of electromagnetic induction, Maxwell's equations, differential and integral forms, boundary conditions, potential functions; time harmonic fields and Poynting theorem. Generalized wave equation (Helmholtz) Plane electromagnetic wave: plane wave in lossless media- Doppler Effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media- low-loss dielectrics, good conductors; phase velocity, group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** Gauss's law, Ampere's and Faraday's Laws and Use them in the context of electrical devices.
CLO2	**Solve** boundary value problems using Poisson's and Laplace equations in different coordinate systems.
CLO3	**Explain** the physical significance of Maxwell's equation and derive the Helmholtz equation from Maxwell's equations.
CLO4	**Explain** phase velocity, group velocity, instantaneous power and average power densities of EM waves.
CLO5	**Analyze** plain wave characteristics in lossless and lossy dielectric and good conductors.

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture , Slides, Tutorial	Assignment / Midterm Exam
CLO2	Lecture , Slides, Tutorial	Assignment / Class Test /Midterm Exam
CLO3	Lecture , Slides, Tutorial	Midterm Exam/ Final Exam
CLO4	Lecture , Slides, Tutorial	Presentation/ Class Test / Final Exam
CLO5	Lecture , Slides, Tutorial	Presentation/ Final Exam

Course Code: EEE 311 **Course Title: Communication Theory** **Credits: 3**

Rationale of the Course:

Communication theory provides a way of talking about and analyzing key events, processes, and commitments that together form communication. Theory can be seen as a way to map the world and make it navigable; communication theory gives us tools to answer empirical, conceptual, or practical communication questions.

Course Objective:

The aim of this course is to introduce with the essential approaches, fundamental concepts and design issues in communication engineering which help the students to pursue further studies in communications engineering as well as some other related engineering disciplines including electrical engineering. It will also help to solve communication engineering related circuit for real world problems.

Course Content:

Overview of Communication Systems: Basic principles, fundamental elements, system limitations, message source, bandwidth requirements, Transmission types- base-band transmission, carrier transmission; transmission media types, bandwidth, and transmission capacity. **Communication systems:** amplitude modulation, introduction, double side band, single side band, vestigial side band, quadrate; spectral analysis of each type, envelope and synchronous detection; angle modulation- instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM. **Pulse modulation:** Sampling- sampling, theorem, Nyquist criterion, aliasing, instantaneous and natural sampling; pulse amplitude modulation- principle, bandwidth requirements; pulse code modulation (PCM)– quantization principle, quantization noise, non- uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM; delta modulation (DM)- principle, adaptive DM; line coding- formats and bandwidths. **Digital modulation:** Amplitude-shift keying- principle, ON-OFF keying, phase-shift keying (PSK)- ; frequency-shift Keying (FSK) -**Multiplexing:** Time-division multiplexing (TDM)- principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems; frequency-division multiplexing- principle, de-multiplexing; wavelength-division multiplexing, multiple-access network - time-division multiple-access, frequency-division multiple-access; code-division multiple- access (CDMA)- spread spectrum multiplexing, coding techniques and constraints of CDMA. **Communication system design:** design parameters, channel selection criteria and performance simulation. **Noise:** Source, characteristics of various types of noise and signal to noise ratio. Thermal Noise, Addition of Noise in Cascade Circuit, Noise Figure.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the fundamental elements and parameter of communication system.
CLO2	**Describe** in detail the analog modulation and demodulation and solve related problems.
CLO3	**Understand** the sampling theorem and Examine the digital modulation.
CLO4	**Discuss** the multiple access techniques and describe the effects of noise in communication system and related problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Mid-term, Class Test, Assignment.
CLO2	Lecture Tutorial	Mid-term, Class Test, Assignment.
CLO3	Lecture Tutorial	Final Exam, Class Test, Assignment.
CLO4	Lecture Tutorial	Final Exam, Class Test, Assignment.

Course Code: EEE 312 Course Title: Communication Theory Lab Credits: 1.5

Rationale of the Course:

Communication engineering is the field of study concerned with the transmission of information either in analog or digital form. Though digital communication is more robust technology over analog communication, Analog communication system is still very popular due to its lower cost & less complicated circuitry. Analog transmission is a method of sending voice, data, image, signal, video etc using a continuous time signal. Whereas digital communication enables the data to be transmitted in an efficient manner through the use of digitally encoded information. Analog & digital Communication laboratories mainly focus on training the students of transmission and reception of signals. Learning the concepts along with practical applications give the students immense pleasure and real motivation toward their studies.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 312. The students will carry out experiments using hardware along with simulation tool. They will gain exposure to equipment and simulation tool in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their calculations.

Course Content:

Experiment	Topics
Experiment 01	Introductory class
Experiment 02	AM Modulator & Demodulator
Experiment 03	DSB-SC Modulator and Demodulator
Experiment 04	SSB Modulator and Demodulator
Experiment 05	FM Modulator & Demodulator
Experiment 06	TDM Multiplexer & De-multiplexer
Experiment 07	FDM Multiplexer & De-multiplexer
Experiment 08	Verification of sampling theorem
Experiment 09	Analog to Digital Converter
Experiment 10	Digital to Analog Converter
Experiment 11	Study of spectrum analyzer and study of AM and FM signals
Experiment 12	ASK Modulator & Demodulator
Experiment 13	FSK Modulator & Demodulator
Experiment 14	PSK Modulator & Demodulator

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Measure** different communication parameters using kit and others equipment and **Simulate** using MATLAB.
CLO2	**Write** reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 315 **Course Title: Digital Electronics** **Credits: 3**

Rationale of the Course:

In the past, logic circuits were built with bulky and unreliable components like transistors, resistors, and vacuum tubes, etc. These components existed individually and circuits built with these components did not work as expected, mainly due to connectivity issues that were built into those circuits. The development of integrated circuits played an important role in solving the problems of logic circuits. These integrated circuits made it possible to fit a large number of transistors on a single chip.

Course Objective:

Digital Electronics, which are the basic building blocks of a microprocessor, field programmable gate array (FPGA), microcontroller, microcontroller base digital signal processor (DSP), as well as computer, are introduced in this course to let the students know what activities it does behind the computing environment. This course portrays excellent ideas of the logic gates available and data processing to make students understand the concept better with the analogue and digital signals while computing. This subject presents the theoretical and practical basis for the structure, operation and design of embedded systems with an in-depth treatment of modern hardware components.

Course Content:

Analysis and Synthesis of Digital Logic Circuits: Number system, codes, and conversion. Boolean algebra, De Morgan's law, logic gates and truth tables, combinational logic design, minimization techniques, Transistor Switching, implementation of basic static logic gates of DDL, RTL, CMOS and BiCMOS. **Combinational Circuit Design:** pass transistor, pass gates, multiplexer, de-multiplexer, encoder, decoder, seven segment decoder, comparators, binary arithmetic elements and ALU design. **Programmable Logic Devices:** Logic Arrays, Field Programmable Logic Arrays (FPGA) and Programmable Read Only Memory (ROM), EPROM, EEPROM. **Sequential Circuits**: Different types of latches, flip-flops, Register, Counter, RAM and their design using ASM approach, timing analysis, timing analysis and power optimization of sequential circuits. Shift registers, counters and their applications.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** electronic switch with transistor and design the electronic switch with RTL, TTL and CMOS.
CLO2	**Apply** Boolean Algebra, K-map and Tabular method to simplify digital logic circuits.
CLO3	**Construct** basic combinational circuits like Encoder/ Decoder, MUX/ DEMUX, ALU, PLA, ROM and verify their functionalities.
CLO4	**Design** sequential circuits such as Register, Counter, RAM, and verify their Functional Operation.
CLO5	**Design and develop** solution for real life problems

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√	√						√	√		
CLO4		√	√						√	√		
CLO5			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/Mini Project

Course Code: EEE 316 **Course Title: Digital Electronics Lab** **Credits: 1.5**

Rationale of the Course:

The Digital Electronics Laboratory provides students with state-of-the-art computer-based and discrete electronic test equipment to enhance their understanding and experience in digital logic circuit design. Moreover it helps students to understand how digital hardwire works.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 316. This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 316. In the second part, students will design simple systems using the principles learned in EEE 316. They will carry out experiments using hardware along with software tools. They will gain exposure to equipment and software in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding.

Course Content:

Experiment	Experiment title

Experiment 01	To Design a NOT Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation Under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.
Experiment 02	To Design a NAND/ AND Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation Under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.
Experiment 03	To Design a NOR/OR Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.
Experiment 04	To Design an EX-OR/EX-NOR Gate Using Basic Logic Gate and Verify Its Functional Logic Operation and Also Justify Its Behaviors Using EX-OR/EX-NOR.
Experiment 05	To Design an All Basic Logic Gate Using NAND/NOR Gate and Verify their Functional Logic Operation.
Experiment 06	To Design a J-K/S-R Flip Flop Using Only universal Gate and Verify Its Functional Operation and Also Justify Its Behaviors Using Direct J-K Flip Flop IC of 74LSXX Series.
Experiment 07	To Design 4 Bit Shift Register Using a Flip Flop and Verify Its Functional Operation and Also Justify Its Behaviors Using Direct 4 Bit Shift Register IC of 74LSXX Series.
Experiment 08	To Design a Mod-4/Mod-10/Mod-12 Ripple Counter Using J-K Flip Flop and Verify Its Functional Operation.
Experiment 09	To Design 2-4 Decoders Using Only Basic logic Gate and also study of BCD to Seven Segment Decoder.
Experiment 10	To Design an 8-3/4-2 Encoder Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Encoder.
Experiment 11	To Design an 8-1/4-1 Multiplexer Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Multiplexer.
Experiment 12	To Design a 1-8/1-4 De-multiplexer Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of De-multiplexer.
Experiment 13	To Design a Single Bit Full Adder Logic Circuit Using only Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Single Bit Full Adder.
Experiment 14	To Design a 4-Bit Parallel Adder Using Single Bit Full Adder Logic Circuit and Verify Its Functional Operation and Also Test the IC of 4-Bit Parallel Adder. Finally Display the Output on Digital Screen using BCD to 7 Segment Decoder.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to design and analyze the circuits by hardware implementation as well as apply appropriate modern technologies to an assigned task.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**

CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: EEE 318 Course Title: Electrical and Electronic Simulation Lab Credits: 1.5

Rationale of the Course:

Electrical and Electronic Engineering (EEE) education is now in a transitional period. On the one hand, EEE courses throughout the world are becoming more specialized. The usage of specialist CAD and simulation software as instructional aids is growing. To improve students' skills, widely used tools like as SPICE, Proteus and MATLAB have been introduced into the undergraduate program.

Course Objective:

This course's goal is to validate the theories and concepts taught in EEE 111, EEE 121, EEE 211, and EEE 221 using simulation tools.

Course Content:

Experiment	Experiment title
Experiment 01	PSPICE simulation of different types of theorems for dc circuits.
Experiment 02	Simulation of Transient response of RLC Circuit To an input (i) step (ii) pulse and (iii) Sinusoidal signals using PSPICE.
Experiment 03	PSPICE Simulation Of Different Types Of Theorems For Ac Circuits.
Experiment 04	PSPICE Simulation Of Experiment 2, 3, 4 Using Netlist Coding.
Experiment 05	Modeling of transformer and PSPICE simulation of a lossy transmission line.
Experiment 06	Study of Operational amplifier as an inverter, Adder, Integrator using PSPICE.
Experiment 07	Study of Differentiator, Non-Inverting Amplifier, Voltage follower (Buffer) and Comparator using Proteus/Multism Simulation.
Experiment 08	Proteus/Multism Simulation of different types of active filters using Operational Amplifier.
Experiment 09	Draw V-I Characteristics of PN Junction Diode using both PSPICE and Proteus/Multisim.
Experiment 10	Study of wave shapes of different types of clipping and clamping circuit's simulation using both PSPICE and Proteus/Multisim.

Experiment 11	Study of Common Emitter, Common Collector, Common Base BJT characteristics using both PSPICE and Proteus/Multisim.
Experiment 12	Introduction to PCB design using Proteus//Multisim.
Experiment 13	PCB design of Voltage regulator using Proteus//Multisim.
Experiment 14	PCB design of real-life Amplifier using Proteus//Multisim.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Design and Simulate** different circuits using modern simulation tools (PSPICE, Proteus, and Multisim).
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Project/Final exam
COL2	Lecture	Lab report/Final exam

Course Code: EEE 321 **Course Title: Power System I** **Credits: 3**

Rationale of the Course:

Power systems are complex networks of generators and loads interconnected via transmission line, distribution lines, and various types of equipment and apparatus (transformers, circuit breakers, switchgear etc). Modern power systems have grown larger and more geographically expansive with many interconnections between neighboring systems and neighboring countries power systems. An overview of modern power systems meeting present and future challenges involves understanding the fast-changing structure of this system, the behavior of its components under steady state, and dynamic and transient conditions. This course helps with an understanding to evaluate the response of this complex system to variable loads, and to determine how this system can be controlled to supply the loads reliable quality power i.e the variation of voltage and frequency at the user end should within the tolerance. After completing this course successfully students should be able to work efficiently in design and operation of a modern power system.

Course Objective:
The objective of this course are to:

1. Explain the importance of power system and operation of different types of power plants.
2. Demonstrate the modeling of power system and transmission lines.
3. Introduce the methods of load flow study in a power system.
4. Discuss the symmetrical and asymmetrical fault analysis in power system.

Course Content:
Introduction: Objective and importance of the course, Course Outcomes, an overview of power system of Bangladesh, AC and DC transmissions. Review of basic concepts of AC circuits. Network representation: single line and reactance diagram of power system and per unit representation. Line representation: equivalent circuit of short, medium and long lines. Reactive compensation of lines. Power flow control: Tap Changing transformer, Phase shifting, booster and regulating transformer and shunt capacitor. Load flow: Gauss-Siedel and Newton-Raphson Methods. Fault analysis: Symmetrical and Unsymmetrical fault analysis. Power plants: types, general layout of thermal power plant, and major components of gas turbine, steam turbine and combined cycle power plants. Load curves: Demand factor, diversity factor, load duration curves, energy load curves, load factor, capacity factor and plant factor. Protection: Introduction to circuit breakers. Typical Layout of a substation.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** the operation of different types of power plants, load curves and Comprehend the transmission line modeling in power system.
CLO2	**Analyze** the load flow in power system applying Gauss-Seidel/Newton-Raphson methods.
CLO3	**Simulate** a specific power system using MATLAB/Power world simulator for load flow study and determine the real and reactive power flow.
CLO4	**Develop** the solution for fault analysis in power system.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√	√									
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: EEE 322 **Course Title: Electrical Service Design** **Credits: 1.5**

Rationale of the Course:

Design of Electrical Services for Buildings provides a basic grounding for students and graduates in the field. It covers methods of wiring, schemes of distribution and protection for lighting and power installations. Systems such as alarms and standby supplies are also covered.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 322. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Introduction to Electrical & Electronic symbols. Tools: Screw drivers, Pliers, Hammers, Wooden saw, Hand drill, Twist drill.
Experiment 02	Wire Splicing & Termination: Necessity of wire splicing & termination, Western Union Splice, Married Joint Splice.
Experiment 03	Single Branch Splice, Double Branch Splice, Tap Joint for Stranded Wires, Flexible Cord Splicing, Pigtail joint.
Experiment 04	Switches: Surface Switch, Flush Switch, Pull Switch, Grid Switch, Architrave Switch, Rotary Snap Switch
Experiment 05	Push Button Switch, Quick Break Knife Switch, Lamp Holders, Socket Outlet, Main Switch, Distribution Fuse Board.
Experiment 06	Protective devices: Relay, Circuit Breaker &
Experiment 07	Protective devices: Fuse.
Experiment 08	Illumination: Fluorescent Lamp with thermal starter & glow starter.
Experiment 09	Problems on Illumination Theory.
Experiment 10	Internal wiring of a building with 3φ Supply
Experiment 11	Internal wiring of a building with 1φ Supply
Experiment 12	Lamp circuits: Simple circuit for bed room & staircase, series parallel circuit.
Experiment 13	Introduction to AutoCAD software with basic symbols and instruction.
Experiment 14	Design a floor with electrical wiring in AutoCAD Software.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Design** a floor with electrical wiring in AutoCAD Software.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: EEE 323 **Course Title: Digital Signal Processing** **Credits: 3**

Rationale of the Course:

Digital Signal Processors (DSP) take real-world signals like voice, audio, video, temperature, pressure, or position that have been digitized and then mathematically manipulate them. Signal processing is integral in searching for life beyond Earth. An important aspect to effective communications across satellite, video, radio and wireless systems, signal processing makes the processing and transmission of data more efficient.

Digital signal processing (DSP) is the use of digital processing, such as by computers or more specialized digital signal processors, to perform a wide variety of signal processing operations. The digital signals processed in this manner are a sequence of numbers that represent samples of a continuous variable in a domain such as time, space, or frequency.

Course Objective:

Digital signal processing is mathematically modeled as a function or a sequence of numbers that represent the state or behavior of a physical system. This course provides the fundamental theories and techniques to construct modern information systems. The course offers the ability to represent signals in time, frequency, z and discrete frequency domains as well as to analyze the systems and to design digital filter. The course is a prerequisite course for further studying of other multimedia related courses, such as speech processing, image processing, audio and video data compressing, pattern recognition, communication systems, biomedical signal processing etc. To accomplish thesis and research on modern interests and topics, this course is necessary step.

Course Content:

Introduction to Digital Signal Processing: Signal, System, Signal processing, Basic Elements of DSP, Advantages, Drawbacks and Application areas of Digital Signal Processing, Classification of Signals with Explanation & Example, Concept of frequency in continuous time sinusoidal signals and Characteristics of Analog Sinusoidal signal, Concept of frequency in Discrete time sinusoidal signals and Properties of Discrete time Sinusoids, ADC, Sampling, Aliasing effect, Anti-aliasing filtering, related mathematical problems.

Discrete-Time Signals and Systems: Representation of discrete-time signal, Basic Elementary Signals, Classification of Discrete-Time Signals, Signal Operations, Block

Diagram, Representation and Classification of Discrete-Time Systems, Analysis of Discrete-Time Linear Time-Invariant Systems, Response of LTI Systems to Arbitrary Inputs: The Convolution Sum, Mathematical and graphical representation of linear convolution, Circular convolution using matrix method, Correlation, Cross correlation coefficient, Auto correlation.
The z-Transform and Its Application to the Analysis of LTI Systems: z-Transform, Properties of z-Transform, Relation between Laplace & z-transform, One-sided z-Transform and Related Mathematical Problems, Rational z-Transform, Pole-Zero Locations & Plot and Related Mathematical Problems.
Frequency Analysis of Signals: The Fourier Series for Continuous-Time Periodic Signals.
The Discrete Fourier Transform: Its Properties and Applications: IDFT, Properties of DFT, DFT as Linear Transformation, Fast Fourier Transform (FFT).
Frequency-Domain Analysis of LTI Systems: LTI Systems as Frequency Selective Filters, Digital Resonators, Notch Filters Design Digital Resonators.
Design of Digital Filters: Introduction to Digital filter, Structure of realization of LTI system, Filter design steps, FIR filter calculation: Window method, Optimal method, Frequency sampling method, Basic features of IIR filter.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Remember the definitions of signal, systems and their discrete-time and continuous time representation using the concepts of trigonometry, complex algebra and acquire knowledge about Systems.
CLO2	Apply Fourier transform and z-transform in solving real life problems.
CLO3	Apply different properties of the transform equations to design, implement, analyze and compare the digital filters for processing of discrete-time signals.
CLO4	Analyze various transfer domain representation in designing filters and integrate computer-based tools for engineering applications and employing signal processing strategies.
CLO5	Develop creative and innovative designs that achieve desired performance criteria within specified objectives and constraints.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									
CLO4			√	√	√							
CLO5			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Class Test/ Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/ Mini Project/ Presentation

Course Code: EEE 324 Course Title: Digital Signal Processing Lab Credits: 1.5

Rationale of the Course:
The area of digital signal processing has advanced rapidly over the last four decades. This advancement is attributed to the progress in digital computer technology and integrated circuit fabrications. This lab introduces students to DSP design and analysis techniques that are core knowledge for DSP engineers, and which serve as solid grounding for advanced level work in DSP. This lab aims at supporting the teaching and research activities in the area of DSP, which are either currently being.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 333. The students will carry out experiments using hardware along with simulation tool. They will gain exposure to equipment and simulation tool in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their calculations.

Course Content:

Experiment	Topics
Experiment 01	Introduction to MATLAB and Generation of Continuous time signal and Discrete time signal using MATLAB.
Experiment 02	Generation of different types of basic signals (Unit step signal, Impulse signal, Ramp signal, Exponential signal) using MATLAB.
Experiment 03	Verification of Sampling Theorem, Aliasing and Spectrum analysis of sampled signals.
Experiment 04	Different types of signal operation of any sinusoidal signal using MATLAB (Summation, Multiplication, Folding and Time Shifting operation of sinusoidal signal for both Continuous time and Discrete time signal).
Experiment 05	DTFT of finite-length signals in MATLAB and their spectra.
Experiment 06	Impulse response of a given system.
Experiment 07	Linear Convolution of two given systems.
Experiment 08	Auto correlation of a given sequence and verification its properties.
Experiment 09	z-Transformation and LTI system analysis in MATLAB.
Experiment 10	Write the MATLAB code for Fast Fourier Transform of any sinusoidal signal.
Experiment 11	FIR/IIR Filters using pole-zero placement.
Experiment 12	Linear phase FIR filter design using window method in MATLAB.
Experiment 13	IIR filter design using impulse invariance.
Experiment 14	Perform Fast Fourier Transform of any sinusoidal signal using FPGA board.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge for signal generation, processing and filter design using MATLAB and also by hardware implementation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 325 Course Title: Electrical Properties of Materials Credits: 3

Rationale of the Course:

Electrical property refers to the response of a material to an applied electric field. Electric conductivity is one of the key properties. One of the principal characteristics of materials is their ability (or lack of ability) to conduct electrical current. Indeed, materials are classified by this property, that is, they are divided into conductors, semiconductors, and nonconductors. With the advancement of material science and the techniques for processing materials, a wide range of materials are now available for any imaginable applications particularly in the field of electrical engineering.

Course Objective:

The advancement of material science and the techniques for synthesizing materials, a wide range of materials are now ubiquitous for any applications and in fact, in the field of electrical engineering. When selecting a material for a given application the material properties must satisfy the function and the operating conditions of the component or the structure being designed. One of the most important properties of material is electrical properties, which directly influence the choice of material. Electrical properties are their ability to conduct electrical current. Various electrical properties are resistivity, electrical conductivity, temperature coefficient of resistance, dielectric strength and thermoelectricity. This course will help to understand and evaluate Electrical, Thermal, Optical and Magnetic properties of materials so that a thorough understanding of the characteristics of materials can be obtained to facilitate the manufacturing technology.

Course Content:

Crystal structures: Types of crystals, lattice and basis, Bravais lattice and Miller indices.

Classical theory of electrical and thermal conduction: scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall effect and thermal conductivity.

Introduction to quantum mechanics: Wave nature of electrons, Schrödinger's equation, one dimensional quantum problems, infinite quantum well, potential step and potential barriers, Heisenberg's uncertainty principle and quantum box.

Band theory of solids: Band theory from molecular orbital, Bloch theorem, Kronig-Penny model, effective mass, density of states.

Carrier statistics: Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy.

Dielectric properties of materials: Dielectric constant, polarization- electronic, ionic and orientational; internal field, Clausius-Mossotti equation, spontaneous polarization, frequency, dependence of dielectric constant, dielectric loss and piezoelectricity.
Magnetic properties of materials: Magnetic moment, magnetization and relative permittivity, different types of magnetic materials, origin of ferromagnetism and magnetic domains. Introduction to superconductivity: Zero resistance and Meissner effect, Type I and Type II superconductors and critical current density.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the crystal structures of the materials, concept of solids, and band theory of solids.
CLO2	Understand classical theory of electrical and thermal conduction in solids.
CLO3	Explain the wave nature of electrons, Schrödinger's equation, one dimensional quantum problems, infinite quantum well, potential step and potential barriers, Heisenberg's uncertainty principle and quantum dot.
CLO4	Explain the dielectric and magnetic properties of materials and familiarize with the concepts of superconductivity and nanotechnology.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid-term exam, Assignment, Class Test
CLO2	Class Lecture	Mid-term exam, Assignment, Class Test
CLO3	Class Lecture	Final exam, Assignment, Class Test
CLO4	Class Lecture	Final exam, Assignments, Class Test

Course Code: EEE 327 Course Title: Industrial and Power Electronics Credits: 3

Rationale of the Course:
Modern industrial and power electronics play a key role in many electrical processes ranging from megawatt electricity transmission and distribution to microwatt energy harvesting and power conditioning.

Course Objective:

In this course the students will learn advance knowledge of the Industrial Power electronics.

Course Content:
Power semiconductor switches and triggering devices: BJT, MOSFET, SCR, IGBT, GTO, TRIAC, UJT, DIAC, Natural commutation, forced commutation, Rectifiers: Uncontrolled and controlled single phase and three phase rectifiers. DC-DC Converters: Linear-series and shunt,

switching buck, buck boost, boost, Cuk, Sepic, Zeta converters. AC voltage controllers: single and three phase, DC motor control. Single phase cycloconverter. Inverters: Single phase and three phase voltage and current source. AC motor control. Stepper motor control. Resonance inverters. Pulse width modulation control of static converters.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the triggering devices.
CLO2	**Describe** the Converters.
CLO3	**Explain** the controller of single phase and three phase
CLO4	**Describe** the inverters.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO3	Lecture, Group Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture, Group Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 328 Course Title: Industrial Power Electronics lab Credits: 1.5

Rationale of the Course:

Power electronics studies the application of semiconductor devices to the conversion and control of electrical energy. The field is driving an era of rapid change in all aspects of electrical energy. The laboratory course provides instruction in general lab practices, measurement methods, and with the design and operation of several common circuits relevant to the field of power electronics. It also provides experience with common components such as motors, batteries, magnetic devices, and power semiconductors. The course has a significant design component.

Course Objective:

By the end of this course, students should be able to:

1. CLOlect data and revise an experimental procedure iteratively and reflectively,
2. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
3. Extend the scope of an investigation whether or not results come out as expected,
4. Communicate the process and outcomes of an experiment,
5. Conduct an experiment CLOlaboratively and ethically.

Course Content:

Experiment	Experiment title
Experiment 01	Study of Diode characteristics and Zener diode characteristics.

Experiment 02	Study of the switching properties of BJT and MOSFET.
Experiment 03	Study of the switching properties of SCR, TRIAC
Experiment 04	Study of the switching properties of DIAC and IGBT.
Experiment 05	Study of single-phase uncontrolled half wave and full wave rectifiers.
Experiment 06	Study of single phase controlled half wave and full wave rectifiers.
Experiment 07	Study of Buck and Boost converter
Experiment 08	Study of Buck-Boost and Cuk converters.
Experiment 09	Study of Sepic and Zeta converters.
Experiment 10	Study of single-phase half bridge inverter.
Experiment 11	Study of single-phase full bridge inverter.
Experiment 12	Study of three phase inverter circuit.
Experiment 13	Study of single-phase voltage controller.
Experiment 14	Study of three phase voltage controller.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** experiments based on power electronics devices and Design real life applications.
CLO2	**Write** comprehensive reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√		√							
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: EEE 411 Course Title: Microprocessors and Embedded Systems Credit: 3

Rationale of the Course:

Microprocessors, microcontroller and assembly language have been the most used methods of incorporating intelligence into automated devices. It is, therefore, necessary to develop a good understanding of their operation and how they can be used as building blocks for automated systems and control applications. This course explores the inner workings of a microprocessor from the programmer's perspective and several laboratory exercises will be based on microprocessor utilizing the assembly language.

Course Objective:

Microprocessor as well as microcontroller is a required course for under-graduate students in the EEE program. The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor or controller implementation. Topics include Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquCSEion systems.

Course Content:
Introduction to 8085 microprocessor: features, architecture, 8085 programming with Assembly Language and C Programming.

Introduction to 8086 microprocessor: features, architecture, minimum mode operation of 8086 microprocessor: system timing diagrams of read and write cycles, memory banks, design of decoders for RAM, ROM and PORT.

Introduction to Intel 8086 Assembly Language Programming: basic instructions, logic, shift and rotate instructions, addressing modes, stack management and procedures, advanced arithmetic instructions for multiplication and division, instructions for BCD and double precision numbers, Introduction to 8086 programming with C language. Hardware Interfacing with Intel 8086 microprocessor: programmable peripheral interface, programmable interrupt controller, programmable timer, serial communication interface, keyboard and display interface (LED, 7 segment, dot matrix and LCD).

AVR and PIC Microcontroller: I/O Ports, External Interrupts, 8-bit Timer/Counter, PWM, Serial Peripheral Interface – SPI, USART, Analog Comparator, Analog to Digital Converter, Memory Programming.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the main components and working principals of the 8086 along with 8085 microprocessor.
CLO2	**Interpret** instruction sets in assembly language.
CLO3	**Demonstrate** memory interfacing and input/output device programming in assembly language.
CLO4	**Design** the solution of real life problems using microcontroller and microprocessor.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4			√		√				√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exams
CLO4	Lecture Tutorial	Final Exams and Mini project

Course Code: EEE 41 Course Title: Microprocessors and Embedded Systems Lab Credit: 1.5

Rationale of the Course:

Microprocessor as well as microcontroller is a required course for under-graduate students in the EEE program. It is, therefore, necessary to develop a good understanding of their operation. This course explores the inner workings of a microprocessor from the programmer's perspective and several laboratory exercises will be based on microprocessor utilizing the assembly language.

Course Objective:

In this course students will perform experiments to verify practically the theories and concepts based in EEE 411. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment's and their functions.

List of Experiments:

Experiment	Topics
Experiment 01	Implementation of mathematical operation in Emulator8085 using Assembly language programming
Experiment 02	Implementation of addition and subtraction in Emulator8086 using Assembly language programming
Experiment 03	Implementation of multiplication and division in Emulator8086 using Assembly language programming
Experiment 04	Solving simple logical problems using Assembly language programming
Experiment 05	Implementation of shifting and rotation in Emulator8086 using Assembly language programming
Experiment 06	Finding odd or even numbers in Emulator8086 using Assembly language programming
Experiment 07	Introducing 8085 and 8086 Trainer Board
Experiment 08	Executing simple instructions in the 8085 and 8086 Trainer Board
Experiment 09	Observation Dot matrix using Microprocessor Trainer Board and PC
Experiment 10	7 segment LED display using Microprocessor Trainer Board and PC
Experiment 11	Implementation of counter using digital input/output port with PIC/AVR Microcontroller.
Experiment 12	Interfacing of ultrasonic sensor using timers/PWM module with PIC/AVR Microcontroller.
Experiment 13	Interfacing of temperature sensor using A/D module with PIC/AVR Microcontroller.
Experiment 14	Interfacing of GSM module with USART module of PIC/AVR Microcontroller.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** experiments based on Assembly language, MDA trainer board and related software.
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course Code: EEE 413 **Course Title: Solid State Device** **Credits: 3**

Rationale of the Course:

Solid-state devices are the controlling components of both high-tech and very ordinary devices. Their widespread usage is related to the fact that they can be utilized to interface with all human senses. The first applications of solid-state devices were the use of transistors in radios and amplifiers that interface with our sense of hearing. At the beginning of the twenty-first century, there were more solid-state devices produced than any other manufactured thing. More than ten billion components are fabricated onto a single eight-inch silicon wafer. During the 1940s the jobs of simple solid-state devices were performed with vacuum tubes and mechanical relays. The invention of the transistor in 1947 at Bell Laboratories ushered in an electronic age, beginning with telephones and radios and eventually providing ever smaller and faster computers, more efficient lighting, a means to harvest electrical energy from the sun and much more.

Course Objective:

Solid state device is an updated course for comprehending electronics in a depth way. It's sometimes called semiconductor physics. In this course, students will be given a clear concept of basic quantum mechanics, quantum nature of solids, the formation of energy bands and a detailed discussion of how energy band diagrams come from. In the earlier course of Electronics-I, students were provided the notion of Diode, BJT and MOSFET as their behavior as circuit elements. But in this course, they will be mastered in their physics like how a hole and electron generate and recombine and after that how their energy band will look like and by the end, students will be able to implement their study in process fabrication in near future. The new era is no longer going forward to concise the device size rather accepting an alternative option like choosing semiconductor materials as what we can see in heterojunction devices is built up with mixed materials. This course will also mirror another amazing idea to make devices faster like quantum tunneling using Schottky diodes.

Course Content:

Semiconductors in equilibrium: Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations, temperature dependence of carrier concentrations and invariance of Fermi level.

Carrier transport processes and excess carriers: Drift and diffusion, generation and recombination of excess carriers, built-in-field, recombination-generation SRH formula, surface recombination, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.

PN junction: Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-equilibrium condition, forward and reverse bias, carrier injection, minority and majority carrier currents, transient and AC conditions, time variation of stored charge, reverse recovery transient and capacitance.

Bipolar Junction Transistor: Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents, coupled-diode model and charge control analysis, Ebers-Moll model and circuit synthesis. BJT non-ideal effects; Hetero-junction transistors.

Metal-semiconductor junction: Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts, Schottky contact.

MOS structure: MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation, body effect and current-voltage relationship of a MOSFET. Non-ideal characteristics of MOSFET: channel-length modulation and short-channel effects in MOSFETs. MOS scaling.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Comprehend energy band diagram of semiconductors, carrier concentrations solve related mathematical problems.
CLO2	Explain the theory of excess carrier generation and recombination and solve related mathematical problems.
CLO3	Interpret the basic structure and characteristics of P-N junction, Metal-Semiconductor junction and solve related mathematical problems.
CLO4	Understand the construction, operation and characteristics of BJT.
CLO5	Describe the construction, operation and characteristics of FET and solve related mathematical problems.

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											
CLO5	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test.
CLO2	Class Lecture	Mid Term Exam/Assignment/Class Test.
CLO3	Class Lecture	Mid Term Exam/Final Exam,Assignment.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: EEE 415 **Course Title: Control Systems** **Credits: 3**

Rationale of the Course:
Control Systems course is a big step forward towards further advanced courses which deal with mathematical modelling as well as physical systems. Students may not be able to gain pragmatic knowledge if they despise this course. Hence, this course can bring a paradigm shift in their cognitive levels. Last but not the least, the course curriculum has been designed deftly to meet the demands of the contemporary era.

Course Objective:
Automatic control encroaches upon many of the defined engineering and mathematics university courses in terms of both theory and practice. In most engineering disciplines it is a topic which is constantly changing in order to keep pace with modern day application requirements. Many new technologies have risen to prominence in the area of control system during the last decade. Significantly the increasing influence of microcomputers has led to a much greater need for an emphasis to be placed on digital aspect of control. With the advent of VLSI design in association with special-purpose machines, higher speed and greater memory capacity computers are becoming available, allowing further control schemes to be considered. The undergraduate students of engineering taking the course as a part of their overall degree must necessarily become aware of the developments in digital control which have now become standard practice in many industrial applications. This is a basic course for engineering students and students need a mathematical background such that Laplace Transform, solutions to differential equations and complex numbers have been taught.

Course Content:
Basic concepts: Control System Fundamentals, Notion of feedback, open-loop and closed-loop systems.
Modeling and representations of control systems: Ordinary differential equations, Transfer functions, Block diagrams, Signal flow graphs (SFG).
State variables: SFG to state variables, transfer function to state variable and state variable to transfer function.
Feedback control system: Closed loop systems, parameter sensitivity, transient characteristics of control systems, effect of third pole and zero on the system response and system types and steady state error.
Stability: Introduction, Routh Hurwitz stability criterion for normal and special cases, stability in state space.
Analysis of feedback control system: Root locus method and frequency response method.
Design of feedback control systems: Nyquist plot, polar plot, controllability and observability, root locus, frequency response and state variable methods.
Digital control systems: Introduction, sampled data systems, stability analysis in Z-domain.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic control engineering and system modeling in the frequency and time domain.
CLO2	**Analyze** system using block diagram representation and SFG.
CLO3	**Analyze** the stability of any particular system by understanding Poles and Zeros.
CLO4	**Design** a feedback control system using different techniques like Nyquist plot, polar plot, root-locus technique etc.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									
CLO4			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Course Code: EEE 416 **Course Title: Control Systems Lab** **Credits: 1.5**

Rationale of the Course:

Control Systems Lab will substantialize the notions related to the control of different systems into practice. Thus, the students will be able to design some sophisticated projects adroitly based on what they learned in the theory course as well as in the relevant mathematic courses prior to the lab.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 415. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Modeling of physical systems and study of their open loop response
Experiment 02	Familiarization with Poles and Zeros using MATLAB
Experiment 03	Response of different types of unity feedback system
Experiment 04	Block Diagram Reduction using MATLAB and SIMULINK
Experiment 05	Miscellaneous topic: Topological reduction of a System
Experiment 06	Study of PID controller
Experiment 07	Nyquist and Polar plot using MATLAB
Experiment 08	Design of control system using root-locus technique
Experiment 09	Study of Steady-State Error Constants and Reduction of Steady-State Error from a System
Experiment 10	Design Parameters of a Complete System and Improving the Stability
Experiment 11	Design a Spring-Damper System and Improve the Stability using PID controller
Experiment 12	Study of stability improvement using root-locus technique

Experiment 13	Study of frequency response e.g., Polar plot using MATLAB
Experiment 14	Familiarization with PLC

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Design** different types of controllers using experimental and simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Mini Project/ Presentation

19(f). Elective Course (Group I: Power Group)

Course Code: EEE 431 **Course Title: Power System II** **Credits: 3**

Rationale of the Course:
Students are able to explain in detail and critically evaluate technologies and information systems for operational management of conventional and modern electric power systems as well as methods and algorithms for steady-state network calculation, failure calculation, power system operation and optimization. They are additionally able to apply these methods to real electric power systems.

Course Objective:
This course examines the basic theory, characteristics, construction operation and application of electrical machines. It includes the study of poly phase Induction motors, Single Phase motors, Synchronous Motors, Alternators and Special Machines.

Course Content:
Power System Stability: Stability; Transient, dynamic and steady-state stability; Stability limit; Assumption of classical stability model; Swing equation, its derivation and significance; H-constant; Coherent machine, swing equation of coherent & non-coherent machines; Power angle equation; Equal area criterion of stability: derivation, explanation and applications; multi-machine system; Factors affecting stability; Related mathematics.

Introduction to switchgear: Definition, essential features, equipment; Faults and abnormalities; short circuit and overload; A typical protective system; primary and back-up protection.

Protective Relays: Definition, functions, fundamental requirements; Classification of relays; Important terms about relay: pick-up current, current setting, plug-setting, PSM, TMS; Overcurrent relay: classification, instantaneous, time-delayed, definite-time, inverse time and IDMT overcurrent relays; Construction and operation: Induction type overcurrent relay, induction type directional power relay, induction type directional overcurrent relay; Related mathematics.

Protection of Alternator: Significance and difficulties, major faults and abnormal conditions, protective schemes; Class A, class B and class C protection; Differential protection; Earth-fault protection; Stator inter-turn protection; Field-failure protection; reverse power protection; under-frequency protection; Related mathematics.

Protection of Transformer: Faults in transformers' auxiliary equipment, internal and external faults; Buchholz relays: construction, operation, advantages and drawbacks; Earth-fault or leakage or overcurrent protection; Problems in application of differential protection; Related mathematics.

Protection of Busbars and Lines: Differential and fault-bus protection; Time-graded overcurrent protection; differential pilot-wire protection; Distance protection.

Fuses: Definition, pros and cons, characteristics, element materials of Fuses; Important terms about fuse: current rating, fusing current, fusing factor, prospective current, cut-off current, pre-arcing and arcing time, operating time, breaking capacity; Types in details; HRC cartridge fuse; HRC fuse with tripping device; drop-out fuse; high voltage fuse; current carrying capacity relation; difference between fuse and circuit breaker.

Circuit Breaker: Definition, functions, operating principle and types; Arc phenomenon and method of quenching; Decay process; oscillogram of voltage and current at arc extinction; Important terms: arc voltage, restriking voltage, recovery voltage, TRV; Factors influencing arc extinction; Construction, working and pros & cons: Oil, SF_6 and vacuum circuit breaker; Breaking capacity, making capacity and short-time rating of circuit breaker; Resistance switching; Related mathematics.

Protection against overvoltage: Voltage surge; causes of overvoltage, lightning; Protection against lightning: earthing screen, overhead ground wires and lightning arresters; Types of LA; Rod gap and horn gap LA; Surge absorber.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** Power System Stability and **Solve** related mathematical problems.
CLO2	**Describe** operation principle of different types of relay and **solve** related mathematical problems.
CLO3	**Explain** alternator, transformer and busbar, overvoltage protection schemes and **solve** related mathematical problems.
CLO4	**Describ**e the construction & operation principle of Fuses and Circuit Breakers and solve related mathematical problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture, Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture, Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture, Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture, Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 416 **Course Title: Power System Lab** **Credits: 1.5**

Rationale of the Course:

Electrical Power systems lab is one on the most developed lab in electrical engineering department. It is equipped with many advanced Apparatuses and devices to make all of important tests on power systems starting from generation unit with control panel and protection equipment passing through the transmission lines to the load units with power factor correction panel. Power system lab links the theoretical part of power systems with the practical part and provide the students with practical experience with real practical power systems devices and equipment and Making analysis on real power systems starting from generation unit till to the load unit.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 415. They will able to understand the concept of MATLAB programming in solving power systems problems and can understand power system planning and operational studies. The students will acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks. They can able to acquire knowledge on power system analysis methods, load flow study, symmetric and unsymmetrical fault.

Course Content:

Experiment	Experiment title
Experiment 01	Familiarization with Power System Lab.
Experiment 02	Formation of Y-bus Matrix Using MATLAB
Experiment 03	Formation of Z-bus Matrix from Y-bus Matrix Using MATLAB.
Experiment 04	Study of different voltage control methods.
Experiment 05	Symmetrical Component Findings from Unbalanced System Using MATLAB.
Experiment 06	Load Flow Study of a Power System using Gauss-Seidel method.
Experiment 07	Load Flow Study of a Power System using Newton Raphson Method.
Experiment 08	Load Flow Study of a Power System using fast decouple method.
Experiment 09	Three phase symmetrical fault analysis using MATLAB Simulink.
Experiment 10	Unsymmetrical faults (L-G, L-L, L-L-G) analysis using MATLAB Simulink.
Experiment 11	Study of a smart grid system.
Experiment 12	Observation of three phase series compensation network.
Experiment 13	Study of Circuit breakers and relays.
Experiment 14	Layout design of substation.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Analyze** load flow, voltage control and fault in power system using modern tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√							√				
CLO2		√						√	√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Final exam
COL2	Lecture	Lab report/Final exam

Course Code: EEE 433 **Course Title: Control Systems II** **Credits: 3**

Rationale of the Course:
Control Systems II is an advanced application-based course of Control Systems where the students will learn to substantialize their theoretical notions into practices. In addition to that, there is no room for dogma, rather materializing the theories adroitly is the imperative vision of this course.

Course Objective:
This course builds on the design and analysis of control systems introduced in EEE 415. More detailed and complex analysis on Root Locus diagrams, bode plots and Nyquist plots will be provided. The concepts of compensation, PID controllers and their applications in control systems design will be introduced. Practical classes on the use of MATLAB for numerical and graphical analysis of control systems will run concurrently with the lectures to enhance learning. Students will also be introduced to robust control. However, the objectives of this course are to:

- Provide students with the tools and concepts used for the design and analysis of control systems.
- Introduce students to some advanced concepts in Control Systems Engineering and their applications e.g., PID controllers, robust control.
- Use MATLAB as a software approach for the design and analysis of advanced control systems.

Course Content:
Modeling of physical systems: Linearization and its consequences, Concepts of state and State-space. Derivation of state models from transfer functions and ordinary differential equations.
Solution of state equations: Controllability and Observability. Classification of synthesis method of sensitivity and error analysis and stability. Design via state space.
Performance measures: ISE, ITAE. Quadratic indices State equations of digital systems with sample and hold, state equation of digital systems, digital simulation and approximation.
Solution of discrete state equations: z-transform, state equation and transfer function, state diagrams, state plane analysis.
Stability of digital control systems: Digital simulation and digital redesign. Time domain analysis. Frequency domain analysis. Optimal linear digital regulator design. Digital state observer.
Introduction to neural network and fuzzy control: Microprocessor control, adaptive control, Hα Control, non-linear control.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the applications of basic control engineering in a physical system.
CLO2	Analyze system using state equations and performance measures.
CLO3	Analyze the stability of different types of digital control systems.
CLO4	Design a non-linear control system using adaptive control and fuzzy logic.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									
CLO4			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Course Code: EEE 434 **Course Title: Control Systems II Lab** **Credits: 1.5**

Rationale of the Course:

Control Systems II Lab will substantialize the notions related to the advanced designing of different types of control systems into practice. Thus, the students will be able to design some sophisticated projects adroitly based on what they learned in the related theory courses along with as well as prior to the lab.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 433. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Modeling of physical systems and study of their analogy as well as closed loop response
Experiment 02	State Space Modelling using MATLAB
Experiment 03	PID Design Method for DC motor Speed Control
Experiment 04	Position Control of DC Servo Motor
Experiment 05	Study of PID (Three terms) Control using a Process Control Simulator
Experiment 06	Control of a Conveyor system using Programmable Logic Controller
Experiment 07	Root Locus Design Method for DC Motor Position Control
Experiment 08	Study of Three-Step Control System using a Process Control Simulator
Experiment 09	Speed Control of DC Servo Motor
Experiment 10	Control of a Conveyor system using Programmable Logic Controller (PLC) Part-2

Experiment 11	Design of Closed Loop DC-DC Converters using PID Controller
Experiment 12	Design of Closed Loop Inverters using PID Controller
Experiment 13	Control of a Grid Connected Photovoltaic System
Experiment 14	Design of Fuzzy Logic Controller

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Write comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	Design different types of digital controllers using experimental and simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Mini Project/ Presentation

Course Code: EEE 435 Course Title: Electrical Power Transmission and Distribution Credit: 3

Rationale of the Course:

In industry, to operate electrical transmission and distribution systems, the knowledge of its various components by power system and their function is one of the main duties and hence quite important. This course is intended to develop such skills to not only to maintain the proper functioning of power system but also to diagnose and rectify the general problems associated with electrical power transmission and distribution.

Course Objective:

Power T&D is the basic course for an electrical engineer. This course provides knowledge about stability and protection of power system analyzing system faults. To develop power sector in a developing country like us, an electrical engineer should have clear concept and ideas regarding this course.

Course Content:

Design and constructional features of overhead power transmission lines and underground distribution line. Transmission line – conductor types, insulators and potential distribution, sag and loading, lightning and ground wire, corona and its reduction, calculation of inductance and capacitance- composite, bundled conductors and parallel circuits line, effect of earth in capacitance calculation. Insulated cables- comparison with overhead line. Solid dielectric, crossed polyethylene (XPLE), oil and gas filled. Distribution systems-radial, ring mains and interconnected. Layout of a typical substations and familiarization with its protective devices. High voltage DC transmission system. Power system harmonics. Introduction to Smart grid.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Analyze** design and construction and features of overhead transmission lines.
CLO2	**Analyze** design and construction and features of overhead and underground distribution lines.
CLO3	**Discuss** about the layout of a typical substations and get familiarized with its protective devices
CLO4	**Describe** the operation of dc transmission system and smart grid.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exam.
CLO4	Lecture Tutorial	Final Exams

Course Code: EEE 437 **Course Title: Power Plant Engineering** **Credits: 3**

Rationale of the Course:

From small to large power applications, power plays an important role. There are many uses of power in today’s society and it can hardly be imagined not to have. Power engineers plan, design, and implement solutions to meet energy demands across the world. Their relevance to society is vital for future needs and must be continued to provide comfortable life.

Course Objective:

The goal of this course is to make the students familiar with power plant systems, terms and definitions, basic power plant engineering design calculations, proper design and application of power plant related equipment, methods of diagnosing and correcting equipment mis-operation or misapplication. They will become familiar with recognized standards utilized in the design and operation of power plant equipment and will prepare & present topical issues relevant to power plant design and operations.

Course Content:

Load forecasting. Load curve: demand factor, diversity factor, load duration curve, energy load curve, load factor, capacity factor, and utilization factor. Thermal power station: heat rate, incremental heat rate, efficiency, capacity scheduling, load division. Principles of power plants: steam, gas, diesel, combined cycle, hydro and nuclear. Captive power plant and cogeneration. Power plant auxiliaries and instrumentation. Power evacuation and switchyard. Selection of location: technical, economical and environmental factors. Generation scheduling.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CO1	**Understand** the load curve and **Comprehend** different factors like demand factor, load factor, diversity factor etc. related to power plant and tariff system.
CO2	**Explain** the operation of Different types of power plant.
CO3	**Solve** problem related to Hydroelectric Power Plant, Steam turbine Power Plant etc.
CO4	**Select** the type of Power Plant to chase the Load Curve in a specific area.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLO	Program Learning Outcomes (PLOs)											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√											
CLO3		√										
CLO4				√			√					

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture / Group Discussion.	Mid-term, Class Test, Assignment.
COL2	Lecture / Group Discussion.	Mid-term, Class Test, Assignment.
COL3	Lecture / Group Discussion.	Final Exam, Class Test, Assignment.
COL4	Lecture / Group Discussion.	Class Test, Final Exam.

Course Code: EEE 439 Course Title: Advanced Electrical Machines Credits: 3

Rationale of the Course:

Electric machines, in the form of generators, produce virtually all electric power on Earth, and in the form of electric motors consume approximately 60% of all electric power produced. Electric machines were developed beginning in the mid 19th century and since that time have been a ubiquitous component of the infrastructure. Developing more efficient electric machine technology is crucial to any global conservation, green energy, or alternative energy strategy.

Course Objective:

This unit of study aims to cover the skills and knowledge required to plan, design and integrate an electrical machine. The student will learn to research and use: manufacturers' datasheets; technical drawings; relevant documentation; and, perform calculations to safely and competently carry out the tasks of design and integration of an electrical machine.

Course Content:

Single-Phase induction motor, Single-phase commutator series motor, Energy conversion in doubly salient machines. Three-phase conventional reluctance machines. Salient pole synchronous reluctance machine. Stepper motor operation principles. Permanent magnet stepper motor. Variable reluctance stepper motors. Switched reluctance motor. Linear induction motors, universal motor, permanent magnet DC motor, unipolar and bipolar brush less DC motors, stepper motor and control circuits. Reluctance and hysteresis motors with drive circuits, switched reluctance motor, electro static motor, repulsion motor, synchronous motors and control transformers. Permanent magnet synchronous motors. Acyclic machines:

Generators, conduction pump and induction pump. Magneto hydrodynamic generators. Fuel Cells, thermoelectric generators, flywheels. Vector control, linear motors and traction. Photovoltaic systems: stand-alone and grid interfaced. Wind turbine generators: induction generator, AC-DC-AC conversion.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Apply mathematics to formulate solutions to solve electrical machine problems.
CLO2	Apply Advanced AC circuit Theory to analyze and design an electrical machine.
CLO3	Identify, analyze and evaluate power conversion and control techniques to interface with an electrical machine.
CLO4	Research, Colaborate, analyze and evaluate the safety and compliance requirements of an electrical machine.
CLO5	Design, program and integrate an electrical machine system.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2			√									
CLO3	√											
CLO4				√								
CLO5			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture / Group Discussion	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Class Test / Final Exam

Course Code: EEE 441 **Course Title: High Voltage Engineering** **Credit: 3**

Rationale of the Course:

The primary reason that power is transmitted at high voltages is to increase efficiency. As electricity is transmitted over long distances, there are inherent energy losses along the way. High voltage transmission minimizes the amount of power lost as electricity flows from one location to the next. The course provides students with knowledge on the fundamentals governing generation and control in high voltage power systems.

Course Objective:

High-voltage engineering is the science of planning, operating, and testing high-voltage electrical devices and designing the insulation coordination in order to ensure the reliable operation of the power network. Student will be able to get a fair knowledge about the generation of high voltages and currents. They will be able to understand the generation and measurement of high voltages and currents. They will also understand the concept of solid, liquid and gaseous dielectrics and gain knowledge in testing of high voltage equipment's.

Course Content:
Generation of high voltage: Alternating voltage, transformer cascade. Series resonant circuit for high voltage ac testing. Test of dc and ac cable. Ionization and decay process: Townsend's first and second ionization coefficient. Electric breakdown in gases. Townsend's criterion for spark breakdown. Sparking potential. Penning effect. Corona discharges, power loss calculation. Breakdown of solid and liquid dielectrics. High voltage DC: Rectifier circuits, voltage multipliers, Van-de-Graff and electrostatic generators. High voltage AC: Cascaded transformers and Tesla coils. Impulse voltage: Shapes, mathematical analysis, codes and standards, single and multi-stage impulse generators, tripping and control of impulse generators. High voltage measurements and testing. Over-voltage phenomenon and insulation coordination. Lightning and switching surges, basic insulation level, surge diverters and arresters.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the generation and characteristics of high voltage AC and DC
CLO2	**Understand** the electric breakdown in gas, solid and liquid dielectrics
CLO3	**Understand** the generation and characteristics of Impulse voltage
CLO4	**Analyze** high voltage measurements and testing

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exam.
CLO4	Lecture Tutorial	Final Exams

Course Code: EEE 442 Course Title: High Voltage Engineering Lab Credit:1.5

Rationale of the Course:
The primary reason that power is transmitted at high voltages is to increase efficiency. As electricity is transmitted over long distances, there are inherent energy losses along the way. High voltage transmission minimizes the amount of power lost as electricity flows from one location to the next. The course provides students with knowledge on the fundamentals governing generation and control in high voltage power systems.

Course Objective:
In this course students will perform experiments to verify practically the theories and concepts based in EEE 441. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment's and their functions.

List of Experiments:

Experiment	Topics
Experiment 01	Determination of dielectric strength Solid Insulating material.
Experiment 02	Determination of dielectric strength Liquid Insulating material.
Experiment 03	Determination of dielectric strength Gaseous Insulating material.
Experiment 04	Determination of dielectric strength of air using Sphere gap.
Experiment 05	Measurement of high voltage using Electrostatic Voltmeter.
Experiment 06	Earth resistance measurement.
Experiment 07	Generation and measurement of AC voltage
Experiment 08	Generation and measurement of AC voltage - Sphere Gap
Experiment 09	Setting up the HV experiment
Experiment 10	Generation and measurement of direct voltage
Experiment 11	Generation of High Direct Voltages
Experiment 12	Testing of Lightning Arrester
Experiment 13	Investigation of a single-stage Impulse Generator
Experiment 14	Investigation of a multi-stage Impulse Generator

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different high voltage equipment's and their experiment
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the PLOs

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture.	Lab Performance, Project Report and Lab Final Exam.
CLO2	Lab demonstration Lecture.	Lab Report.

Course Code: EEE 443 Course Title: Power System Protection and Reliability Credit: 3

Rationale of the Course:
Electrical Power System is a highly invested area. The more reliable electricity we want, the more is need to protect it. Protection is essential to keep equipment and personnel safe from any kind of damage caused by an electrical unbalance or fault condition.

Course Objective:
The main objective of using power system protection is to detach the faulty section from the system to make the rest of the portion work without any disturbance. In addition to this, it is used for the protection of power system and prevent the flow of fault current.

Course Content:
Electric arcs, arc extinction mechanism, transient recovery voltage. Circuit Breakers: operating mechanisms, construction and operation of Miniature Circuit Breaker (MCB), Molded Case Circuit Breaker (MCCB), Air Circuit Breaker (ACB), Air Blast Circuit Breaker (ABCB), Vacuum Circuit Breaker (VCB), Oil Circuit Breaker (OCB), Minimum Oil Circuit Breaker (MOCB) and Sulfur Hexafluoride (SF6) circuit breaker. High Rupturing Capacity (HRC) Fuse, Drop Out Fuse (DOF), Load Break Switches, Contactors. Bus bar layout, isolators, earthing switch; lightning arresters, CT, PT: wound type and CCVT (Capacitor Coupled Voltage Transformer), MOCT (Magneto Optical Current Transducer). Fundamental of protective relaying. Classical relays (electromagnetic attraction type, induction type); numerical relays. Inverse Definite Minimum Time (IDMT) relays, directional relays, differential and percentage differential relays, distance relays, pilot relays (wire pilot, carrier). Protection of generators, motors, transformers, transmission lines, HVDC system and feeders.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Electric arcs and arc extinction mechanism.
CLO2	**Understand** the operating principle of different Circuit Breaker.
CLO3	**Understand** the fundamentals of protective relaying.
CLO4	**Understand** the Protection of generators, motors, transformers, transmission lines, HVDC system and feeders.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exam.
CLO4	Lecture Tutorial	Final Exams

Course Code: EEE 444 Course Title: Power System Protection and Reliability Lab Credit: 1.5

Rationale of the Course:

Electrical Power System is a highly invested area. The more reliable electricity we want, the more is need to protect it. Protection is essential to keep equipment and personnel safe from any kind of damage caused by an electrical unbalance or fault condition.

Course Objective:
In this course students will perform experiments to verify practically the theories and concepts based in EEE 443. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment's and their functions.

List of Experiments:

Experiment	Topics
Experiment 01	Introduction to MATLAB and Electrical Transients Analyzer Program (ETAP)
Experiment 02	Introduction to Power System Protection
Experiment 03	Impact of induction motor starting on power system
Experiment 04	Current Transformers
Experiment 05	Voltage Transformers
Experiment 06	Overvoltage and Undervoltage Relay
Experiment 07	Overcurrent Relay
Experiment 08	Overcurrent Protection of Transmission Line
Experiment 09	Overcurrent Protection of TransformerExperiment
Experiment 10	Parameterization of Differential Relay
Experiment 11	Differential Protection of Transformer; Low Voltage Tests on Complete System
Experiment 12	Differential Protection of Transformer; Real Protection Tests on Complete System
Experiment 13	Introduction to Ground Grid Modeling in ETAP
Experiment 14	Ground Grid Modeling of a Given System using ETAP

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different protective equipment's and their experiment.
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course Code: EEE 445   Course Title: Power System Operation and Control   Credits: 3

Rationale of the Course:

This course deal with day-to-day operation of the power system and the control actions to be implemented on the system in order to meet the minute-to-minute variation of system load demand.

Course Objective:

The goal of this course is to have an overview of power system operation and control, model power - frequency dynamics and to design power-frequency controllers. Model reactive power - voltage interaction and the control actions to be implemented for maintaining voltage profile against varying system load.

Course Content:

Principles of power system operation: SCADA, convention and competitive environment. Unit commitment, static security analysis, state estimation, optimal power flow, automatic generation control and dynamic security analysis.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Describe** Principles of power system operation.
CLO2	**Define** SCADA system and **Apply** them in proper environment.
CLO3	**Analyze** optimal power flow and static security.
CLO4	**Define** automatic generation control scheme on a power system and **Analyze** generation control on a power system using simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4	√				√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Class Test /Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Assignment / Class Test / Final Exam
CLO4	Lecture / Group Discussion	Assignment / Class Test / Final Exam

Course Code: EEE 447   Course Title: Renewable Energy   Credits: 3

Rationale of the Course:

The emphasis on renewable energy sources is growing significantly, which drives research into the integration of renewable energy sources such as solar, wind, biomass, hydro, and geothermal into current energy systems. Traditional energy sources (such as fossil fuels, coal, and gas) have two major constraints: i) they are not unlimited, and after a certain period, the reserve will be insufficient to meet the world's energy demand, and ii) they seriously pollute the environment, including temperature rises, increases in PM 2.5 levels above the safe limit, and so on. Because of these two fundamental constraints of traditional energy sources, the globe is encouraged to utilize renewable energy to meet global energy demand while reducing reliance on conventional energy sources. Renewable energy sources have great promise since they can, in theory, fulfill many times the world's energy needs.

Course Objective:

The goal of this course is to educate students to the essential principles of renewable energy sources and their advantages over traditional energy sources. It demonstrates to pupils how to calculate energy costs for various renewable energy sources. It teaches students how to build renewable/hybrid energy systems that satisfy specific energy demands while remaining economically viable and having a low environmental effect.

Course Content:

Renewable energy sources: Solar, wind, mini-hydro, geothermal, biomass, wave and tides. Solar Photovoltaic: Characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, sun tracking systems, Maximum Power Point Tracking (MPPT): chopper, inverter. Sizing the PV panel and battery pack in stand-alone PV applications. Modern solar energy applications (residential, electric vehicle, naval, and space). Solar power plants connected to the grid. Solar thermal: principles of concentration, solar tower, parabolic dish, receiver, storage, steam turbine and generator. Wind turbines: Wind turbine types and their comparison, power limitation, Betz's law. Control mechanism: pitch, yaw, and speed. Couplings between the turbine and the electric generator, Wind turbine generator - DC, synchronous, self-excited induction generator and doubly fed induction generator. Grid interconnection: active and reactive power control. Biomass and biogas electricity generation.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the contemporary world energy scenario, primary energy sources and their transformations, measure and analyze the available solar radiation.
CLO2	**Explain** the basic principles and technologies of various renewable resource-based electricity generation systems.
CLO3	**Design** solar PV-based electrical power generation systems for specific application.
CLO4	**Calculate** the cost of energy harvested from different renewable sources and **explain** the technological, environmental and economic impacts of different renewable energy sources.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√						√					
CLO2	√											
CLO3			√									
CLO4		√			√		√					

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture/Group Discussion	Midterm Exam/ Final Exam/Project
CLO4	Lecture/Group Discussion	Presentation/ Class Test / Final Exam

Course Code: EEE 449 Course Title: Smart Grid Power System Credits: 3

Rationale of the Course:

With the advancement of technology, humanity began to focus on the problem of air pollution emissions as a result of industrial activity, increasing numbers of vehicles, et cetera. Air pollution does direct and indirect damage to humans and other living creatures. In order to cause a significant reduction in air pollution, a new solution was found: the Smart Grid. The Smart Grid was invented to implement proper management of energy in the power grid.

Course Objective:

The general goals of Smart Grid are to ensure a transparent, sustainable and environmental-friendly system operation that is cost and energy efficient, secure and safe. The smart grid represents the full suite of current and proposed responses to the challenges of electricity supply.

Course Content:

Smart grid: two way communication; distributed energy resources (DERs) - DG (distributed generation) and ES (energy storage); high power density batteries, EV (electric vehicles) and PHEV (plug-in hybrid electric vehicles); smart sensors, meters and appliances at demand side. Data communication channels; protoCLOs; TCP/IP; IEEE 802 series wireless LANs: bluetooth, Zigbee, WiMax; wired LANs- Ethernet, PSTN, PLC (Power Line Carrier); cyber security. Smart meters and AMI (advanced metering infrastructure): construction; standards for information exchange-Modbus, DNP3 and IEC61850; interfacing with HAN, NAN, WAN. Power electronic interfaces between grid and DERs. Demand side integration (DSI): DSM; real time pricing; ancillary markets; DR (demand response) for load shaping, frequency and voltage control, energy efficiency. Micro-grids, self-healing and restoration.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** the concept of a smart grid.
CLO2	**Describe** the operation of the basic part of a smart grid (namely the Micro-grid) and Quantify its operational, financial and environmental advantages.
CLO3	**Identify** the telecommunication infrastructure needed for smart grid operation.
CLO4	**Identify** and **Classify** smart metering devices of various technologies and discuss their relative merits.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3												

CLO4	√		√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture / Group Discussion	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Class Test / Final Exam

19(g). **Elective Course (Group II: Electronics)**

Course Code: EEE 451 **Course Title: VLSI Design** **Credits: 3**

Rationale of the Course:

The technique of constructing an integrated circuit (IC) by integrating millions of MOS transistors onto a single chip is known as very large-scale integration (VLSI). When MOS integrated circuit chips became extensively used in the 1970s, sophisticated semiconductor and communications technologies could be developed. VLSI devices are used in the microprocessor and memory chips. Prior to the development of VLSI technology, most ICs could only execute a restricted range of functions. A CPU, ROM, RAM, and other glue logic may be found in an electrical circuit. VLSI allows IC designers to combine all of these functions into a single chip.

Course Objective:

The objectives of this course are to introduce students to digital integrated circuits. This course helps the students to get familiarized with NMOS, PMOS, CMOS devices and manufacturing technology. It will help them get acquainted with CMOS logic gates and their layout. Students will learn how to calculate propagation delay, noise margins, and power dissipation in digital VLSI circuits and design of combinational (e.g., arithmetic) and sequential circuits and memory in VLSI circuits.

Course Content:

VLSI technology: Top-down design approach, technology trends and design styles. Review of MOS transistor theory: Threshold voltage, body effect, I-V equations and characteristics, latch-up problems. Rationed circuits: NMOS inverter with resistive and transistor load, Pseudo NMOS inverter. Ratio less circuits: CMOS inverters: operation, transfer characteristics, design for equal rise and fall time, propagation delay, rise time, fall time and power consumption estimation. NMOS pass transistors and CMOS pass gate circuits. Buffer chain design to drive large capacitive loads. Integrated circuit fabrication technology: photolithography, CMOS process flow, design rules. Estimation of resistance and capacitance from layout. Layout matching. Stick diagram and area estimation from stick diagram. Reliability issues: Latch-up, electro migration. CMOS circuit and logic design: Layout design rules and physical design of simple logic gates. CMOS subsystem design: Adders, multiplier and memory system, arithmetic logic unit. Programmable logic arrays. I/O systems. VLSI testing.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic operation of MOSFET and Comprehend different characteristics of MOSFET.
CLO2	**Demonstrate** different devices based on CMOS technology and fabrication process.
CLO3	**Analyze** different types of devices based on various MOS technology, their circuit characteristics and performances.
CLO4	**Design** logic circuits, ADDER, PLA, Multiplier, Memory, ALU, using CMOS, BiCMOS and GaAs technology.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											

CLO2	√											
CLO3		√										
CLO4			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture ,Tutorial	Assignment / Midterm Exam
CLO2	Lecture, Tutorial	Assignment / Class Test /Midterm Exam
CLO3	Lecture, Tutorial	Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: EEE 452 **Course Title: VLSI Design Lab** **Credits: 1.5**

Rationale of the Course:

Design of VLSI circuits provides a basic thoughts for students and graduates in the advanced electronics field. This course covers the lambda based design rules implemented in Microwind as well as helps the students to know about the VERILOG, PSpice and DSCH software.

Course Objective:

This course's goal is to validate the theories and concepts taught in EEE 451. Students will do lab experiments as well as simulations. They will be exposed to laboratory equipment and simulation tools, as well as understand experimental procedures. The students will examine their data and draw meaningful inferences based on their comprehension, while keeping in mind the mistakes and uncertainties in their measurements. This course's goal is to validate the theories and concepts taught in EEE 451.

Course Content:

Experiment	Experiment title
Experiment 01	Introduction to verilog
Experiment 02	Analysis of CMOS inverter using PSPICE and verilog
Experiment 03	Simulation of CMOS NAND gate using PSPICE and verilog
Experiment 04	Introduction to MICROWIND
Experiment 05	Layout design of a CMOS inverter using MICROWIND
Experiment 06	Layout design of a 2-input CMOS NAND and NOR gate for equal rise time and fall time
Experiment 07	Layout design of a CMOS X-OR and X-NOR logic gate using MICROWIND
Experiment 08	Introduction to DSCH software
Experiment 09	VLSI design using schematic capture
Experiment 10	Layout design of MUX and DEMUX using MICROWIND and DSCH
Experiment 11	Layout design of HALF ADDER circuit using MICROWIND and DSCH
Experiment 12	Layout design of 4-bit FULL ADDER circuit using MICROWIND and DSCH
Experiment 13	Layout design of 4-bit shift register using DSCH
Experiment 14	Layout design of 4-bit ALU using DSCH

ECourse Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Design and** Simulate different digital logic circuits using modern simulation tools. (PSPICE, MICROWIND, DSCH, VERILOG).
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Project/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: EEE 453 **Course Title: Analog Integrated Circuits** **Credits: 3**

Rationale of the Course:

The integrated circuit (IC) has millions of electronic components, like transistors, resistors, and capacitors, constructed into a single unit. Today almost every electronic device (computers, cell phones, cars, televisions, digital watches) use ICs due to its small size and high reliability and efficiency. Without ICs, electronic gadgets would be much slower and bulkier. Analog integrated circuit design is used for designing operational amplifiers, linear regulators, oscillators, active filters, and phase locked loops. The semiconductor parameters such as power dissipation, gain, and resistance are more concerned in the designing of analog integrated circuits.

Course Objective:

The goal of this course is to discuss bias points, gain, impedance, and frequency response for multiple transistor amplifier circuits using BJT and MOS transistors, as well as cascodes and cascades that are either actively or passively loaded. Students may evaluate and construct differential pair amplifiers that are either actively or passively loaded, including biasing, differential-mode gain, common-mode gain, CMRR, half-circuits, and various impedances. It will help pupils to determine output current, output resistance, and output swing for a circuit using a given (possibly unfamiliar) current source. This course will also assist students in analyzing and designing output stages, such as Class A and Class B designs. Finally, it aids in the explanation and application of compensation design and strategies, such as a knowledge of feedback principles (e.g., closed-loop gain, loop transmission, etc.), phase margin, narrow-banding, and pole splitting.

Course Content:

Analog IC Design: Bipolar, MOS and BiCMOS IC technology and its impact, eggshell analogy, application areas and the future of analog IC design. Review of transistors: Large and small signal models, compact models for Bipolar, FET, and BiCMOS. Amplifiers with passive and active loads, cascode stages. Multiple current sources/sinks using Bipolar and FET technologies. Current mirrors: Basic, cascode and active current mirrors. Constant current or voltage references: Supply voltage and temperature independent biasing,band-gap references; constant-Gm biasing. Differential pairs: Differential vs. single-ended operations of simple amplifiers, differential and common mode voltages, common mode rejection ratio (CMRR), input common mode range (ICMR), transfer characteristics, small signal analysis. High-gain amplifiers: Design and analysis of operational amplifiers (Op Amps) using BJTs and FETs, hierarchy in analog integrated circuits for an Op-Amps, internal structure of IC Op-Amps, high-performance Op-Amps. Switch capacitor circuits: Equivalent resistance of a switched capacitor, unity gain buffers, charge amplifiers and integrators. Sampling switches: Charge injection, clock feed-through, charge feed-through; quantized model and remedy of charge injection. Switched capacitor filters.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the fundamentals of BiCMOS IC technology.
CLO2	**Describe** in detail of the current mirrors and solve problems
CLO3	**Understand** the design of op-amps using BJT and FET.
CLO4	**Discuss** the switch capacitor circuits and examine its sampling switching function.

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture/Group Discussion	Final Exam/Project
CLO4	Lecture/Group Discussion	Presentation/ Class Test / Final Exam

Course Code: EEE 457 **Course Title: Digital System Design** **Credits: 3**

Rationale of the Course:

Digitization is now implemented in a wide range of applications, including information (computers), telecommunications, control systems, etc. Digital circuits replace many analog systems. It is cheaper and easier to design, easier to store, transmit and manipulate information. Due to digital design, devices become smaller and faster.

Course Objective:

Digital system design course focuses on design digital system from scratch. The course focuses on designing combinational and sequential building blocks, using these building blocks to design bigger digital systems. During this course, Verilog to design/model a digital system is also learnt.

Course Content:

Memory Devices: Memory Basics; RAM characteristics; Bipolar RAM; MOS static & MOS Dynamic RAM; ROM; EPROM; EEPROM; Flash memory. Processor Logic Design: Processor organization; Arithmetic Logic Unit; Design of Arithmetic Circuit; Design of Logic circuit; Design of ALU; Design of Shifter & Accumulator. Control Logic Design: Control organization; Hard-wired control; Micro program Control; Control of processor unit; PLA control; Micro program Sequencer. Computer Design: System of configuration; Computer instructions; timing and control; Execution of Instruction; Design of computer Registers; Design of control; Computer console. Microcomputer system Design: Microcomputer & microprocessor organization; Instruction & addressing mode; Stack, subroutines & interrupts; memory organization; direct memory address; Microprocessor based designs.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** basics of different types of memory and their characteristics.
CLO2	**Design** of Arithmetic Circuit, Logic circuit, Shifter & Accumulator.
CLO3	**Design** Microcomputer system and Control system.
CLO4	**Learn** Verilog to design/model a digital system.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3			√									
CLO4	√		√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture / Group Discussion	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Class Test / Final Exam

Course Code: EEE 458 **Course Title: Digital System Design** **Credits: 1.5**

Rationale of the Course:

Design of Electrical Services for Buildings provides a basic grounding for students and graduates in the field. It covers methods of wiring, schemes of distribution and protection for lighting and power installations. Systems such as alarms and standby supplies are also covered.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 322. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	**Verify** (i) Demorgan's Theorem for 2 variables. (ii) The sum-of product and product-of-sum expressions using universal gates.
Experiment 02	**Design** and Implement Half Adder & Full Adder using a) basic gates and b) NAND gates.
Experiment 03	**Design** and Implement Half subtractor & Full subtractor using a) basic gates and b) NAND gates.
Experiment 04	**Design** and Implement 4-bit Parallel Adder/Subtractor using IC 7483.
Experiment 05	**Design** and Implement BCD to Excess-3 code conversion and vice-versa.
Experiment 06	**Design** and Implement (i) 1-bit Comparator (ii) 5-bit Magnitude Comparator using IC 7485.
Experiment 07	**Realize** (i) Adder & Subtactors using IC 74153. (ii) 4-variable function using IC74151 (8:1MUX).
Experiment 08	**Realize** Binary to Gray code conversion & vice-versa using IC74139.
Experiment 09	**Implement** the following flip-flops using NAND Gates. i)D, ii)T, iii)JK, and iv) Master-Slave Flip-Flop.
Experiment 10	**Realize** the following shift registers using IC7474/7495 (i) SISO (ii) SIPO (iii)) PISO(iv))PIPO (v) Ring (vi) Johnson counter
Experiment 11	**Design** (i) Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop (ii) Mod-N Counter using IC7490 / 7476 (iii) Synchronous counter using IC74192
Experiment 12	**Design** Pseudo Random Sequence generator using 7495.
Experiment 13	**Design** Serial Adder with Accumulator and Simulate using Simulation tool.
Experiment 14	**Design** Binary Multiplier and Simulate using Simulation tool.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Design** different digital circuit using different ICs.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 459 Course Title: Compound Semiconductor Devices Credits: 3

Rationale of the Course:

Over the years, compound semiconductors have played a key role in driving innovative electronics in segments such as high frequency, high power, photonics, and sensor devices. A major motivation for using compound semiconductors in the industry is their superior material properties compared to Si with respect to thermal, optical, and electrical properties. In addition, these properties can be tailored to specific device performance parameters by utilizing a large variety of different compound semiconductor materials or even varying compositions within specific material systems.

Course Objective:

Compound Semiconductor Devices is an updated course for comprehending hetrojunction devices in a depth way. In this course, students will be given a clear concept of Zinc-blende crystal structures, growth techniques, alloys, band gap, basic opto-electronic properties, Band alignment, band offset, Anderson's rule, single and double sided hetero-junctions, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems, Hetero-Junction diode: Band banding, carrier transport and I-V characteristics. Hetero-junction field effect transistor: Structure and principle, band structure, carrier transport and I-V characteristics, Hetero-structure bipolar transistor (HBT): Structure and operating principle, quasi-static analysis, extended Gummel-Poon model, Ebers-Moll model, secondary effects and band diagram of a graded alloy base HBT. Resonant Tunneling diodes: physics and operation etc. The new era is no longer going forward to concise the device size rather accepting an alternative option like choosing semiconductor materials as what we can see in heterojunction device is built up with mixed materials. This course will also mirror another amazing idea to make device faster like quantum tunneling using Schottky diode.

Course Content:

Reviews of Compound semiconductor: Zinc-blende crystal structures, growth techniques, alloys, band gap, basic opto-electronic properties, density of carriers in intrinsic and doped compound semiconductors.

Introduction to Physics of Hetero-Junctions: Band alignment, band offset, Anderson's rule, single and double sided hetero-junctions, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems.

Hetero-Junction diode: Band banding, carrier transport and I-V characteristics**.**

Hetero-junction field effect transistor: Structure and principle, band structure, carrier transport and I-V characteristics. Nonideal effects, frequency response, high electron mobility transistor.

Hetero-structure bipolar transistor (HBT): Structure and operating principle, quasi-static analysis, extended Gummel-Poon model, Ebers-Moll model, secondary effects and band diagram of a graded alloy base HBT.

Resonant Tunneling diodes: physics and operation.

Resonant Tunneling Transistors: device physics, operation and characteristics.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Zinc-blende crystal structures, growth techniques, alloys Band alignment, band offset, quantum wells and quantization effects, lattice mismatch and strain and common hetero-structure material systems and solve various mathematical problems on them.
CLO2	**Explain** Structure, principle and I-V characteristics of Hetero-Junction diode and Hetero-junction field effect transistor and solve related mathematical problems.
CLO3	**Interpret** Structure, operating principle and various kind of models of Hetero-structure bipolar transistor (HBT) and solve related mathematical problems.
CLO4	**Understand** the physics and operation of Resonant Tunneling diodes and Resonant Tunneling Transistors.

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test/Assignment.
CLO2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
CLO3	Class Lecture	Final Exam/Assignment/Class Test.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: EEE 461 Course Title: Biomedical Instrumentation Credits: 3

Rationale of the Course:

The diagnosis of the condition is the first and most important stage in therapy, therefore it must be flawless and correct. Because of technological advancements, bio instruments are currently highly developed, yet there is always room for development. This is now achievable because of advancements in the field of bioinstrumentation. Students in Biomedical Instrumentation have the opportunity to contribute to the healthcare sector by participating in the program. Computer-based software, which demands a strong basis of knowledge in artificial intelligence, plays a key part in the creation of bio instruments. It is concerned not only with diagnostic equipment, but also with the tools used during various procedures, as well as with the maintenance and improvement of the student's condition throughout therapy.

Course Objective:

The course aims at providing the operational and design principles of the most commonly used diagnostic instrumentation (instrumentation for recording bio-electrical potentials, for the acquCSEion of bio-images, for the measurement of forces and pressures, body flows and volumes, blood oxygenation). At the end of the class, the student knows – for each described device/instrumentation- the underlying physical phenomena, architecture, employed materials, operational modes, aspects of interaction with the human body. The student is also able to analyze and solve problems related to design of biomedical measurement instruments.

Course Content:

Human body: Cells and physiological systems. Bioelectricity: genesis and characteristics. Measurement of bio-signals: Ethical issues, transducers, amplifiers and filters. Electrocardiogram: electrocardiography, phono cardiograph, vector cardiograph, analysis and interpretation of cardiac signals, cardiac pacemakers and defibrillator. Blood pressure: systolic, diastolic mean pressure, electronic manometer, detector circuits and practical problems in pressure monitoring. Blood flow measurement: Plethysmography and electromagnetic flow meter. Measurement and interpretation: electroencephalogram, cerebral angiography and chronicle X-ray. Brain scans. Electromyogram (EMG). Tomograph: Positron emission tomography and computed tomography. Magnetic resonance imaging. Ultrasonogram. Patient monitoring system and medical telemetry. Effect of electromagnetic fields on the human body.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Demonstrate the cells and physiological systems of the human body.
CLO2	Describe in detail about measurements of bio-signals
CLO3	Describe about electrocardiogram and photo cardiograph
CLO4	Discuss about blood pressure and blood flow measurement.
CLO5	Explain measurement and interpretation systems using different technologies.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√											
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture/Group Discussion	Final Exam/Assignment
CLO4	Lecture/Group Discussion	Presentation/ Class Test / Final Exam

Course Code: EEE 462 Course Title: Biomedical Instrumentations Lab Credits: 1.5

Rationale of the Course:

Biomedical Instrumentations helps physicians to diagnose the problem and provide treatment. To measure biological signals and to design a medical instrument, concepts of electronics and measurement techniques are needed. This course will help the students to get familiarized with various types of medical instrumentations and thus helps them to understand their functions.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 461. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	Blood Pressure Measurement
Experiment 02	Real time monitoring of Echocardiography
Experiment 03	Study of working of different types of Diathermy equipment
Experiment 04	ECG wave analysis using simulator
Experiment 05	Real time patient monitoring system
Experiment 06	Ultrasound blood flow measurement to identify arteries and veins
Experiment 07	Respiratory system analysis using Spirometer
Experiment 08	Analysis of ECG abnormal wave pattern using Arrhythmia Simulator
Experiment 09	EEG wave analysis using simulator
Experiment 10	Auditory system checkup using Audiometer
Experiment 11	Heart sound measurement using PCG
Experiment 12	Study on Biotelemetry
Experiment 13	ECG heart rate alarm system with HRV
Experiment 14	EMG Biofeedback with NCV

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** functions of the different, measuring instrument showing experimental setup.
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: EEE 463 **Course Title: Optoelectronics** **Credits: 3**

Rationale of the Course:

Optoelectronics is a very broad term which refers to the study and use of electronic devices that emit, detect, and control light. There are many examples of optoelectronic devices in everyday life, such as the LEDs in my computer monitor and the photo detector in my computer mouse. The main reason why optoelectronic devices are so prevalent is because most people depend greatly on vision to observe the world around them. Because of this, being able to manipulate light is extremely useful — the capability has allowed us to see at night, record images and videos of things we observe, and easily share information with others. But beyond that, there are many other important optoelectronic applications such as solar cells, optical fiber communication, lasers, and more.

Course Objective:
Optoelectronics is an updated course for comprehending optical properties of electronic devices in a depth way. In this course, students will be given a clear concept of direct and indirect band-gap materials, optical absorption, photo-generated excess carriers, minority carrier lifetime, luminescence and quantum efficiency in radiation, Light emitting diode (LED): Principles, materials, for visible and infrared LED, Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers, Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors. Solar cells: Solar energy and Spectrum, silicon and Schottky solar cells etc. The new era is no longer going forward to concise the device size rather accepting an alternative option like choosing semiconductor materials as what we can see in heterojunction device is built up with mixed materials. This course will also mirror another amazing idea to make device faster like quantum tunneling using Schottky diode.

Course Content:
Optical properties in semiconductor: Direct and indirect band-gap materials, radioactive and non-radioactive recombination, optical absorption, photo-generated excess carriers, minority carrier lifetime, luminescence and quantum efficiency in radiation.
Properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation.
Light emitting diode (LED): Principles materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers.
Stimulated emission and light amplification: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optics feedback and threshold conditions.
Semiconductor Lasers: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers.
Photo-detectors: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors.
Solar cells: Solar energy and Spectrum, silicon and Schottky solar cells.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Optical properties in semiconductor, Properties of light and solve various mathematical problems on them.
CLO2	**Explain** Light emitting diode (LED) and its , internal and external efficiency, loss mechanism, structure and solve related mathematical problems.
CLO3	**Interpret** Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optics feedback and solve related mathematical problems.
CLO4	**Understand** the construction, operation and characteristics of Photo detectors, solar cells.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√	√	√	√							
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test/Assignment.
CLO2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
CLO3	Class Lecture	Final Exam/Assignment/Class Test.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: EEE 465 Course Title: Semiconductor Technology Credits: 3

Rationale of the Course:

The course provides an overview of the foundations of microelectronic fabrication technology, which entered into the Nanotechnology Era around the year 2000 consistent with Moore's Law. The success of microelectronic fabrication technology relies on continuous improvement of integrated circuit performance. This continuous need for device scaling is summarized in Moore's Law which postulates that the level of chip complexity that can be manufactured for minimal cost is an exponential function that doubles in a period of time. The rate of doubling was originally every year and has since then slowed down to a doubling every two years due to rising chip complexity. This improvement is achieved by reducing (scaling) the dimensions of key components of these electronic systems – the metal oxide semiconductor field effect transistor (MOSFET).

Course Objective:

The main objective of this particular course to the students of Electrical and Electronic Engineering is to get them a clear idea on processing technologies used for fabrication of silicon VLSI integrated circuits, developing an understanding of process integration for NMOS, CMOS and MOS memory IC technology, exposing to silicon process information pertinent to the interface between process engineers and integrated circuit design engineers. Side by side they will also learn about processing technology of compound semiconductors and methods and techniques used for fabricating compound semiconductor devices used in communications, optoelectronics, high speed wireless applications.

Course Content:

Substrate materials: Crystal growth and wafer preparation, epitaxial growth technique, molecular beam epitaxy, chemical vapor phase epitaxy and chemical vapor deposition (CVD).
Doping techniques: Diffusion and ion implantation. Growth and deposition of dielectric layers: Thermal oxidation, CVD, plasma CVD, sputtering and silicon-nitride growth.
Etching: Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching.
Cleaning: Surface cleaning, organic cleaning and RCA cleaning.

Lithography: Photo-reactive materials, pattern generation, pattern transfer and metallization.
Discrete device fabrication: Diode, transistor, resistor and capacitor.
Integrated circuit fabrication: Isolation – p-n junction isolation, mesa isolation and oxide isolation. BJT based microcircuits, p-channel and n-channel MOSFETs, complementary MOSFETs and silicon on insulator devices. Testing, bonding and packaging.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Crystal growth and wafer preparation, epitaxial growth technique, molecular beam epitaxy, chemical vapor phase epitaxy, CVD and different types of doping techniques and solve various mathematical problems on them.
CLO2	**Explain** Wet chemical etching, silicon and GaAs etching, anisotropic etching, selective etching, dry physical etching, ion beam etching, sputtering etching and reactive ion etching, Surface cleaning, organic cleaning and RCA cleaning solve related mathematical problems.
CLO3	**Interpret** Photo-reactive materials, pattern generation, pattern transfer and metallization, Discrete device fabrication solve related mathematical problems.
CLO4	**Understand** Integrated circuit fabrication.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test/Assignment.
CLO2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
CLO3	Class Lecture	Final Exam/Assignment/Class Test.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: EEE 467 Course Title: Nano-science and Technology Credits: 3

Rationale of the Course:
When the size of semiconductor materials is reduced to nanoscale, their physical and chemical properties change drastically, resulting in unique properties due to their large surface area or quantum size effect. Currently, semiconductor nanomaterials and devices are still in the research stage, but they are promising for applications in many fields, such as solar cells, nanoscale electronic devices, light-emitting nano devices, laser technology, waveguide, chemicals and biosensors. Further development of nanotechnology will certainly lead to significant breakthroughs in the semiconductor industry.

Course Objective:
The main objective of this particular course to the students of Electrical and Electronic Engineering is to get them a clear idea on Lattice vibration, Electrical conductivity, Isotropic and anisotropic crystals, band diagrams and effective masses of different semiconductors and

alloys, scattering rates for impurity and phonons, inter-band and inter-sub-band optical absorption, and mobility and Quantum mechanical model of carrier transport. This course deals with the some of the current initiatives and critical issues in the improvement of semiconductors based on nanostructures and nanodevices.

Course Content:

Lattice vibration: Simple harmonic model, dispersion relation, acoustic and optical phonons.

Free electron model: Electrical conductivity.

Band structure: Isotropic and anisotropic crystals, band diagrams and effective masses of different semiconductors and alloys.

Scattering theory: Perturbation theory, Fermi-Golden rule for static and oscillating potentials, scattering rates for impurity and phonons, inter-band and inter-sub-band optical absorption, and mobility.

Quantum mechanical model of carrier transport: Tunneling transport, current and conductance, resonant tunneling, resonant tunneling diodes, super-lattices and mini-bands. Introduction to intersubband transition devices.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Simple harmonic model, dispersion relation, acoustic and optical phonons, Free electron model and solve various mathematical problems on them.
CLO2	**Explain** Isotropic and anisotropic crystals, band diagrams and effective masses of different semiconductors and alloys and solve related mathematical problems.
CLO3	**Interpret** Perturbation theory, Fermi-Golden rule for static and oscillating potentials, scattering rates for impurity and phonons, inter-band and inter-sub-band optical absorption, and mobility solve related mathematical problems.
CLO4	**Understand** Quantum mechanical model of carrier transport.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√	√										
CLO2	√	√	√	√	√							
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test/Assignment.
CLO2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
CLO3	Class Lecture	Final Exam/Assignment/Class Test.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.

19(h). Elective Course (Group III: Communication)

Course Code: EEE 473 **Course Title: Digital Communication** **Credits: 3**

Rationale of the Course:

Digital communication provides a seamless experience to customers and stakeholders – By eliminating the need for time-consuming face to face interactions, digital communication in various forms such as AI, chat bots and automation, makes it easier for customers to reach out to organizations at a time that is convenient and non-disruptive to them. Digital communication also helps build an enhanced relationship with stakeholders at various levels, leading to real-time communication more effectively.

Course Objective:

The primary goal of the course is to provide the student an understanding of the principles, techniques, trade-offs, and fundamental limits in modern digital communication systems. Upon successful completion of the course, students should be able to develop signal space representations for digital modulation methods and recognize representations published in the literature; compare the strengths, weaknesses, and requirements of different modulation techniques; model constraints imposed by a bandlimited channels and formulate methods for dealing with these constraints, describe the concept of channel capacity and the promise of coding; describe the basic operating principles of block and convolutional codes and implement encoding and decoding algorithms. In addition, the student should develop competency in modeling and analysis communication system elements and an appreciation for the inter-relations within the different elements in modern communication systems.

Course Content:

Introduction: Communication channels, mathematical model and characteristics. Probability and stochastic processes.

Source coding: Mathematical models of information, entropy, Huffman code and linear predictive coding.

Digital transmission system: Base band digital transmission, inter symbol interference, bandwidth, power efficiency, modulation and coding trade-off. Receiver for AWGN channels: Correlation demodulator, matched filter demodulator and maximum likelihood receiver. Channel capacity and coding: Channel models and capacities and random selection of codes.

Block codes and conventional codes: Linear block codes, convolution codes and coded modulation. Spread spectrum signals and system.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the fundamental elements and parameter of Digitlal communication system.
CLO2	**Describe** Source coding and solve related problems.
CLO3	**Understand** the Digital transmission system.
CLO4	**Discuss** Block codes and conventional codes.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO3	Lecture, Group Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture, Group Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 474 Course Title: Digital Communication Lab Credits: 1.5

Rationale of the Course:

In this laboratory, our students are trained for constructing the circuits for analog and digital modulations. The concepts of all type of modulation & demodulation, and recent communication techniques are demonstrated using available hardware and software defined radio (SDR) tool.

Course Objective:

This course gives students deep knowledge in digital communication systems at the practical level. This lab focuses the fundamental concepts on TDM, Pulse modulations, digital modulation techniques, source coding techniques and Error-control coding techniques.

Course Content:

Experiment	Experiment title
Experiment 01	Study, Generation and Analysis of Typical Test Signals in Time domain.
Experiment 02	Sampling and Reconstruction.
Experiment 03	Experiment on Time Division Multiplexing
Experiment 04	Experiment on PAM
Experiment 05	Experiment on PPM
Experiment 06	Experiment on PWM
Experiment 07	Experiment on Pulse Code Modulation
Experiment 08	Experiment on Delta Modulation
Experiment 09	Experiment on Amplitude Shift Keying
Experiment 10	Experiment on Frequency Shift Keying
Experiment 11	Experiment on Phase Shift Keying
Experiment 12	Experiment on Differential Phase Shift Keying
Experiment 13	Experiment on Quadrature Phase Shift Keying
Experiment 14	Mini-Projects

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Measure** different communication parameters using kit and other equipment and Simulate using MATLAB.

CLO2	**Write** comprehensive reports on the experiments done in the laboratory in a group and **demonstrate** the ability to work as an individual and within a team.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 475 Course Title: Antenna and Propagation Credits: 3

Rationale of the Course:

This course goals to learn antenna and propagation-engineering concepts including in-depth studies of various antennas, antenna arrays, computer modeling of antennas for analysis and design in different propagation media.

Course Objective:

This course is designed to provide an overview of the fundamental principles associated with microwave and RF antennas and propagation. It will present the underlying theory in an accessible manner, together with techniques for application of the theory to satellite and mobile communications scenarios as well as broadcasting and indoor wireless applications.

This course is designed to understand basic terminology and concepts of Antennas. To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that. Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis. This course is to have knowledge on antenna operation and types as well as their usage in real time filed. Aware of the wave spectrum and respective band based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

Course Content:

Introduction and antenna fundamentals: Introduction, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Illustrative Problems. Fields from Oscillating Dipole, Field Zones, Front-to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials- Helmholtz Theorem. Thin Linear Wire Antennas - Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area, Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths, Illustrative Problems.

Types of antennas and introduction to arrays: Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas: Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas: Types, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems. Microstrip Antennas: Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas: Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics, Reflector Antennas: Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors: Geometry, Pattern Characteristics, Feed Methods, Slot antenna, Reflector Types: Related Features, Illustrative Problems. Lens Antennas: Introduction, Geometry of Non-metallic Dielectric Lenses, Zoning, Applications.
Propagation fundamentals: Free space propagation, Scales of variation in mobile systems, Path loss, Shadowing, Fast fading, Reflection - specular reflection, Fresnel coefficients, Polarization effects, Rough and random surfaces, Refraction - refractive index, Snell's Law, Fresnel transmission coefficients, Multipath effects, Introduction to stochastic, Deterministic and empirical channel models. Sky Wave Propagation – Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multihop Propagation.
Fixed link propagation models: Plane earth loss, spherical earth effects, Diffraction and Huygens Principle, Knife-edge diffraction, Fresnel zones, Tropospheric refraction, Path profiles - line of sight versus non-line of sight, Tropospheric refraction - n-units, Effective earth radius, Ducting.
Slant path propagation for fixed satellite links: Propagation impairments relating to satellite links and focuses on fixed satellite links. The various impairments introduced in the troposphere and ionosphere are presented along with a description of the methods for assessing the impact of these effects.
Diffraction models: Multiple knife edge diffraction, Approaches to modelling diffraction including Deygout method, causebrook correction and Giovanelli method.
Mobile systems overview, microcells and macrocells: Overview of mobile systems - cell types, Narrowband fast fading – Rayleigh and rice fading, Outage probability, bit error rate effect, Doppler spread and channels with memory, Macrocells - empirical: Power law, clutter factor, Theoretical: Multiple building diffraction, flat edge, Comparison of theoretical and empirical models, Shadowing – statistics, Availability at cell edge and over cell area, Microcells - empirical: Dual slope, attenuation factor.
Antenna Design: Brief introduction to how antennas are designed and characterised.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand basic terminology and concepts of Antennas and interpret the important elements of antenna and propagation theory.
CLO2	Attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
CLO3	Apply theoretical principles to design an antenna.
CLO4	Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
CLO5	Explain techniques for estimating the propagation performance of a communication channel and define specifications for a communications system based on a set of requirements.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√						√	√		
CLO4			√	√	√							
CLO5			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Midterm Exam/ Final Exam
CLO5	Lecture / Group Discussion/ Video presentation	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: EEE 477 Course Title: Microwave Engineering Credits: 3

Rationale of the Course:

Microwave engineering pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from electronic engineering. This is because there are different interactions with circuits, transmissions and propagation characteristics at microwave frequencies.

Some theories and devices that pertain to this field are antennas, radar, transmission lines, space based systems (remote sensing), measurements, microwave radiation hazards and safety measures.

Course Objective:

Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied. Design procedures are presented along with methods to evaluate device performance. The free space communication link is examined and equations developed to determine the link carrier-to-noise ratio performance factor. Microwave computer-aided design (CAD) methods are introduced by means of laboratory exercises. Project work serves to develop student engineering design and report writing skills.

Course Content:

An Introduction to Microwave Engineering: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and lossy transmission lines. **Waveguides:** general formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides. **Micro Strips:**

Structures and characteristics. **Rectangular Resonant Cavities:** Energy storage, losses and Q. **Radiation:** Small current element, radiation resistance, radiation pattern and properties, Hertzian and half wave dipoles. **Antennas:** Mono pole, horn, rhombic and parabolic reflector, array, and Yagi-Uda antenna.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the significance of microwaves and microwave transmission lines.
CLO2	Analyze the characteristics of microwave tubes and compare them.
CLO3	Be able to apply analysis methods to determine circuit properties of passive/active microwave devices.
CLO4	Know how to model and determine the performance characteristics of a microwave circuit or system using computer aided design methods.
CLO5	Have knowledge of basic communication link design, signal power budget, noise evaluation and link carrier to noise ratio.
CLO6	Have knowledge of how transmission and waveguide structures and how they are used as elements in impedance matching and filter circuits.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√			√							
CLO4		√	√	√	√							
CLO5	√					√	√		√			
CLO6	√	√	√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Midterm Exam/ Final Exam
CLO5	Lecture / Group Discussion/ Video presentation	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: EEE 478 Course Title: Microwave Engineering Lab Credits: 1.5

Rationale of the Course:

Microwave engineering pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from electronic engineering. This is because there are different interactions with circuits, transmissions and propagation characteristics at microwave frequencies.

Some theories and devices that pertain to this field are antennas, radar, transmission lines, space based systems (remote sensing), measurements, microwave radiation hazards and safety measures. This lab course will give a practical exposure to students to learn the characteristics of Microwave components. To gain the practical hands on experience by exposing the students to various microwave components.

Course Objective:

In this course students will perform experiments to verify practically the theories and concepts based in EEE 477. The lab course will give a practical exposure to students to learn the characteristics of Microwave components. The laboratory exercises are designed to give students ability to design, build, and analyze the components. A key part of the microwave laboratory experience is to learn how to use microwave test equipment to make measurements of power, frequency, S parameters, SWR, return loss, and insertion loss. More detail on the operation of the equipment can be found in the Operation Manuals in the Microwave Instructional Lab. Scattering parameters of microwave components are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied. The students will have an understanding of the concepts involved in transmission and reception of the microwave signals, characteristics of components. Also students will gain in-depth knowledge in the field of Microwave Engineering.

Course Content:

Experiment	**Topics**
Experiment 01	Microwave Oscillator Characterization and Power measurement.
Experiment 02	Measurement of Standing Wave Ratio, Frequency & Wavelength.
Experiment 03	Measurement of Unknown Impedance using SMITH chart.
Experiment 04	Study of Waveguide Components.
Experiment 05	Attenuation Measurement in Microwave System.
Experiment 06	Inverse Square Law of Electromagnetic Wave Propagation.
Experiment 07	Study of the Characteristics Features of Various Antennas.
Experiment 08	Introduction to Software based Study of Antenna Training System.
Experiment 09	Introduction to Antenna Array System.
Experiment 10	Study of wave guide horn and its radiation pattern and determination of the Beam width.
Experiment 11	To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.
Experiment 12	To measure attenuation and insertion loss of a fixed and variable attenuator.
Experiment 13	To measure the standing wave ratio and reflection coefficient in a Microwave Transmission line.
Experiment 14	To Study working of Doppler Radar , and measure the of the velocity of the object moving in the Radar range.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to understand the concepts involved in transmission and reception of the microwave signals, characteristics of components by hardware

	implementation and gain experience to learn how to use microwave test equipment to make measurements of power, frequency, S parameters, SWR, return loss, and insertion loss.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 479 **Course Title: Digital Signal Processing II** **Credits: 3**

Rationale of the Course:
Digital Signal Processing is important because it significantly increases the overall value of hearing protection. Unlike passive protection, DSP suppresses noise without blocking the speech signal. Real world signals are converted into a domain where abstract scientific and mathematical models are then applied.

Course Objective:
In this course the students will learn advance knowledge of the digital signal processing containing the knowledge of Spectral estimation of random processes, Adaptive signal processing and Multirate DSP.

Course Content:
Introduction to Digital Signal Processing (DSP): Digital signals and systems: Operations in digital signal processing, the scope of DSP, analog to digital conversion, frequency Domain Effects of Sampling: Periodic repetitions in frequency domain due to sampling in time domain, recovery ofcontinuous-time signal from its samples (reconstruction), role of antialiasing and reconstruction filters, examples of aliased signals (show how waveform is distorted), impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation.
Spectral estimation of random processes: classical methods, minimum variance method, parametric methods: AR and ARMA spectral estimation, Levinson-Durbin algorithm, super resolution techniques: Pisarenko, and MUSIC.
Adaptive signal processing: Applications, e.g., equalization, interference suppression, acoustic echo cancellation. FIR and IIR adaptive filters. Recursive least squares algorithm, steepest descent and Newton algorithm, least mean-square (LMS) algorithm, convergence analysis. Variable step size LMS algorithm.

Multirate DSP: Interpolation and decimation, single-stage and multistage implementation, design of anti-aliasing and anti-imaging filters. Polyphase representation of multirate systems. Multirate implementation of ideal LP filter, digital filter banks, narrowband filters. Perfect reconstruction filters banks. Short time Fourier transform, sub band decomposition and wavelet transform, CWT DWT, inter scale relationship of DWT coefficients, multirate implementation. Applications of wavelet transform.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the signal Processing and and all typed of transformation.
CLO2	**Describe** Spectral estimation of random processes and application.
CLO3	**Explain** Adaptive signal processing and related mathematical algorithms.
CLO4	**Describe** the Multirate DSP

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO3	Lecture, Group Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture, Group Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 481 **Course Title: Digital Image Processing** **Credits: 3**

Rationale of the Course:
As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and distortion during processing.

Course Objective:
In this course students will learn digital image processing techniques including representation, sampling and quantization, image acquCSEion, imaging geometry, image transforms, image enhancement, image smoothing and sharpening, and image restoration. More advanced topics include degradation models, image filtering, CLOor image processing, and image segmentation.

Course Content:
Basic Image Processing System: Image sources, characteristics, image representation, hardware and software requirements.

Two Dimensional Systems: Properties of two dimensional sequence and Systems, 2D Fourier Transform, 2D Z-Transform, 2D sampling Theory. Image quantization, image Perception, quality Measures.

Image Transform: 2D DFT, 2D DCT, Sine Transform, Hadamard, Slant and KL Transform.

Image compression algorithms: Pixel coding-PCM, run length Coding,
predictive technique DPCM, transform coding-DCT, Vector Quantization, VQ in image coding, wavelet based compression, intra-frame coding, standard for image compression-JPEG, MPEG.

Image segmentation: Feature extraction, edge detection, boundary extraction, region representation, moment representation, shape feature, scene matching, and image segmentation, classification techniques of super supervised and non-supervised learning

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the Basic Image Processing System.
CLO2	**Describe** the Two Dimensional Systems.
CLO3	**Understand** the Image Transform and Image compression algorithms and solve related mathematics.
CLO4	**Discuss** the mage segmentation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture, Group Discussion	Mid-term, Class Test, Assignment.
CLO3	Lecture, Group Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture, Group Discussion	Final Exam, Class Test, Assignment.

Course Code: EEE 483 Course Title: Cellular and Optical Fiber Communication Credits: 3

Rationale of the Course:

To expose the students to understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards. Wireless communications have enabled the connection of billions of people to the Internet so that they can reap the benefits of today's digital economy.

Fiber-optic communication is a method of transmitting information from one place to another by sending pulses of infrared light through an optical fiber. The light is a form of carrier wave that is modulated to carry information. Fiber is preferred over electrical cabling when high bandwidth, long distance, or immunity to electromagnetic interference is required. This type of communication can transmit voice, video, and telemetry through local area networks or across long distances. To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Course Objective:

This course aims to develop-

1. An understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards.
2. To know the evolution of Mobile communication and cell concept to improve capacity of the system.
3. To know the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4. To study the principles and working of Radar and Satellite Communication systems.
5. To build on work presented in earlier years of the program in order to enable you to develop a fuller understanding and appreciation of the factors which affect the design, operation and performance of both digital and analogue optical fiber communication systems.
6. To study many design factors and trade-offs which are involved for the design of an optical fiber system and characteristics, limitations of system components and the factors affecting the performance of different optical fiber communication systems.

Course Content:

Frequency Management and Channel Assignment: Concept, analog and digital communication, fundamentals of channel assignment, traffic and channel assignment. **Cellular Radio Systems:** Concept, evolution and fundamentals, analog and digital cellular systems, frequency reuse, co-channel interference, cell splitting and components. Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate. **Diversity Techniques:** Concept of diversity branch and signal paths, diversity types, Carrier to noise and carrier to interference ratio performance. **Digital Cellular Systems:** Global system for mobile, OFDM, GSM, AMPS, GPRS, EDGE, WCDMA, generations of mobile communication, Packet switching and data communication.

Introduction to Satellite Communication, Satellite frequency bands, satellite orbits, satellite types, regulation of the spectrum and interference, propagation channel, Introduction and simple form of Radar equation, Radar block diagram, Applications of Radar.

Introduction to Fiber Optic Communication System: Basic Optical Fiber Communication System, Advantages of Optical Fiber Communication System, Application of Optical Fiber Communication System, Ray Theory, Total internal reflection. **Optical Fiber Basics:** Optical Fiber Construction, Principle of light propagation through optical fiber, Acceptance angle, Numerical Aperture. **Transmission Characteristics of Optical fiber:** Attenuation, Material absorption losses, Scattering Losses, Fiber Bend loss. Material dispersion, Waveguide dispersion, Intermodal dispersion, Dispersion shifted fibers, Dispersion Flattened fibers. **Optical fiber Connections:** Multimode fiber joints, Single mode fiber joints, Fiber splices, Fiber couplers, Optical Isolators. **Optical Sources: the LASER:** Absorption and emission of radiation, Population inversion, Optical feedback and laser oscillation, Stimulated emission and lasing, Hetero-junctions, Laser modes, Single mode operation. **Optical Sources: the Light Emitting Diode:** The double-heterojunction LED, Planner LED, Surface emitter LED, Resonant cavity, Lens coupling to fiber, LED characteristics. **Optical Detectors:** Optical detection principles, PN photo-detector, PIN photo-detector, Avalanche photo-detector. **Optical Amplification and Multi-Channel Optical System:** Semiconductor optical amplifiers, Frequency division multiplexing, Wavelength division multiplexing, Co-channel interference.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** the functioning and evolution of different wireless communication systems with standards and also basic physics related to optical fiber.
CLO2	**Demonstrate** knowledge on cellular concepts like frequency reuse, fading, equalization, GSM, CDMA, FDMA and Comparison of these technologies based on their signal separation techniques and **Explain** the construction and operation of different types of fiber.
CLO3	**Explain** the architecture, functioning, protocols, capabilities and Mobile Radio Propagation with antenna design and satellite system using theoretical knowledge and **implement** the Optical fiber communication system.
CLO4	**Demonstrate** an ability to explain multiple access techniques, equalization and different diversity techniques for Wireless Communication.
CLO5	**Apply** the concept of hand-off and interface to calculate wireless network planning (Link budget and power spectrum calculations) with **understanding** the construction and working principle of Optical sources (LEDs and LASERs) and detectors (PIN, APD etc)
CLO6	**Demonstrate** an ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks for Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS. And **Design** and **analysis** of Optical networks and link budget.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√		√									
CLO2	√	√										
CLO3		√	√	√								
CLO4	√		√	√	√							
CLO5		√	√	√	√				√	√		
CLO6			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy

CLO1	Lecture	Class Test/ Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/ Final Exam / Presentation
CLO6	Lecture/ Group Discussion	Final Exam/ Assignment/ Mini Project/ Presentation

Course Code:EEE 484 Course Title: Cellular and Optical Fiber Communication Lab Credits: 0.75

Rationale of the Course:

To perform practical pertaining to the study of the topics studied in the Cellular and Optical Fiber Communication theory course. This lab provides the students with an enriching hands-on experience with concepts and in-depth knowledge of Fiber Optical domain along with cellular concept. The laboratory is equipped with state -of -art Fiber Optic Trainer Kits and Hard ware Modules. The simulation-based experiments are performed using the powerful optical simulator COMSOL and MATLAB.

With state-of-art simulation platform, user friendly GUI, easy help manual, the student performs experiments to study the digital optical link, understand the components of an Optical Communication System, characteristics of Optical Sources (LED & LD), Optical Detectors (LD & APD) and Optical Fibers(SM & MM).

This lab introduces students to communication link design and analysis techniques that are core knowledge for Communication engineers. This lab aims at supporting the teaching and research activities in the area of cellular, satellite and optical field which are either currently being.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE XXX. The students will carry out experiments using hardware along with simulation tool.

- To understand the basic concepts of Optical and Cellular Communication
- To demonstrate the basic optical link design and understand the various components of optical communication system.
- To train students so that can relate theory with elements of design and applications.
- To provide the state-of-art simulation software and hardware for the design of optical communication system and understand the fiber characteristics.

Course Content:

Experiment	***Topics***

Experiment 01	Study of Spread Spectrum – DSSS Modulation & Demodulation using Communication Trainer Kits.
Experiment 02	Study of Propagation Models and Path Loss Estimation in Cellular Mobile Communication using MATLAB Programming.
Experiment 03	Observe signal constellation of GMSK signal and study of Multipath Fading, Power-Delay Profile and Doppler Spectrum for Channel Classification in Cellular Mobile Communication using MATLAB.
Experiment 04	Design of Radio Resource Allocations and Scheduling in Cellular Mobile Communication and study of GSM data services and capability.
Experiment 05	Design of a satellite communication link and study of change in uplink and downlink frequencies.
Experiment 06	Apply RFID technology for real life applications using RFID kit.
Experiment 07	Simulate Bluetooth voice transmission to observe effect of AWGN and of interference of 802.11b on transmission using MATLAB and Simulink.
Experiment 08	To observe and analyze various fiber optic data links when used for both digital and analog data transmission.
Experiment 09	Fiber Splicing and Introduction to the OTDR Measurement of Fiber Length, Attenuation and Splice Loss.
Experiment 10	Tracing the angular radiation (or reception) pattern of an optical fiber to determine its numerical aperture and acceptance angle.
Experiment 11	Determination of connecting losses due to lateral misalignment, longitudinal displacement, and angular misalignment of fiber cores.
Experiment 12	Study of 660nm Analog Transmitter Circuit & 820nm Analog Receiver Circuit.
Experiment 13	Study of 660nm Digital Transmitter Circuit & 820nm Digital Receiver Circuit..
Experiment 14	To determine the coupling efficiency between an emitter and an optical fiber and determine the half power beam width for the TIL24 LED.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge for cellular concept and fiber optic communication link design using MATLAB and also by hardware implementation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: EEE 485 Course Title: Radar and Satellite Communication Credits: 3

Rationale of the Course:

This course goals to learn antenna and propagation-engineering concepts including in-depth studies of various antennas, antenna arrays, computer modeling of antennas for analysis and design in different propagation media.

Course Objective:

This course is designed to provide an overview of the fundamental principles associated with microwave and RF antennas and propagation. It will present the underlying theory in an accessible manner, together with techniques for application of the theory to satellite and mobile communications scenarios as well as broadcasting and indoor wireless applications.
This course is designed to understand basic terminology and concepts of Antennas. To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that. Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis. This course is to have knowledge on antenna operation and types as well as their usage in real time filed. Aware of the wave spectrum and respective band based antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

Course Content:

Introduction to Satellite Communication, Satellite frequency bands, satellite orbits, satellite types, regulation of the spectrum and interference, propagation channel, air interfaces, link budget analysis, Digital Modulation, Error Correction Codes, Multiple Access, receiver synchronization, baseband processing, fixed and mobile applications, basics of satellite networking.
Introduction, Simple form of Radar equation, Radar block diagram, Applications of Radar, Prediction of range performance, Minimum detectable signal, Receiver noise, Probability density function, S/N ratio, Integration of Radar pulses, Radar cross sections of target, Cross section fluctuations, Transmitter power, PRF and range ambiguities, Radar cross section, information contents in radar signals, noise and clutter, radar detectors, CW and frequency modulated Radar, Doppler and MTI radar, pulse compression, CW and FM-CW radar, radar transmitter and receivers, introduction to polarimetric radar and synthetic aperture radar.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** basic terminology and concepts of Antennas and interpret the important elements of antenna and propagation theory.

CLO2	**Attain** knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
CLO3	**Apply** theoretical principles to design an antenna.
CLO4	**Analyze** the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
CLO5	**Explain** techniques for estimating the propagation performance of a communication channel and define specifications for a communications system based on a set of requirements.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√						√	√		
CLO4			√	√	√							
CLO5			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Midterm Exam/ Final Exam
CLO5	Lecture / Group Discussion/ Video presentation	Mini Project/ Presentation/ Class Test / Final Exam

Course Code: EEE 487 **Course Title: Telecommunication Engineering** **Credits: 3**

Rationale of the Course:

Telecommunications Engineering is a four-year study in engineering discipline centered around electrical and computer engineering. The field of engineering work ranges from basic circuit design to strategic mass developments. Telecommunication engineers design, test and build the various technologies that allow people to communicate over distances. They work in fields like telephone and internet networks, broadcasting and satellite communications, and radio and television. After studying Telecommunication engineering, students have a career as electronics engineers, electronics and communication engineer, electronics design & development engineers, desktop support engineers, system control engineers.

Course Objective:

The educational objectives of the Telecommunications Engineering Program are: To equip students with the necessary background and technical knowledge for successful careers in Telecommunications Engineering. To produce graduates who are able to earn advanced degrees.To prepare students for professional success with clear communication ability, commitment to ethical and social responsibilities, diversity, lifelong learning, and teamwork.

Course Content:

Introduction: Principle, evolution and telecommunication networks. National and International regulatory bodies, Telephone apparatus, telephone Exchanges, subscriber loop, supervisory tones, PSTN.

Switching systems: Introduction to analog system, Strowger and Crossbar switching systems, stored program control (SPC) systems.

Digital switching systems: space division switching, time division switching, blocking probability and multistage switching, and digital memory switch.

Traffic analysis: Traffic characterization, grades of service, network blocking probabilities, delay system and queuing.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Principle, evolution and telecommunication networks. National and International regulatory bodies, Telephone apparatus, telephone Exchanges, subscriber loop, supervisory tones, PSTN.
CLO2	**Explain** Introduction to analog system, Strowger and Crossbar switching systems, stored program control (SPC) systems **solve** related mathematical problems.
CLO3	**Interpret** space division switching, time division switching, blocking probability and multistage switching, and digital memory switch and **solve** related mathematical problems.
CLO4	**Understand** Traffic characterization, grades of service, network blocking probabilities, delay system and queuing.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Class Lecture	Mid Term Exam/ClassTest/Assignment.
COL2	Class Lecture	Mid Term Exam/Class Test/Final Exam.

COL3	Class Lecture	Final Exam/Assignment/Class Test.
COL4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: EEE 489 Course Title: Radio and Television Engineering Credit: 3

Rationale of the Course:

The course provides students with knowledge on the fundamentals of Radio and Television engineering. Students will learn the fundamentals of producing radio and television in this course, as well as the background and history of broadcasting.

Course Objective:

Students will be taught the history and origin of radio and TV broadcasting, as well as the principles and practice of Broadcasting. They will also examine the importance of programming and advertising in the Broadcast Media.

Course Content:

Radio: Evolution of Wireless Transmission, Subsystems of Radio Communications, Radio Network, Transmission and Reception, Audio Power Amplifier, Coverage Area, Spectrum Analysis, Frequency Allocation, CCIR Standards.

TV Systems: TV Standards, Interlace Scanning, Bandwidth, Signal Generation by VSB Modulation, Composite Video Signal Analysis, Horizontal and Vertical Sync Details. Video Section, Contrast Control Methods, Flyback Transformer, Sync Separation Circuit, Transistor VHF Tuner, Video IF Section, Practical Video IF Circuit.

Color TV: Color Mixing, Color Reproduction Circuits, and Color Matrix, Color Killer Circuit, ICs used in Color TV Receivers, Remote Control Circuits, Digital TV.

HDTV: Introduction, Principle, Standards and Applications, TV Booster. Digital TV and Multimedia Applications, Satellite Broadcasting Home TV System, Cable TV System.

Modern TV Receiver: Introduction to LCD, LED, Plasma, Quantum Dot LED TV Receiver.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** the basics of Radio transmission and receiver system.
CLO2	**Understand** the basic of Television transmission and receiver system.
CLO3	**Understand** the basics of color television.
CLO4	**Analyze** the basics of the modern television receiver.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)										
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exam.
CLO4	Lecture Tutorial	Final Exams

19(i). Elective Course (Group IV: Intelligent System and Information Technology)

Course Code: CSE 321 **Course Title: Computer Architecture** **Credits: 3**

Rationale of the Course:

Knowing what's inside and how it works will help the students to design, develop, and implement applications better, faster, cheaper, more efficient, and easier to use since they will be able to make informed decisions instead of guessing and assuming.

Course Objective:
This course aims to give an understanding of the mechanisms for implementing the programmer's idealized computer. It builds on the introduction to hardware and to simple processors in the Digital Systems course. The Computer Architecture course aims to describe a broad range of architectural designs and to contrast them, highlighting the design decisions they incorporate. The designs are described and analyzed at the register-transfer level of abstraction. The course has an emphasis on understanding concurrency and power implications of design choices.

Course Content:
Introduction: Generation and types of computers, languages, virtual machines, multilevel machines, hardware and software, milestones in computer architecture.
Computer Organization: Processor's architecture, functions, operations, instruction formats, addressing, instruction types, control flow, comparison between Intel and Motorola; memory - functions, classification of memory; Input/Output - keyboard, terminals, disk-drive, modem, mouse, printers; computer buses: control bus, data bus, address bus, synchronous bus, asynchronous bus, bus arbitration, interrupt handling, system bus - IBM PC XT/AT bus, VME bus, VESA bus, PCI bus.
Microprocessor: Types, overview of Intel and Motorola processor, instruction and addressing mode of Intel 8086 microprocessor, assembly language programming (any 8086 processor).
Microcomputer/ Interfacing Support Chips: Interfacing technique, different support chips, bus controller, interrupt controller, DMA controller, key-board controller.
Micro Programmed Control: Basic concepts. Micro-instruction sequencing and execution; Grouping of signals; Bit-slice architecture. RISC & CISC machines, Parallel processing, multiprocessing, Vector computation.
Fault tolerant systems: Instruction, execution Characteristics; Use of large register file; RISC architecture, RISC pipe lining, machine.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the types of computers along with the languages and architectures.
CLO2	Analyze different types of I/O devices, buses etc. and make comparisons.
CLO3	Analyze different types of microprocessors and interfacing techniques.
CLO4	Explain micro-instruction sequencing and execution e.g., RISC & CISC machines.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										

CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Course Code: CSE 323 Course Title: Computer Networks Credits: 3

Rationale of the Course:

This course helps students to excel in Designing, engineering, and installation of networks to connect digital computers. The key goals are resource sharing, high reliability, increased system performance, and security.

Course Objective:

This course examines the basic concepts of computer networks. It also correlates between the communication and computer engineering.

Course Content:

Introduction to Computer Networks: Basic concept of Computer networks and distributed systems; Goals of networking; General approaches of communication within a network. Network classification;. Uses & Network Software's. Network Topology : Bus, tree, ring, and star topology, transmission. Network Protocol : OSI model, TCP/IP protocol and the Internet, LAN and MAN-topologies, optical fiber bus, MAC protocols, LAN/MAN standards, FDDI and Fast Ethernet, LAN and bridges; Geosynchronous and 1ow orbit satellites, VSATS, protocols for multiple access unlink channel, digital cellular radio, GSM, personal communication services. Network Interconnections : bridges and gateway, connectionless and connection oriented internetworking, routing and fragmentation, firewall, IP protocol and IP addresses, internet Control Protocols - ICMP, ARP, RARP, Domain name and Name servers; Overview of internet applications; Electronic Mail Systems and protocol SMIP and MIME, world wide web, URLS; ISDN user interface and channels, Broadband ISDN, Frame Relay services and protocols, ATM virtual Channels and paths, ATM cells, header error control, ATM switches. Network Security : Introduction to network security authentication protocols and digital signatures, simple network, management protocol.

Network Applications: Client/server programming, RPC techniques; applications- file server, print server, e-mail, directory services, remote login, HTTP, HTML, World Wide Web, web browser, applications server. **Network Management :** Internet management - management information base(MIB), simple network management protocol (SNMP). **The Network Layer:** The Physical Layer - The Data Link Layer - The Medium Access Control Sub-layer. Transport layer and the application of layers.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** and explain the layered protocol model
CLO2	**Describe** what classful and classless addressing schemes are.
CLO3	**Program** network communication services for client/server and other application layouts and **Use** networking tools to observe and analyze behaviors of networking protocols
CLO4	**Describe**, **analyze** and **evaluate** a number of datalink, network, and transport layer protocols

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√							√			
CLO4	√									√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture,Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Course Code: CSE 324 Course Title: Computer Networks Lab Credits: 0.75

Rationale of the Course:

This course studies the standard models for the layered approach to communication between autonomous machines in a network, and the main characteristics of data transmission across various physical link types. It considers how to design networks and protocols for diverse situations, analyses several application and support protocols from a distributed systems viewpoint, and identifies significant problem areas in networked communications.

Course Objective:

TCP/IP protocol and the Internet, LAN Configuration, bridges and gateway, connectionless and connection oriented internetworking, routing and fragmentation, firalls, IP protocol and IP addresses, internet Control Protocols - ICMP, ARP, RARP, Domain name and Name servers; Client/server programming, RPC techniques; applications- file server, print server, e-mail, directory services, remote login, HTTP, HTML, World Wide Web, web browser, applications server, DHCP, RIP, VLAN, VLSM, FLSM, NAT.

Course Content:

Experiment	Experiment title
Experiment 01	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.
Experiment 02	Study of Network Devices in Detail.
Experiment 03	Study of network IP.
Experiment 04	Connect the computers in Local Area Network.
Experiment 05	Study of basic network command and Network configuration commands.
Experiment 06	Performing an Initial Switch Configuration
Experiment 07	Performing an Initial Router Configuration
Experiment 08	Configuring and Troubleshooting a Switched Network
Experiment 09	Connecting a Switch
Experiment 10	Configuring WEP on a Wireless Router
Experiment 11	Using the Cisco IOS Show Commands
Experiment 12	Examining WAN Connections
Experiment 13	Demonstrating Distribution Layer Functions
Experiment 14	Planning Network-based Firewalls

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Write** VLSM using CISCO packet tracer and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Analyze** application layer protocols.
CLO3	**Design** and **implement** network protocols.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2				√	√							
CLO3			√	√	√					√		√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Final exam
COL2	Lecture	Lab report/Final exam
CLO3	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Course Code: CSE 411 **Course Title: Software Engineering** **Credits: 3**

Rationale of the Course:
Software engineering is the study of and practice of engineering to build, design, develop, maintain, and retire software. There are different areas of software engineering and it serves many functions throughout the application lifecycle. Effective software engineering requires software engineers to be educated about good software engineering best practices, disciplined and cognizant of how your company develops software, the operation it will fulfill, and how it will be maintained.

Course Objective:
Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. An introduction to object-oriented software development process and design, Topics include: iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course Content:
The Software Process: Generic view of process, process models, an agile view of process. Software Engineering Practice: Software engineering, system engineering, requirement engineering, building the analysis model, design engineering, creating an architectural design, modeling component –level design, performing user interface design, testing strategies, testing tactics, product metrics. Applying Web Engineering: web engineering, initiating a web app project, Analysis for Web App project, Design for Web App project, Testing Web App project. Managing Software Projects: Project management, metrics for process and project, estimation, project scheduling, risk management, quality management, change management. Advanced Topics in Software Engineering: formal methods, clean room software engineering, component-based development, re-engineering, the root ahead.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** basics of computer science, software engineering knowledge, best practices, and standards appropriate for engineering complex software systems.
CLO2	**Understand** of different software architectural styles and implementation issues such as modularity and coding standards.
CLO3	**Define** adapting software processes and software development tools to meet the needs of an advanced development project.
CLO4	**Describe** data models, object models, context models and behavior model.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Midterm Exam/ Final Exam

Course Code: CSE 412 **Course Title: Software Engineering lab** **Credits: 1.5**

Rationale of the Course:
This Software engineering lab course introduces concepts and techniques relevant to the production of large software systems. Students are taught a programming method based on the recognition and description of useful abstractions. Topics include modularity, specification, data abstraction, object modeling, design patterns, and testing. Students complete several programming projects of varying size, working individually and in groups.

Course Objective:
The objective of this course is to verify the theories and concepts taught in CSE 411. Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools.

Course Content:

Experiment	Experiment Title
Experiment 01	Familiarization with software Engineering lab.
Experiment 02	Write down the problem statement for a suggested system of relevance.
Experiment 03	To perform the function oriented diagram: Data Flow Diagram (DFD.
Experiment 04	To perform the function oriented diagram: Structured chart.
Experiment 04	To perform the user‘s view analysis for the suggested system.
Experiment 06	To draw the structural view diagram for the system: Class diagram.
Experiment 07	To draw the structural view diagram for the system: object diagram.
Experiment 08	To draw the behavioral view diagram: State-chart diagram, Activity diagram.
Experiment 09	To perform the behavioral view diagram for the suggested system : Sequence diagram, CLOlaboration diagram
Experiment 10	To perform the implementation view diagram: Component diagram for the system.
Experiment 11	To perform the environmental view diagram: Deployment diagram for the system.
Experiment 12	To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system..
Experiment 13	Perform Estimation of effort using FP Estimation for chosen system
Experiment 14	To Prepare time line chart/Gantt Chart/PERT Chart for selected software project.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Analyze** of different software architectural styles and implementation issues such as modularity and coding standards.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2		√			√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Course Code: CSE 413 **Course Title: Intelligent Systems** **Credits: 3**

Rationale of the Course:
The course aims to introduce students to the basic concept of knowledge representation, problems solving and learning methods of artificial intelligence. At the end of the course students should be able to develop artificial intelligence methods for addressing computer engineering problems such as speech recognition, intelligent control and image recognition.

Course Objective:
This course requires the student to demonstrate the following:
1. Understand knowledge-based intelligent systems, and rule-based expert systems,
2. Understand fuzzy expert systems,
3. Analyze systems with Artificial Neural Networks,
4. Develop classification methods based on Support Vector Machines,
5. Use evolutionary computation methods for system optimization,
6. Application of artificial intelligence methods for solving computer engineering problems.

Course Content:
Introduction and General Concepts of Machine Learning and AI systems, Linear Algebra Review.
Feature Scaling and Choice of Learning Rate – Gradient Descent, Gradient Descent for Large Datasets.
Review of Probability Concepts: Bayesian Decision Theory. Bayes Theorem and Decision Rule. Minimum Risk Action. Discriminant Functions. Gaussian Distributions.
Skewed Data Evaluation: Precision and Recall etc. Linear Discriminant Functions/algorithms
Introduction of Multiplayer Neural Networks: BP algorithms. Deep learning.
Introduction to Support Vector Machines: Cost Function Kernels Optimizing Cost Function. Advice on Applying Machine Learning Algorithms. Bias and Variance. Learning Curves. Machine Learning System Design. Error Analysis. Classifier Evaluation.
Introduction to Unsupervised Learning: K-means Clustering. . Fuzzy C-means Clustering. Hierarchical Clustering.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Introduction and General Concepts of Machine Learning and AI systems, Linear Algebra Review. Feature Scaling and Choice of Learning Rate – Gradient Descent, Gradient Descent for Large Datasets.
CLO2	**Explain** Review of Probability Concepts: Bayesian Decision Theory. Bayes Theorem and Decision Rule. Minimum Risk Action. Discriminant Functions. Gaussian Distributions. Skewed Data Evaluation: Precision and Recall etc. Linear Discriminant Functions/algorithms and **solve** related mathematical problems.
CLO3	**Interpret** Introduction of Multiplayer Neural Networks: BP algorithms. Deep learning. Introduction to Support Vector Machines: Cost Function Kernels

	Optimizing Cost Function. Advice on Applying Machine Learning Algorithms and **solve** related mathematical problems.
CLO4	**Understand** Bias and Variance. Learning Curves. Machine Learning System Design. Error Analysis. Classifier Evaluation. Introduction to Unsupervised Learning: K-means Clustering. Fuzzy C-means Clustering. Hierarchical Clustering.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Class Lecture	Mid Term Exam/Class Test/Assignment.
COL2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
COL3	Class Lecture	Final Exam/Assignment/Class Test.
COL4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: CSE 415 Course Title: Data Structure & Algorithms Credits: 3

Rationale of the Course:

As applications become complex and data-rich, there are three common problems - data search, processor speed, and multiple requests - that applications face today. To solve the above problems, data structures come to the rescue. The data can be organized in a data structure so that all items do not need to be searched and the necessary data can be searched almost instantly.

Course Objective:

Gain an understanding of basic data structures and algorithms, and the tradeoffs between different implementations of these abstractions. Moreover student can be able to achieve Theoretical analysis, implementation and application. Lists, stacks, queues, stacks, dictionaries, maps, hashing, balanced trees and trees, quantities and graphs. Search and classification algorithms.

Course Content:

Analysis Techniques : Induction, Recursion Recurrence, Relations Probabilistic Analysis **Basic Data Structures:** Abstract Data Types , Linked Lists **Trees:** Tree Traversals Huffman Codes, Priority Queues, Heaps, Search Trees, Dictionaries, Binary Search Trees, Balanced Binary Search Trees, Hashing **Searching Algorithms:** Sequential Search, Binary Search, Interpolation Search **Sorting Algorithms:** Basic Algorithms Insertion Sort Bubble Sort Selection Sort **Advanced Algorithms:** Merge Sort, Heap Sort, Quick Sort **Graph Algorithms:** Graph Traversals, Biconnected Components, Shortest Path Problems, Dijkstra's Algorithms, Minimum Spanning Trees. Kruskal's Algorithm, Prim's Algorithm **Algorithm Design Techniques:** Divide and Conquer, Greedy Method**,** Fractional Knapsack Problem**,** Huffman Algorithm**, Dynamic Programming:** All pairs shortest path problem**,** Introduction to NP Completeness.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the design of fundamental data structures as well as algorithms that operate on them.
CLO2	**Apply** an appropriate data structure and algorithm for the solution of a real life problem
CLO3	**Implement** abstract data types
CLO4	**Analysis** data structures according to their typical uses, strengths, and weaknesses for designing optimized computer-based systems. (C4-Analyzing)

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√	√						√	√		
CLO4				√	√				√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture// Group Discussion	Assignment / Midterm Exam
CLO2	Lecture// Video Lecture	Mini Project/ Presentation /Class Test /Midterm Exam
CLO3	Lecture	Project/Final Exam
CLO4	Lecture/ Video Lecture	Final Exam

Course Code: CSE 417 Course Title: Introduction to IoT Credits: 3

Rationale of the Course:

Advances in technology are making possible a more widespread adoption of IoT, from pill-shaped micro-cameras that can pinpoint thousands of images within the body, to smart sensors that can assess crop conditions on a farm, to the smart home devices that are becoming increasingly popular.

Course Objective:
Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defense sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

Course Content:
Introduction to the Internet of Things: Elements of an IoT ecosystem Technology and business drivers, IoT applications, trends and implications.
Sensors and sensor nodes: Sensing components and devices, Sensor modules, nodes and systems.
Connectivity and networks: Wireless technologies for the IoT Edge connectivity and protocols Wireless sensor networks. System Programming and OS Dependencies Cloud Computing Services , Cloud and IoT Integration, IoT Data and the Cloud Cloud Evolution.
SDN Architecture: Control and Management plane improvements with SDN, Openness, Network Automation and Virtualization, SDN and OpenStack, ONOS SDN Controllers, Applications and APIs Protocols.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Learn** Elements of an IoT ecosystem Technology and business drivers, IoT applications, trends and implications.
CLO2	**Understand** Sensing components and devices, Sensor modules, nodes and systems, Wireless technologies for the IoT Edge connectivity and protocols Wireless sensor networks.
CLO3	**Discover** System Programming and OS Dependencies Cloud Computing Services , Cloud and IoT Integration, IoT Data and the Cloud Cloud Evolution.
CLO4	**Implement** Control and Management plane improvements with SDN, Openness, Network Automation and Virtualization, SDN and OpenStack, ONOS SDN Controllers, Applications and APIs Protocols.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)										
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3			√									
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-LearningStrategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Course Code: CSE 419 **Course Title: Artificial Intelligence** **Credits: 3**

Rationale of the Course:

AI eliminates the risk of human error. AI has the incredible potential to be available 24 hours a day, seven days a week. It includes digital assistance. Besides, AI with unbiased decisions can enable new inventions. Further, it aids in the completion of repeated tasks in day-to-day applications.

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Course Objective:

Introduce the vast variety of issues investigated in artificial intelligence, stressing the "core competencies" of intelligent systems - problem solving, reasoning, decision making, and learning - as well as the logical and probabilistic basis of these activities.

Course Content:

History, Intelligent agents, Uninformed search, Informed search, Constraint satisfaction, Game-playing, Logical agents, Propositional logic, First-order logic, Inference in first-order logic, Resolution, Logic programming, Planning, Plan execution, Uncertainty, Probability theory, Probabilistic inference, Bayesian networks and associated inference algorithms, Optimal decisions under uncertainty, optimal sequential decisions, Markov decision processes, Learning agents, Inductive learning, Decision trees.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Apply** general artificial intelligence techniques for common problem types.
CLO2	**Examine** various problem scenarios to model environments and agents.
CLO3	**Recommend** solutions to real-life artificial intelligence problems by analyzing the existing technique.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)										
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture ,Tutorial	Assignment / Midterm Exam
COL2	Lecture, Tutorial	Assignment / Class Test /Midterm Exam/Final Exam
COL3	Lecture, Tutorial	Midterm Exam/ Final Exam

Course Code: CSE 420 **Course Title: Artificial Intelligence Lab** **Credits: 0.75**

Rationale of the Course:
To study first-order predicate logic and logical reasoning using Prolog language and implementing various techniques and algorithms of AI used in general problem solving, optimization problems, and also to familiarize students with various scopes of AI, such as neural network and machine learning.

Course Objective:
The objective of this course is to verify the theories and concepts taught in CSE 411. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Content:

Experiment	Experiment title
Experiment 01	How to install python or other software like it
Experiment 02	Introduction to Different variables and memory management.
Experiment 03	Familiarization to Different Data types and user input.
Experiment 04	Finding Positive and Negative number.
Experiment 05	Finding Maximum Number out of different Numbers.
Experiment 06	Swapping two numbers.
Experiment 07	Finding prime numbers.
Experiment 08	Mapping and Filtering function
Experiment 09	Zipping and unzipping function
Experiment 10	Reducing function
Experiment 11	Introduction to Local variable and Global variable.
Experiment 12	Implementation of toy problems

Experiment 13	Developing agent programs for real world problems
Experiment 14	Applying deep learning methods to solve an application.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Design** an expert system using relevant tools and approaches and **Express** real-world issues as state space problems.
CLO2	**Write** comprehensive reports on the work done in Laboratory and demonstrate the ability to work as an individual or as a team

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√		√							√
CLO2	√	√							√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Final exam
COL2	Lab demonstration/ Lecture	Lab report/Final exam

Course Code: CSE 421 **Course Title: Multimedia Communication** **Credits: 3.0**

Rationale of the Course:

This course introduces students to integrated marketing communications. Students examine digital media channels and how to use them effectively. For their final project, students will create an intergrated communications plan for a real-world client. Course topics include: SEO, social media, video marketing, branding, planning, and email marketing.

Course Objective:

- understanding the multimedia communications systems, application and basic principles,
- analysis of the multimedia streaming
- performing and establishing multimedia communication terminals
- presentation of multimedia communications.

Course Content:

Concept of Multimedia: Overview of Audio, video, text, and graphics, data, different formats of data storage, hardware and software requirements.

Overview of Graphics: Digital Image fundamental, 2 & 3 Dimensional Graphics, Image data compression, Special effect to graphics; Basic concepts of Color Display; Color Management, Graphics input device; Graphics editing & drawing software.

Audio Signal: Analog & Digital signal; Configuring the sound card, Mono & Stereo channeling, Audio file size, Audio file formats; Audio recording techniques, Audio Editing terminology, Special effect to audio file, MIDI fundamentals, Audio editing software; Data compression.

Data compression and Transmission Techniques: Audio and video compression, synchronization. Multimedia networking and protocols, QOS principles. Video streams on ATM. Mobile multimedia computations. Operating system support for multimedia. Hypermedia system. Standard for multimedia. Multimedia database and multimedia applications

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Overview of Audio, video, text, and graphics, data, different formats of data storage, hardware and software requirements.
CLO2	**Explain** Digital Image fundamental, 2 & 3 Dimensional Graphics, Image data compression, Special effect to graphics; Basic concepts of Color Display; Color Management, Graphics input device; Graphics editing & drawing software and **solve** mathematical problems.
CLO3	**Interpret** Analog & Digital signal; Configuring the sound card, Mono & Stereo channeling, Audio file size, Audio file formats; Audio recording techniques, Audio Editing terminology, Special effect to audio file, MIDI fundamentals, Audio editing software; Data compression.
CLO4	**Understand** Audio and video compression, synchronization. Multimedia networking and protocols, QOS principles. Video streams on ATM. Mobile multimedia computations. Operating system support for multimedia. Hypermedia system. Standard for multimedia. Multimedia database and multimedia applications

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)										
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Class Lecture	Mid Term Exam/Class Test/Assignment.
COL2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
COL3	Class Lecture	Final Exam/Assignment/Class Test.
COL4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: CSE 423   **Course Title: Simulation and Modeling**   **Credits: 3.0**

Rationale of the course:

This course aims to enable a substitute for physical experimentation, which is frequently used when conducting experiments on a real system is impossible or impractical, often due to cost or time constraints, and instead uses mathematical knowledge and computing power to solve real-world problems reasonably and quickly.

Course Objective:

- To introduce with the various system simulation and modeling techniques, and highlight their applications.
- To introduce modeling, design, simulation, planning, verification and validation in the areas of simulation.
- To develop skills among the learners of system simulation.
- To make them able to solve real world problems, which cannot be solved by mathematical approaches.

Course Content:

Simulation modeling basics: systems, Models and simulation, classification of simulation models, steps in simulation Study, concepts in discrete event simulation , event scheduling and process interaction approaches, time advance mechanism, organization of a discrete event Simulation model, continuous simulation models, combined discrete continuous Models, Monte-Carlo simulation, simulation of queuing system. Building credible and credible simulation models: validation principle principles and techniques, Statistical procedures for comparing real world observation and simulation outputs, input modeling, generating random numbers and random vitiates, output analysis. Simulation languages; analysis and modeling of some practical systems.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the fundamentals of computer simulation and how it may be used to solve engineering problems.
CLO2	**Perceive** the advantages of utilizing simulation and modeling to make engineering decisions.
CLO3	**Classify** different simulation models and provide examples for each one.
CLO4	**Create** a model for a set of data and justify its validity.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2				√								
CLO3	√	√										
CLO4			√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Class Lecture	Mid Term Exam/Class Test/Assignment.
COL2	Class Lecture	Mid Term Exam/Class Test/Final Exam.
COL3	Class Lecture	Final Exam/Assignment/Class Test.
COL4	Class Lecture	Final Exam/Assignment/Class Test.

Course Code: CSE 425 **Course Title: Web Programming** **Credits: 3**

Rationale of the Course:

Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. The course addresses the concepts, methods, technologies, and techniques of developing Web sites that collect, organize and expose information resources. Topics covered include requirements engineering for Web applications, design methods and technologies, interface design, usability of web applications, accessibility, testing, metrics, operation and maintenance of Web applications, security, and project management. Specific technologies covered in this course include client-side (HTML, JavaScript, and CSS) and server-side (ASP.NET/PHP).

Course Objective:

Apply basic design principles to present ideas, information, products, and services on websites. Apply basic programming principles to the construction of websites. Effectively manage website projects using available resources.

Course Content:

Review: Short lecture on how a Web server processes Web pages and Active Server Pages including programming scripts, Tutorial on additional HTML coding including links, images, lists, and tables.

Visual Basic Programming: Short lecture on programming concepts: variables and memory, replacement statement, expressions, conditional processing, looping, Web pages as output.

Interacting with Databases in Visual Basic Programs: Short lecture on application programming, the ASP object model, and overview of middleware for connecting to databases Web Programming: Introduction to the World Wide Web, HTTP, Markup with HTML5, and Revision Control with Git, Design and Layout with Cascading Style Sheets (CSS), Client-Side Programming with JavaScript and the Document Object Model (DOM), More JavaScript, More HTML5, APIs, Server-Side Programming with PHP, Server-Side Programming with PHP (continued); Pattern Matching with Regular Expressions, Ajax; Cookies, Sessions, and Local Storage, Databases with MySQL, Web Security, JavaScript Libraries

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Analyze** and **design** comprehensive systems for the creation, dissemination, storage, retrieval, and use of electronic records and documents
CLO2	**Learn** and **use** some of the client-side and server-side languages used to manipulate information on the World Wide Web – i.e. PHP, and Java-script.
CLO3	**Learn** techniques and evaluation metrics for ensuring the proper operability, maintenance and security of a web application.
CLO4	**Apply** the web engineering methodologies for Web application development

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√	√									
CLO2			√		√							
CLO3			√									
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Course Code: CSE 426 Course Title: Web Programming Lab Credit: 0.75

Rationale of the Course:

The internet and the web are now an essential part of daily life. This art is crucial to master because it exists in all conceivable dimensions. This course studies both theoretical and practical approach to Web Engineering through various real life problems &solutions. And how state of the art technologies can be learned and used later.

Course Objective:

This course aims to give students a systematic way to gain a thorough understanding of web technologies through practical application. After completing the course, students will be able to learn new technologies, analyze current web applications and systems, and effectively design new ones.

List of Experiments:

Experiment	Topics
Experiment 01	Introduction to laboratory.
Experiment 02	Implementation of a hyper link.
Experiment 03	Inserting an image on a web page.
Experiment 04	Creating a form.
Experiment 05	Applying different properties of css to give a web page a professional look.
Experiment 06	Using JavaScript to pre-compute the total cost of an order and display it to the customer before the order is submitted to the server for processing.
Experiment 07	Implementation of bootstrap to make pages responsive.
Experiment 08	Making a dynamic website.
Experiment 09	Deleting a record from the database using web interface.
Experiment 10	Implementation of MVC design pattern through PHP.
Experiment 11	Implementation of AJAX.
Experiment 12	Installing Laravel on computer.
Experiment 13	Implementation of routes on laravel.
Experiment 14	Creating Model in laravel.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different programming techniques, protocols available for development

CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration/ Lecture	Lab Report

Part D

20. Grading/Evaluation

a) **Grading Scale**

Numerical Grade	Letter Grade		Grade Point
80% - 100%	A+	(A Plus)	4.00
75% - 79.99%	A	(A Regular)	3.75
70% - 74.99%	A-	(A Minus)	3.50
65% - 69.99%	B+	(B Plus)	3.25
60% - 64.99%	B	(B Regular)	3.00
55% - 59.99%	B-	(B Minus)	2.75
50% - 54.99%	C+	(C Plus)	2.50
45% - 49.99%	C	(C Regular)	2.25
40% - 44.99%	D	-	2.00
Less than 40%	F		0.00

b) **Grades**

Hamdard University Bangladesh (HUB)will follow the Uniform Grading System (As directed by University Grants Commission of Bangladesh).

Note:Grades without numerical value
P:Pass
I:Incomplete
W: Withdrawal

c) **Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)**

Two kinds of grade point average will be use at Hamdard University Bangladesh (HUB). The CGPA is calculated by dividing that the total earned quality points by the number of credit hours attempted in a given semester. The earned grade point is computed by multiplying the value of the grade point equivalent to the corresponding Letter grade by the number of credit hours for the course (e.g., a student earning a "B" (3.0) grade in a 3 credit hours course earns 9.0 grade points).

The Cumulative GPA is calculated by the following equation:

$CGPA = \frac{\sum C_n G_n}{\sum C_n}$ Where, C is Credit Hour, G is Grade Point.

So, $\sum C_n G_n = C_1 G_1 + C_2 G_2 + C_3 G_3 + ... + C_n G_n$ and $\sum C_n = C_1 + C_2 + C_3 + ... + C_n$.

It is necessary to maintain a certain CGPA for a degree at HUB. For example, a CGPA of C^+ (2.5) for Bachelor's degree is essential.

d) **Course Withdrawal**

Withdrawal is assigned to a student who withdraws from the course within the deadline for withdrawal with 'W' grade. A student who withdraws after this date will earn the grade based on his performance before his withdrawal. Exception to this rule may be made on medical ground and on terms and condition of the University.

e) **Incomplete (I) courses**

An Incomplete (I) grade is assigned only when a student has failed to complete one or more requirements of the course for unavoidable reason/accidental circumstance and has applied for (I) grade. The students who are permitted to appear in make-up examination (s) will be assigned an (I) grade for that course and this grade will stay until the student appears in the make-up examination at the first available opportunity; if s/he fails to appear in the make-up examination the (I) grade will automatically be converted to (F) grade.

f) **Retake**

If any examinee obtains grade "F" in one or more subject of any semester, he/she will have to re-register and pass those courses within the following two semesters (one year).

g) **Grade Improvement**

In the final examination, if any student obtains grade less than B, he/she will be able to appear in improvement examination. A student can sit for maximum of two improvement examinations for a particular course in the following two semester

(one year). In addition, students will have the chance to participate on improvement examination for highest two (2) courses in any semester.
[NB. Any examinee can apply for the improvement exam in the same course either in Midterm or Final examination, not both examinations]

h) **Dropout**
If any student doesn't complete registration in consecutive 2 (two) semesters, he/she will be counted as a dropout. If that student wants to continue his/ her study, he/ she must get re-admission.

Appendix A : Course Outline

General Education Courses (Group I: General Compulsory Courses)

Part A

Course No./Course Code :	ENG 111
Course Title :	English For Technical Communication
Course Type	General Course
Year /Level/Semester/Term :	First Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	N/A
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The main goal of this course is to help you improve your spoken English skills to enable you to communicate more effectively in English.
Native English speaker proficiency and expression are not expected of OEPP students. The general expectation for certification is the ability to communicate in English without great effort or misunderstanding for all parties involved. Our goal is to assist the student in developing skills in the goal areas (intelligibility, vocabulary, grammar, presentation and interactive communication) so that any deficiencies in skill or practice do not interfere with communication.

Course Objective:
The objective of this course is-

- Students will heighten their awareness of correct usage of English grammar in writing and speaking
- Students will improve their speaking ability in English both in terms of fluency and comprehensibility
- Students will give oral presentations and receive feedback on their performance
- Students will increase their reading speed and comprehension of academic articles
- Students will improve their reading fluency skills through extensive reading
- Students will enlarge their vocabulary by keeping a vocabulary journal
- Students will strengthen their ability to write academic papers, essays and summaries using the process approach.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** Introduction, various approaches to learning English. Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.

CLO2	**Explain** Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories. Principles of effective writing; Organization, planning and development of writing; Composition, precise writing, amplification. Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.
CLO3	**Interpret** Communication today, business communication, different types of business communication. The phonemic systems and correct English pronunciation.
CLO4	**Understand** Practicing dialogue; Story telling; Effective oral presentation. Defining a report, classification of reports, structure of a report, and writing of reports.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Class Lecture	Mid Term Exam/Class Test.
COL2	Class Lecture	Mid Term Exam/Assignment/Class Test.
COL3	Class Lecture	Mid Term Exam/Final Exam, Assignment.
COL4	Class Lecture	Final Exam/Assignment/Class Test.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

1-2	**General discussion:** Introduction, various approaches to learning English. **Grammatical Problems:** Construction of sentences, grammatical errors, sentence variety and style, conditionals, vocabulary and diction.	Class Lecture	Mid Term Exam/Class Test.	CLO1
3-6	**Reading Skill:** Discussion readability, scan and skin reading, generating ideas through purposive reading, reading of selected stories. **Writing Skill:** Principles of effective writing; Organization, planning and development of writing; Composition, precise writing, amplification.	Class Lecture	Mid Term Exam/Assignment/Class Test.	CLO1, CLO2
7-8	**General strategies for the writing process:** Generating ideas, identifying audiences and purposes, construction arguments, stating problems, drafting and finalizing.	Class Lecture	Mid Term Exam/ Assignment/ Final Exam.	CLO2
	Mid Term Exam			
9-10	**Approaches to Communication:** Communication today, business communication, different types of business communication.	Class Lecture	Assignment / Final Exam	CLO3
11-13	**Listening Skill:** The phonemic systems and correct English pronunciation.	Class Lecture	Class Test / Final Exam	CLO4
14-16	**Speaking Skill:** Practicing dialogue; Story telling; Effective oral presentation.	Class Lecture	Assignment / Final Exam	CLO4
17-18	**Report Writing:** Defining a report, classification of reports, structure of a report, and writing of reports.	Class Lecture	Class Test / Final Exam	CLO4

	Final Exam

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. *Grammar in Use Intermediate with Answers with Audio CD: Self-study Reference and Practice for Students of English 2nd* Edition by Raymond Murphy (Author), William R. Smalzer (Author)

Supplementary Readings:

1. *An Applied English Grammar and Composition (for CBSE, ICSE, ISC Students) Paperback* – January 1, 2014 by P C Das (Author)

2. *High School English Grammar and Composition Paperback* – March 1, 1995 by P.C. Wren (Author), H. Martin (Author), N.D.V.Prasada Rao (Editor)

Part A

Course No./Course Code :	ENG 127
Course Title :	Developing English Language Lab
Course Type	General Course
Year /Level/Semester/Term :	Second Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	N/A
Credit Value :	1.5
Contact Hours :	36 Hours

Total Marks :	100

Rationale of the Course:

English Skills Language lab is software-based laboratory on learning a language. Good communication depends upon the language skills one acquires while learning a language. If the four skills of language that are reading, writing, listening and speaking are practiced well. Language lab plays an important role in the language learning process.

Course Objective:

The aim of Language Lab is to augment LSRW and GV skills (Listening, Speaking, Reading, Writing and Grammar, Vocabulary) through tests, activities, exercises etc., comprehensive web-based learning and assessment systems with the engineering subjects for the students.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	Pronounce speech sounds appropriately.
CLO2	Identify the distinct qualities of English phonology.
CLO3	Develop soft skills, such as oral presentation skills, communication skills, group discussion skills and interview skills thereby enhancing employability skills

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2		√			√	√						
CLO3									√			

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	**Experiment title**	***Hrs***	***CLOs***
1	**Grammar:** Tense, article, preposition.	2	CLO1, CLO2
2	**Grammar:** subject-verb agreement, clause, conditional and sentence structure.	2	CLO1, CLO2
3	**Vocabulary building:** correct and precise diction, affixes.	2	CLO1, CLO2

4	**Vocabulary building:** level of appropriateness. Colloquial and standard, informal and formal.	2	CLO1, CLO2
5	**Developing reading skill:** Strategies of reading-skimming, scanning.	2	CLO1, CLO2
6	**Developing reading skill:** Strategies of predicting, inferencing.	2	CLO1, CLO2
7	**Developing reading skill:** Analyzing and interpreting variety of texts; Practicing comprehension from literary and nonliterary texts.	2	CLO1, CLO2
8	**Developing writing skill:** Sentences, sentence variety, generating sentences.	2	CLO1, CLO2
9	**Developing writing skill:** Clarity and correctness of sentences, linking sentences to form paragraphs, writing paragraphs.	2	CLO1, CLO2
10	**Developing writing skill:** Clarity and correctness of sentences, linking sentences to form essays, reports, formal and informal letters.	2	CLO1, CLO2
11	**Listening skill and note taking:** Listening to recorded texts and class lectures and learning to take useful notes based on listening.	2	CLO1, CLO2
12	Quiz on Reading, Listening and Writing		
13	**Developing speaking skill:** Oral skills including communicative expressions for personal identification, life at home.	2	CLO1, CLO2
14	**Developing speaking skill:** Oral skills including communicative expressions for giving advice and opinion, instruction and directions.	2	CLO1, CLO2
15	**Developing speaking skill:** Oral skills including communicative expressions for requests, complains, apologies, describing people and places, narrating events.	2	CLO1, CLO2
16	**Speaking Test**		
17	**Group/Single Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. *Grammar in Use Intermediate with Answers with Audio CD: Self-study Reference and Practice for Students of English 2nd Edition* by Raymond Murphy (Author), William R. Smalzer (Author)

Supplementary Readings:

1. *An Applied English Grammar and Composition (for CBSE, ICSE, ISC Students) Paperback – January 1, 2014 by* P C Das (Author)

2. *High School English Grammar and Composition Paperback – March 1, 1995 by* P.C. Wren (Author), H. Martin (Author), N.D.V.Prasada Rao (Editor)

Part A

Course No./Course Code :	BAN 211
Course Title :	History of Emergence of Bangladesh (Bangladesh Studies)
Course Type	General Course
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
History of Emergence of Bangladesh has been designed for the purpose of learning the entire history of Bangladesh, to understand present Bangladesh in the light of history and to provide them with basic knowledge of current politics and economy of the country in the focus of B.Sc. level students. This course will intensify students understanding of multifarious interconnection of historical events which lead to the formation of Bangladesh, current trend in political and economic development thereby improving critical thinking along with their

written and oral communication skills, quantitative skills and technical literacy. It will also enhance their understanding of current phenomena in the light of history which will make them responsible global citizen.

Course Objective:
The course intends to equip students with factual knowledge and analytical skills that will enable them to learn and critically appreciate history, politics, and economy of Bangladesh. It will trace the historical root of Bangladesh as an independent state focusing on the social, economic and political developments that have taken place since its independence.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the history, geography, trade, socio-economic and cultural changes, Language and Literature, the independent Sultanate, Bengal under the Mughals, British CLOonial Rule and Response, Introduction of Zamindari system, Resistance movements.
CLO2	**Understand** the revival of statehood in Bengal, the growth of Indian National Congress, the creation of New Province of East Bengal and Assam, Muslim League, foundation of Awami League and Language Movement, Economic Disparity between the two regions, 6-point Movement, Mass Upsurge, Election of 1970, the War of Independence and the Emergence of Bangladesh.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1						√						
CLO2						√						

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Presentation/ Midterm Exam/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Sources of History, History in Nation Building	Lecture	Quiz	CLO1
02	Ancient Geography and trade links with other world	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Pala and Sena dynasties and Muslim conquest of Bengal	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	socio-economic and cultural changes, Unification of Bengal,	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	The development of Bengali Language and Literature	Lecture	Assignment/ Midterm Exam	CLO1
06	The independent Sultanate in Bengal, Bengal under the Mughals,	Lecture	Assignment / Midterm Exam	CLO
07	The Nawabi Rule in Bengal (1700-1765), British CLOonial Rule and Response	Lecture	Assignment / Class Test /Midterm Exam	CLO1
08	Introduction of Zamindari system and its decline, changes of socio-economic condition, Resistance movements	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO1
Mid Term Exam				
09	Revival of statehood in Bengal,	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2
10	the growth of Indian National Congress	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO2
11	The creation of New Province of East Bengal and Assam, Muslim League (1906), Bengal Pact (1923)	Lecture	Assignment / Final Exam	CLO2
12	Foundation of Awami League, Language Movement of 1952,	Lecture	Assignment / Class Test / Final Exam	CLO2
13	United Front and Fall of Muslim League, the Military Rule of Ayub Khan	Lecture / Group Discussion	Presentation/ Final Exam	CLO2

14	Economic Disparity between the two regions, cultural suppression of West Pakistan	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam	CLO2
15	6-point Movement and Mass Upsurge in 1969,	Lecture/ Gro up Discussion	Assignment/ Mini Project/Final Exam	CLO2
16	Rule of Yahya Khan, Election of 1970	Lecture	Assignment / Midterm Exam/ Final Exam	CLO2
17	The War of Independence	Lecture / Group Discussion	Assignment / Class Test Final Exam	CLO2
18	The Emergence of Bangladesh	Lecture / Group Discussion	Presentation/ Final Exam	CLO2
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings

1. Sirajul Islam , ***History of Bangladesh 1704-1971,*** Asiatic Society of Bangladesh, 3rd Edition, 2007.

Supplementary Readings:

1. M. Shamsul Kabir Khan, Dantatunnahaer Khanam, ***Bangladesh Studies***, Chaity Chayan Prokashoni, 3rd Edition, 2012.
2. Suman Das and M. N. Mohabbat, ***Bangladesh Studies,*** M. R. Printing Press, 5th Edition, 2013.

3. Sheikh Mujibur Rahman, ***Unfinished Memories,*** University Press Limited, 4th Edition, 2014.

Part A

Course No./Course Code :	ACT 215
Course Title :	Financial and managerial Accounting
Course Type	General Course
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Accounting is the process of organizing, analyzing, and communicating financial information that is used for decision-making. Financial information is typically prepared by accountants—those trained in the specific techniques and practices of the profession. This course explores many of the topics and techniques related to the accounting profession. While many students will directly apply the knowledge gained in this course to continue their education and become accountants and business professionals, others might pursue different career paths. However, a solid understanding of accounting can for many still serve as a useful resource. In fact, it is hard to think of a profession where a foundation in the principles of accounting would not be beneficial. Therefore, one of the goals of this course is to provide a solid understanding of how financial information is prepared and used in the workplace, regardless of your particular career path.

Course Objective:

The course has an objective to offer students the knowledge of the main financial and managerial accounting principles, concepts as well as the basic understanding of how financial statements are created and published. Moreover this course helps students progress and understand other finance-based courses, and make a solid foundation for further accounting based courses. It will give students a foundation of both financial and managerial accounting concepts.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the conceptual basis of accounting, the basic accounting rules for recording business operations, assets and liabilities, the methodology of preparing accounting reports, and the requirements for their contents.
CLO2	**Explain** the basic accounting rules for recording business operations.

CLO3	**Analyze** managerial accounting analytical tools for internal control, pricing and developing different budgets for financial planning purposes as well as to get essential skills in capital budgeting techniques.
CLO4	**Compare** between the profitability ratios and investment analysis.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2											√	
CLO3										√	√	
CLO4										√	√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Introduction: Definition of Accounting and Its Functions-Users of Accounting Data-The Work of an Accountant-Ethics in Financial Reporting-Generally Accepted Accounting Principles (GAAP)-Understanding of Accounting Principles	Lecture	Quiz	CLO1

02	Accounting Concepts, Assumptions and Conventions-The Basic Accounting Equation/Balance Sheet Equation-Financial Transactions and their Effect on Accounting Equation - Understanding of Different Financial Statements and Summary of the Accounting Cycle.	Lecture	Class Test /Midterm Exam	CLO2
03	**The Recording Process:** The Account- Mechanics of Double-Entry Accounting-Transactions Illustrating the Rules of Debit and Credit-The Account	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	The Equation-Steps in the Recording Process-Meaning of Journal-Various Kinds of Journal-Journalizing Business Transactions-Meaning of Ledger–Importance of Ledger–Posting Mechanism–Accounts and their Balances-Definition of Trial Balance–Trial Balance and Accounting Accuracy-Preparation of Trial Balance.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	**Adjusting the Accounts and Preparing the Statements:** Need for Adjustments at the End of Accounting Period-Accrual Vs. Cash-Basis	Lecture	Assignment/ Midterm Exam	CLO2
06	Accounting-Recognizing Revenues and Expenses-Types of Adjusting Entries-Adjusting the Accounts-The	Lecture	Assignment / Midterm Exam	CLO2

	Adjusted Trial Balance			
07	Preparing Statements from the Adjusted Trial Balance-The Adjustment Process-Cash Flow Statement-The Classified Balance Sheet/Classification of Balance Sheet Items-Owner's Equity on the Balance Sheet.	Lecture	Assignment / Midterm Exam	CLO2
08	**Completing the Accounting Cycle:** Definition of Worksheet-Steps in Preparing Worksheet-Preparing Financial Statements from Worksheet-Preparing Adjusting Entries from a Worksheet.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Mid Term Examination				
09	Preparing Closing Entries-Posting Closing Entries-Preparing Post-Closing Trial Balance.	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2
10	**Accounting for Merchandising Operations:** Merchandising Operations-Recording Purchases of Merchandise-Recording Sales of Merchandise	Lecture/ Group Discussion	Assignment/ Class Test	CLO2
11	Completing the Accounting Cycle-Forms of Financial Statements: Multiple-Step and Single-Step Income Statements and Classified Balance Sheet-Determining Cost of Goods Sold Under a Periodic System-Periodic Inventory System-Classifying Inventories	Lecture	Assignment / Final Exam	CLO3

12	Determining Inventory Quantities-Inventory Costing-Inventory Errors-Estimating Inventories-Worksheet for Merchandising Company.	Lecture	Assignment / Class Test / Final Exam	CLO3
13	**Accounting Information Systems:** Basic Concepts of Accounting Information Systems	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Computerized Accounting Systems vs. Manual accounting Systems	Lecture	Presentation/ Class Test / Final Exam	CLO3
15	**Accounting for Receivables:** Types of Receivables-Accounts Receivables-Notes Receivables-Statement Presentation and Analysis.	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
16	**Accounting for Plant Assets, Natural Resources, and Intangible Assets:** Determining the Cost of Plant Assets-Depreciation-Depreciation Methods	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
17	Expenditures for Useful Life-Plant Assets Disposals-Exchange of Plant Assets-Natural Resources-Accounting for Intangible Assets.	Lecture	Assignment / Midterm Exam/ Final Exam	CLO3
18	**Accounting for Current Liabilities and Payroll Accounting:** Accounting for Current Liabilities - Contingent Liabilities - Payroll Accounting.	Lecture	Assignment / Class Test/ Final Exam	CLO3/ CLO4
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Weygandt & Kieso, *Accounting Principles, (8/e)*, Volume 1, 8th Canadian Edition,2019.

Supplementary Readings:

1. William W. Pyle and Kermit D. Larson, *Fundamental Accounting Principles*, Richard D. Irwin, Inc.; 10th Edition, January 1, 1984.

Part A

Course No./Course Code :	MGT 417
Course Title :	Industrial and Operational Management
Course Type	General Course
Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
This course reviews the management of operations in manufacturing, service, and government organizations. Topics include a review of the activities and responsibilities of operations management, the tools and techniques available to assist in running the operation, and the factors considered in the design of the system.

Course Objective:
Develop an understanding of engineering costing and project management principles to help optimise business processes and boost productivity. Cultivate the specialist knowledge and entrepreneurial skills, coupled with human resource management or business finance concepts, to craft impactful global strategies that power the business of tomorrow.

Course Content:

Introduction: Introduction, evolution, management function, organization and environment. Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning. Personnel Management: Scope; Importance; Need hierarchy; Motivation; job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict. Cost and Financial Management: Elements of costs of products depreciations; Break-even analysis; Investment analysis; Benefit cost analysis. Management Accounting: Cost Planning and control; Budget and budgetary control; Development planning process; Project management; Network models for project time estimation; Estimation of confidence level; Simplex method for minimization of project time; Project effort analysis methods; Marketing Management: Concepts; Strategy; Sales promotion; Patent laws. Technology Management: Management of innovation and changes; Technology life cycle; Case studies.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	Understand the fundamentals of operations management.
CLO2	Explain the cost and financial management
CLO3	Analyze management accounting and project management.
CLO4	Compare between quantitative and qualitative analysis techniques to improve understanding of operations.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1											√	
CLO2											√	
CLO3											√	
CLO4										√	√	

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Introduction: operation management	Lecture	Quiz	CLO1
02	Introduction, evolution, management function, organization and environment.	Lecture	Class Test /Midterm Exam	CLO2
03	Organization: Theory and structure; Coordination; Span of control; Authority delegation	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Groups; Committee and task force; Manpower planning.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Personnel Management: Scope; Importance; Need hierarchy; Motivation; job redesign;	Lecture	Assignment/ Midterm Exam	CLO2
06	Leadership; Participative management; Training; Performance appraisal; Wages and incentives;	Lecture	Assignment / Midterm Exam	CLO2
07	Informal groups; Organizational change and conflict.	Lecture	Assignment / Midterm Exam	CLO2
08	Cost and Financial Management: Elements of costs of products depreciations	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Mid Term Examination				
09	Break-even analysis	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2
10	Investment analysis; Benefit cost analysis.	Lecture/ Group Discussion	Assignment/ Class Test	CLO2

11	Management Accounting: Cost Planning and control; Budget and budgetary control;	Lecture	Assignment / Final Exam	CLO3
12	Development planning process; Project management	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Network models for project time estimation; Estimation of confidence level;	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Simplex method for minimization of project time	Lecture	Presentation/ Class Test / Final Exam	CLO3
15	Project effort analysis methods	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
16	Marketing Management: Concepts; Strategy; Sales promotion	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
17	Patent laws. Technology Management	Lecture	Assignment / Midterm Exam/ Final Exam	CLO3
18	Management of innovation and changes; Technology life cycle; Case studies.	Lecture	Assignment / Class Test/ Final Exam	CLO3/ CLO4
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Min-Jung Yo, Remy Glardon, *Manufacturing Operations Management*, World Scientific Europe Ltd (July 7, 2018)

Supplementary Readings:

1. Courtney Hoover, ***Industrial Engineering and Operations Management***, Willford Press (June 3, 2016)

Part A:

Course No./Course Code :	**HUM 127**
Course Title :	Fundamentals of Economics
Course Type	General course
Year /Level/Semester/Term :	First Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

this course aims to give knowledge of fundamental concept of economics and interrelates with the engineering and the economics subjects. This course provides knowledge necessary for the selection and control of a market.

Course Objective:

This course examines the basic concepts of economics. It also correlates between the engineering and economics. It's objective is also to enhance the management skill of an engineer.

Course Content:

Introduction to economics. Economics and engineering. Different economic systems. Fundamental economic problems. Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus. Theory of production and cost. Theory of the firm and market structure. Optimization.

Introducing macroeconomics. National income accounting, the simple Keynesian analysis of national income, employment and inflation. Savings, investment and decision making. Fiscal policy and monetary policy- money and interest rate, income and spending.

Economics of development and planning.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**State** economics and **Explain** Economics and engineering relation and Different economic systems.
CLO2	**Discuss** Basic elements of demand, supply and product market. Theory of utility and preferences, consumer's surplus and **solve** Fundamental economic problems.
CLO3	**Examine** macroeconomics sectors and **solve** related mathematical problems.
CLO4	**Describe** Economics of development and planning.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture,Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

1	**Overview of the Course**	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
2	Introduction to economics	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
3	Different economic systems.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
4	Economics and engineering	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
5	Fundamental economic problems	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
6	Basic elements of demand, supply and product market	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
7	Theory of utility and preferences, consumer's surplus.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
8	Theory of production and cost.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
9	Theory of the firm and market structure. Optimization.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
Midterm Examination				
10	Introducing macroeconomics	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
11-13	National income accounting, the simple Keynesian analysis of national income, employment and inflation.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
14	Savings, investment and decision making.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**

15-16	Fiscal policy and monetary policy- money and interest rate, income and spending.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
16-18	Economics of development and planning.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Mid-term, Class Test, Assignment, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. William Boyes, Michael Melvin**,** *Fundamentals of Economics,* Cengage Learning; 6th edition (December 31, 2012)

General Education Courses (Group II: Natural Science Courses)

Part A

Course No./Course Code :	PHY 111
Course Title :	Electricity and Magnetism
Course Type	General Education Courses
Year /Level/Semester/Term :	First Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	HSC Physics
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Physics is a fundamental science that endeavors to explain all the natural phenomena that occur in the universe. Its power lies in the use of a comparatively small number of assumptions, models, laws and theories to explain a wide range of phenomena, from the incredibly small to the incredibly large. Physics has helped to unlock the mysteries of the universe and provides the foundation of understanding upon which modern technologies and all other sciences are based.

Course Objective:

The subject Physics evolved from an interesting laboratory experiment to a technology with applications in all aspects of life. In part 1 of this course, the basics of the Coulomb's Law, Gauss's law, Biot-Savart law, Maxwell's equation can be understood. In Part 2, we will use this framework to understand the Magnetism: such as The Hall Effect, Ampere's law, The Faraday's Laws of electromagnetic induction. In Part, we will learn Mechanics such as Motion along a straight line. In Part 4, we will focus our study on Modern Physics, especially on Quantum physics. Although much have changed in the last 20 years - Physics has been reached at a very advanced level- yet the simple but powerful concepts that you will learn in this introductory course will still provide you the background for your future study and experiments.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** electricity, charge, Capacitance, Position and **Understand** various laws of physics like Coulomb's Law Gauss's law Ampere's Law, Biot-Savart law, Faraday's Law, Lenz' Law.
CLO2	**Apply** knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
CLO3	**Apply** the concepts of modern physics, Elementary quantum mechanics and nuclear physics to various fields of engineering.
CLO4	**Evaluate** typical simple and moderately complex problems of selected topics and of the linked topics of science/engineering courses.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Introduction to Electricity, Charge.	Lecture	Quiz	CLO1
02	Introduction to conductors and Insulators, Coulomb's Law	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Introduction to Gauss's law	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Potential and Field Strength, Potential due to a dipole.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Introduction to capacitance and dielectrics.	Lecture	Assignment/ Midterm Exam	CLO1
06	Energy stored in Electric Field. Poisson's Equation, Atomic view of Dielectric.	Lecture	Assignment / Midterm Exam	CLO2
07	Magnetic force on a current, Ampere's Law	Lecture	Assignment / Class Test /Midterm Exam	CLO2

08	Biot-Savart law. Hall effect	Lecture / Group Discussion	Class Test / Final Exam	CLO1
Midterm Examination				
09	Hall voltage, magnetic field in a current carrying coil	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO1
10	Faraday's Law, Lenz' Law, Maxwell's equation	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO1
11	Galilean relativity and Einstein' special theory of relativity	Lecture	Assignment / Final Exam	CLO3/ CLO4
12	Lorentz transformation equations.	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Length contraction, Time dilation	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Einstein law, related math, Photoelectric effect	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam	CLO3/ CLO4
15	Conception of Quantum physics and applications.	Lecture/ Group Discussion/ Video Tutorial	Assignment/ Mini Project/ Final Exam	CLO3
16	Characteristics of Quantum physics	Lecture/ Group Discussion	Assignment / Midterm Exam/ Final Exam	CLO3
17	De Broglie equation, Heisenberg Uncertainty Principle	Lecture/ Group Discussion	Assignment / Class Test Final Exam	CLO3
18	Schrodinger time independent equation, Probability for finding a particle along any axis	Lecture/ Group Discussion	Assignment / Class Test Final Exam	CLO3
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Arthur Beiser, *Concepts of modern Physics,* 6th edition, Tata McGraw Hill (2008), ISBN: 0-07-244848-2.

Supplementary Readings:

1. Halliday, Resnick and Walker, *Fundamentals of Physics,* 10th edition, Wiley, ISBN: 10 1118230728, 2013.
2. Dr. Giasuddin Ahmad, *Physics for Engineers (Part-1 & Part-2),* 4th edition, Hafiz Book Centre, 2000.
3. Resnick and Halliday, *Physics part-I & II,* (2nd edition), John Wiley & Sons, Inc . ISBN: 0 852263554, 1968.
4. Brijlal and N. Subrahmanyam, S. Chand, *A Text Book of Optics,* ISBN: 81-219-0467-6,2006.

Part A

Course No./Course Code :	PHY 121
Course Title :	Optics, Modern Physics, Wave and oscillation
Course Type	General Education Courses
Year /Level/Semester/Term :	Second Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	HSC Physics
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Studying physics strengthens quantitative reasoning and problem solving skills that are valuable in areas beyond physics. Students who study physics or engineering physics are prepared to work on forefront ideas in science and technology, in academia, the government, or the private sector.

Course Objective:

The course aims at making students to understand the basic concepts of Principles of Physics in a broader sense with a view to lay foundation for the various engineering courses. ϖ Students will be able to demonstrate competency and understanding of the concepts found in Mechanics, Harmonic Oscillations, Waves in one dimension, wave Optics, Lasers, Fiber Optics and a broad base of knowledge in physics. ϖ The main purpose of this course is to equip engineering undergraduates with an understanding of the scientific method, so that they may use the training beneficially in their higher pursuits. ϖ Today the need is to stress principles rather than specific procedures, to select areas of contemporary interest rather than of past interest, and to condition the student to the atmosphere of change he will encounter during his career.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Simple Harmonics Motion of the particles, concept of Two body oscillation, damped oscillations, resonances, , group and phase velocities.
CLO2	**Explain** different theories of light (Reflection, Refraction, Interference, Dispersion, Diffraction, Polarization).
CLO3	**Explain** Smith-Helmholtz Equation and Langrange Law, Defects of images, coma, distortion, curvature.
CLO4	**Explain** different Thermodynamics law and their applications, Maxwell's distribution of molecular speeds, Maxwell relations, Clausius and Clapeyron equation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture / Group Discussion	Assignment / Midterm Exam
CLO2	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Oscillations, SHM	Lecture / Group Discussion	Quiz	CLO1

02	Two body oscillation, reduced mass, damped oscillation, forced oscillation	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
03	Resonance, group and phase velocities	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Optics: Reflection and Refraction	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Smith-Helmholtz Equation and Langrange Law.	Lecture / Group Discussion	Assignment/ Midterm Exam	CLO1
06	Defects of images: spherical aberration, astigmatism	Lecture	Assignment / Midterm Exam	CLO2
07	Coma, distortion, curvature, chromatic aberration	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Interference: Fresnel bi-prism, interference in thin films,	Lecture / Group Discussion	Class Test / Final Exam	CLO1
Midterm Examination				
09	Newton's rings, interferometers, Diffraction	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO1
10	Diffraction from a circular aperture, resolving power of optical instruments	Lecture/ Group Discussion	Assignment/ Midterm Exam/ Final Exam	CLO1
11	Polarization: Brewster's law, Malus law	Lecture	Assignment / Final Exam	CLO3/ CLO4
12	polarization by double refraction	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Thermal Physics: Heat & Thermodynamics: Heat, Thermal expansion	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Heat and temperature, Absorption of heat by solids and liquids	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3/ CLO4
15	First Law of Thermodynamics and its applications	Lecture/ Group Discussion/ Video Tutorial	Assignment/ Final Exam	CLO3
16	Translational K.E, Distribution of molecular speeds, Molecular specific heats of an ideal gas	Lecture/ Group Discussion	Assignment / Midterm Exam/ Final Exam	CLO3
17	Degree of freedom, Maxwell's distribution of molecular speeds	Lecture/ Group Discussion	Assignment / Class Test Final Exam	CLO3

18	Second law Thermodynamics, Thermodynamic functions, Maxwell relations, clausius and clapeyron equation.	Lecture/ Group Discussion	Assignment / Class Test Final Exam	CLO3
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. D Halliday, R Resnick & J Walker, *Fundamentals of Physics* , 10th ed. NY,USA: McGraw-Hill Publications.

Supplementary Readings:

1. H. J. Pain**,** *The Physics of Vibrations and Waves*, 2nd ed. Upper Saddle River, NJ:Willey Online Books, 2005.
2**.** Subramaniam and Brijlal, *A Textbook of Optics*,2nd ed., India: S Chand & Company LTD, 2003.
3. Y A Cengel & M A Boles, *Thermodynamics* , 5th ed. NY,USA: McGraw-Hill Publications,2006.

Part A

Course No./Course Code :	PHY 122
Course Title :	Physics lab
Course Type	General Course
Year /Level/Semester/Term :	Second Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	N/A
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

The introductory physics laboratories have the following purposes and goals such as To provide an experimental foundation for the theoretical concepts introduced in the lectures, To familiarize students with experimental apparatus, the scientific method, and methods of data analysis so that they will have some idea of the inductive process by which the ideas were originated, To introduce the methods used for estimating and dealing with experimental uncertainties, including simple ideas in probability theory and the distinctions between random (statistical) and systematic "errors." The laboratory is not a contest whose object is to get the "right answer." The purpose is to learn how to gain knowledge by looking at reality, not an attempt to make reality conform to preconceptions.

Course Objective: By the end of this course, students should be able to:

1. CLOlect data and revise an experimental procedure iteratively and reflectively,
2. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
3. Extend the scope of an investigation whether or not results come out as expected,
4. Communicate the process and outcomes of an experiment,
5. Conduct an experiment CLOlaboratively and ethically.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Verify** the theoretical laws of physics and determination of several physical parameters using hardware tools.
CLO2	**Write** comprehensive reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1										√		
CLO2		√										

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weak	Experiment Name	*Hrs*	*CLOs*
1	Introduction of Physics Lab	2	CLO1,CLO2
2	Using Slide Caliper/ Vernier Calipers, measure the following: (a) Length of a metal sample in inch and centimeter and calculate the ratio between the CGS and FPS units (b) The volume of a Cylinder	2	CLO1,CLO2

3	Using Slide Caliper/ Vernier Calipers, measure the following: (c) Volume of a metallic round Bob (d) Volume of a Cubic metal (e) Ratio between two spheres	2	CLO1,CLO2
4	Using Screw Gauge, measure the following (a) Diameter, Radius and area of a metallic Wire (b) Diameter, Radius and area of a metallic Cylinder	2	CLO1,CLO2
5	Using a simple pendulum, measure the following (a) Graph of Length versus squire of time period (b) Value of g	2	CLO1,CLO2
6	Determine the spring constant of a spring	2	CLO1,CLO2
7	Using the Searle's Apparatus, Calculate the following (a) Young's Modulus (Y) of a solid metallic wire (b) Rigidity Modulus (n) of a solid metallic wire (c) Poisson's Ratio of a short wires	2	CLO1, CLO2
8	Using a Simple Balance, Measure the following: (a) Specific gravity of a sample heavier than water and insoluble in water (b) Specific gravity of a sample heavier than water and soluble in water	2	CLO1, CLO2
9	Using a Simple Balance, Measure the following: (c) Specific gravity of a sample lighter than water and insoluble in water (d) Specific gravity of a sample lighter than water and soluble in water	2	CLO1, CLO2
10	Using a Sono-meter, Measure the following: (a) Velocity of sound in a Laboratory in normal temperature using Tuning Fork and Vertical CLOumn (b) Velocity of sound in a Laboratory in different temperature using Tuning Fork and Vertical CLOumn	2	CLO1, CLO2
11	Using a Sono-meter, Measure the following: (c) Variation of Frequency of a Tuning Fork using Sono-meter and hence find the unknown frequency of a tuning fork. (d) Verify the laws of transverse variation of a stretched string	2	CLO1, CLO2
12	Using a Plane Mirror, Measure the following: (a) Verification of Snell's Laws of Reflection (b) Location of Image position of a sample by no-parallax tech	2	
13	**Mini Project**		
14	Verification of Ohm's Law using (a) Ammeter-Voltmeter (b) Tangent Galvanometer	2	CLO1, CLO2
15	Measurement of Unknown Resistance of a sample wire using (a) CLOor Code (b) Meter bridge (c) Digital meter	2	CLO1, CLO2

	(d) Analog meter Measurement of Resistively of a sample wire using Meter bridge		
16	Using a Spherical/Simple Glass Sample, Measure the following: (a) The relation between the focal length and radius of curvature using Spherical Mirrors (b) Verification of Total Internal Reflection using Plane Glass (c) Verification of Critical angle using Plane Glass Sample	2	CLO1, CLO2
17	**Project Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Dr Giasuddin Ahmed,Md Shahabuddin ***Practical Physics,*** *Hafiz Book Center; 4th edition .*

Supplementary Readings:

1. Jerry D. Wilson (Author), Cecilia A. Hernández-Hall**,** ***Physics Laboratory Experiments***, *D C Heath & Co; 5th edition (February 1, 1998)*
2. Francisco Glover, S.J.Engr. Reyman Zamora, E.C.E, ***Physics Laboratory Workbook*** *Ateneo de Davao University,Davao City; revised edition (2008).*

Part A

Course No./Course Code :	CHE215
Course Title :	Chemistry
Course Type:	General Course
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Chemistry is specifically designed for students who are not pursuing a program to learn more about the physical, inorganic and organic parts. We investigate these interrelationships by studying the underlying processes in terms of their industrial pollution and chemistry.

Course Objective:

Chemistry has a huge part in electrical writing. We rely heavily on computers now-a-days in order to help us with our work. Silicon lies at the heart of today's ubiquitous computing technologies, but that was not always so. Vacuum tubes were once the cutting edge of electronics, essential components in early radios, televisions and even computers. Scientists had been interested in the peculiar characteristics of silicon and other semiconductors since the late 19th century. These materials were neither highly conductive metals nor non-conducting insulators, but somewhere in between - hence the name. Unlike metals, their resistivity did not increase with temperature. However, they did respond to exposure to light, even producing a current. They also had the peculiar ability to restrict an electric current to passing in one direction, transforming (or rectifying) AC current into DC current.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Element, Atoms & Electrons, Bohr's Model of Atom, The Aufbau Method and Electron Structures
CLO2	**Analyze** Chemical Changes, molarity and normality, The Periodic Table and its Physical Properties, Groups of Periodic-table
CLO3	**Analyze** the covalent Bond and the Geometry of Molecules, Alkanes and Cycloalkanes, the Alkenes & Alkynes, Benzene, Atomicity

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam

Part B

Course plan specifying content, CLOs, co curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	**Element, Atoms & Electrons:** Dalton's atomic theory, Millikan's experiment, Energy levels, Energy changes.	Lecture	Quiz	CLO1
02	**Bohr's Model of Atom:** Energy levels, Orbits, Quantum numbers, Stationary states, Ground & Excited states.	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	**The Aufbau Method and Electron Structures:** Aufbau method, Orbital energy, Pauli Exclusion Principle, Hund's rule.e	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	**The Periodic Table:** Origin, modern concept, electronic structure and different groups of periodic table.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO2
05	**Periodicity of Physical Properties:** Periodicity of ionization energies, atomic volume, radius, valences, electro negativity, melting and boiling points**.**	Lecture	Assignment/ Midterm Exam	CLO2
06	**Groups of Periodictable:** Nature of the elements and reactions of the different groups of the periodic table	Lecture	Assignment / Midterm Exam	CLO2
07	**The Mole:** Mole, Moles of compounds, moles & equations, the Empirical formulae & molecular formulae of compound, percentage compositions.	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	**Chemical Changes:** Physical & Chemical changes, Equations for chemical reactions, different types of reaction.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Midterm Exam				
09	**Acids, Salts and Bases:** Acids, salts and bases, PH-scale, ionic nature, chemical reactions,	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2

	reaction characteristics of acid, salts and bases.			
10	**Chemistry of Gases:** Gay-Lussac's law, Avogardro's theory, Dalton's law & Graham's law of Diffusion.	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO2
11	**Kinetic Theory of Gases:** Kinetic theory, pressure of ideal gas, relation between energy and temperature.	Lecture	Assignment / Final Exam	CLO2
12	**Energy Changes:** Energy changes, energy diagrams, Exothermic & Endothermic reactions.	Lecture	Assignment / Class Test / Final Exam	CLO3
13	**The covalent Bond and the Geometry of Molecules:** Electronic structure of atoms, the Lewis model of covalent bond, atomic valences, extension of atomic orbital in space,	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Covalent bond by overlapping of atomic orbital, polarity of bond & molecules, Common organic functional groups, Isomerism and Resonance.	Lecture / Video Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO3
15	**Alkanes and Cycloalkanes:** Isomerism in alkanes, Nomenclature of organic compound, alkyl group, Cycloalkanes, Stereoisomerism in cycloalkanes,	Lecture/ Gro up Discussion	Assignment/ Mini Project/ Final Exam	CLO3
16	**Alkenes:** Structure, nomenclature, physical properties, preparations and different reactions of alkenes,	Lecture	Assignment / Midterm Exam/ Final Exam	CLO3
17	**Alkenes:** Structure, nomenclature, physical properties, preparations and different reactions of alkenes,	Lecture	Assignment / Class Test Final Exam	CLO3
18	**Benzene and the Concept of Aromacity:** Different structure, Resonance energy, Nomenclature & sources of Aromatic hydrocarbons,	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. D.D.Ebbing & S. D. *Gammon*, *General Chemistry*, *Houghton Mifflin Harcourt Publishing Company*, ISBN-10 : 0547213522, 9th Edition,, 2009.

Supplementary Readings:

1. Poulse and Tracy, *Introduction to Chemistry*. Copyrighy, CK-12 Foundation, 2010.
2. M. M. Huque, *Advanced Physical Chemistry For Under Graduate and Graduate Students (Part-1 &Part-2)*, Dhaka, Bangladesh.

Part A

Course No./Course Code :	CHE 216
Course Title :	Chemistry Lab
Course Type	General
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	N/A
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The purpose of the laboratory component of the course is several-fold. It reinforces the material that the students have learned in class and it gives you a chance to apply your knowledge. The students will learn some important experimental techniques that are necessary for you to become an effective chemist.

Course Objective:
The objective of this course is to reinforce the understanding of some common laboratory concepts and techniques while gaining knowledge in data treatment by reporting. In the first part, it will cover an extensive range of titration methods which is based on acids and bases.

And, in second part it will cover the determination of different elements from various compounds.

Course Content:

Experiment	***Topics***	***Hrs***	***CLOs***
01	Introduction to safety principle of chemistry lab	2	CLO1, CLO2
02	Basic Concepts of molarity, normality, titration and its application, titration	2	CLO1, CLO2
03	Standardization of Sodium Hydroxide (NaOH) solution with standard Oxalic Acid (HOOC-COOH.2H_2O) solution.	2	CLO1, CLO2
04	Standardization of Hydrochloric Acid (HCI) with standard Sodium Hydroxide (NaOH).	2	CLO1, CLO2
05	Standardization of Hydrochloric Acid (HCI) with standard Sodium Carbonate (Na_2CO_3) solution.	2	CLO1, CLO2
06	Standardization of Sodium Thiosulphate solution with a standard Potassium Dichromate solution	2	CLO1, CLO2
07	Estimation of Copper Contained in Supplied solution by Iodometric Method.	2	CLO1, CLO2
08	Determination of Ferrous Iron by a standard Potassium Dichromate solution	2	CLO1, CLO2
09	Mini Project		
10	Standardization of Potassium Permanganate ($KMnO_4$) solution with standard sodium Oxalate (NaOOC-COONa) solution.	2	CLO1, CLO2
11	Determination of Ferrous Ion in a solution by standard $KMno_4$ solution.	2	CLO1, CLO2
12	Determination of Na_2CO_3, content of washing Soda.	2	
13	Determination of Chromium in Chromium (III) Salt	2	CLO1, CLO2
14	Determination of Amonia in a Amonium Salt	2	CLO1, CLO2
15	Determination of Organic Nitrogen (the Kjeldahl Procedure)	2	CLO1, CLO2

	Determination of Silver in a Silver Alloy	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Demonstrate** experiments based on titration based on acid and base as well as Determination of Ferrous Iron, Ferric and Copper from different compounds

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1					√					√		
CLO2					√					√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Experiment	Report writing
CLO2	Experiment	Report writing / Final Exam

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. G. H. Jeffery , J. Bassett, J. Mendaam & R. C. Dennefy, *Vogel's Texbook of Quantitative Chemical Analysis*, 1989.

Supplementary Readings:

1. A. Jabbar and M. Haque, *Practical Chemistry*. Dhaka University Press, Dhaka, Bangladesh, 1983.

2. E. Prichard, *Quality in the Analytical Chemistry Laboratory* (Analytical Chemistry by Open Learning). ISBN-10: 0471954705, Wiley; 1st edition , 1995.

3. S. L. Kitaw, *Practical Analytical Chemistry*, Lab Manual, ISBN-13 : 978-3659290459, 2015.

General Education Courses (Group III: Mathematics)

Part A

Course No./Course Code :	MAT 115
Course Title :	Differential and Integral Calculus
Course Type	General Course
Year /Level/Semester/Term :	First Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
After completing this course, the Students will be able to know about differential and integral Calculus and be able to draw graphs of different curves. They will have the idea of differentiation and Integration. This will also lead the students to calculate area and volume of regular and irregular shape and enhance the student's ability to the entrance the deep course and knowledge of Mathematics. Mathematics is key to Engineering and Calculus is a key to Mathematics.

Course Objective:
Differentiation is an important concept in mathematics and, together with its inverse, Integration, is one of the two main operations in calculus. The principles of integration were formulated independently by Isaac Newton and Gottfried Leibniz in the late 17th century. Through the fundamental theorem of calculus, which they independently developed, integration is connected with differentiation. Integrals and derivatives became the basic tools of calculus, with numerous applications in science and engineering. This course contains what is integral and integration, different types of integration and their application in science & Technology. This course also describe about various coordinate system. Basically it will help us to know some related topics which is closely related to engineering science.

Course Content:
Function, Limit and Continuity: Functions, domain, range, odd, even, absolute value function, Limits, continuity. **Differentiability**: Successive differentiation of various types of functions, evaluation of indeterminate forms of L' Hospital's rule, Leibnitz's theorem, Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders. Cauchy's form of remainders, **Partial Differentiation**: Expansion of functions, Partial differentiation, Euler's theorem. **Coordinates**: Tangent and normal, Subtangent and subnormal in cartesian and polar co-ordinates. **Application of derivatives**: Determination of maximum and minimum values of functions. Curvature, Asymptotes, Curve tracing. **Inegration as anti-derivative**: Integration by the method of substitution, Standard integrals, Integration by successive reduction. **Definite integrals:** properties and use in summing series. Walli's formulae, Improper integrals, **Beta function and Gamma function**. **Application of integration**: Area under a plane curve and area of a region enclosed by two curves in cartesian and polar co-ordinates, Volumes and surface areas of solids of revolution.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** Function, basic rules of differentiation and integration, Beta Function and Gamma Function.
CLO2	**Apply** Derivatives applied in rate of change, geometrically and physically application field of derivatives.
CLO3	**Apply** Determination of area, volume of regular and irregular shape and of solid geometry.
CLO4	**Evaluate** Rolle's theorem, Mean value theorem, Leibnitz thorem, Taylor and Maclaurin's series and their real life application.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√	√						√	√		
CLO4		√	√						√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Mid/Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Functions, domain, range, odd, even, absolute value function, Limits, continuity	Lecture	Quiz	CLO1
02	Successive differentiation of various types of functions	Lecture	Assignment / Class Test /Midterm Exam	CLO1

03	evaluation of indeterminate forms of L' Hospital's rule	Lecture	Assignment / Presentation/ Midterm Exam	CLO1
04	Beta function and Gamma function	Lecture	Mini Project/ Presentation/ Class Test / Final Exam	CLO1
05	Expansion of functions, Partial differentiation, Euler's theorem	Lecture	Assignment / Class Test /Midterm Exam	CLO2
06	Tangent and normal, Subtangent and subnormal in cartesian and polar co-ordinates	Lecture	Assignment / Class Test /Midterm Exam	CLO2
07	Determination of maximum and minimum values of functions	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Curvature. Asymptotes, Curve tracing	Lecture	Assignment / Class Test /Midterm Exam	CLO2
Midterm Exam				
09	Integration by the method of substitution, Standard integrals, Integration by successive reduction	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
10	Definite integrals and its properties	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
11	Walli's formulae. Improper integrals	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
12	Taylor's and Maclaurin's theorems in finite and infinite forms, Lagrange's form of remainders. Cauchy's form of remainders	Lecture	Presentation/ Class Test / Mid/Final Exam	CLO4
13	Area under a plane curve and area of a region enclosed by two curves in cartesian co-ordinates	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
14	Area under a plane curve and area of a region enclosed by two curves in polar co-ordinates	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
15	Surface areas of solids of revolution.	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3

16	Volumes of solids of revolution	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam	CLO3
17	Leibnitz's theorem and application	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam	CLO4
18	Rolle's theorem, Mean value theorem	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Anton, Howard, Bivens, Irl & Davis, Stephen (2013), *Calculus*, 10th ed. John Wiley & Sons, Singapore Pte. Ltd. Indian Reprint (2016) by Wiley India Pvt. Ltd. Delhi.

Supplementary Readings:

2. Strauss, Monty J., Bradlley, Gerald L., & Smith, Karl J. (2007). *Calculus*, 3rd ed. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi. India Reprint 2011
3. Prasad, Gorakh (2016). *Differential Calculus*, 19th ed. Pothishala Pvt. Ltd. Alahabad.
4. Thomas, Jr. George B., Weir, Maurice D., & Has, Joel (2014).*Thomas' Calculus*, 13 ed. Pearson Education, Delhi, Indian Reprint 2017.

Part A

Course No./Course Code :	MAT 125
Course Title :	Linear Algebra and Complex Variables
Course Type	General Course
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Linear algebra is fundamental in modern presentations of geometry, including for defining basic objects. It is used in engineering, physics, mathematics, astrophysics, and many other fields. It provides powerful tools for doing mathematical analysis, and often yields pleasing and unanticipated answers.

Course Objective:
This course equip the students with methods of solving a general system of linear equations and familiarize them with the concept of Eigen values and diagonalization of a matrix which have many applications in Engineering. This helps to understand the basic theory of functions of a complex variable and conformal Transformations and determine harmonic conjugates, check for analyticity by Cauchy-Riemann equations. It also expands analytic functions in Taylor and Laurent series, Cauchy's Theorem and the Cauchy Integral Formulas to evaluate complex integrals.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** basis, dimensions, image, kernel, nullity, rank of matrix, linear transformations, singularities, analytic function, harmonic function, conformal mapping, zeros, poles, essential singularity etc. Understand system of linear equations, how to diagonalize a matrix, represent linear transformations by matrices and vice- versa.
CLO2	**Apply** Cauchy's Theorem and the Cauchy Integral Formulas to evaluate complex integrals.
CLO3	**Apply** characteristic polynomials to compute eigenvalues and eigenvectors.
CLO4	**Evaluate** real definite Integrals as application of Residue Theorem.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√				√							
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

01	Linear equations, System of linear equations (homogeneous and non-homogeneous) and their solutions.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
02	System of linear equations (homogeneous and non-homogeneous) and their solutions.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
03	Introduction to matrices	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
04	Application of Matrices and determinants for solving system of linear equations.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
05	Notions of groups and fields, Abstract vector space	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
06	Subspace, Sum and direct sum of sub spaces	Lecture / Group Discussion	Assignment / Class Test /Midterm	CLO1
07	Linear dependence, independence and combination of vectors.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
08	Basis and Dimension of vector spaces. Row and CLOumn space of a matrix; rank of matrices.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
Midterm Exam				
09	Linear transformations. Kernel and image of a linear transformation and their properties.	Lecture / Group Discussion	Class Test / Final Exam	CLO1
10	Rank and Nullity of a linear transformation.	Lecture/ Group Discussion	Assignment / Class Test /Final Exam	CLO1
11	Matrix representation of linear transformations.	Lecture / Group Discussion		CLO1
12	Eigen values and eigenvectors.	Lecture / Group Discussion	Assignment / Final Exam	CLO3
13	Diagonalization.	Lecture / Group Discussion	Assignment / Class Test / Final Exam	CLO3

14	Limit continuity and differentiability of functions of complex variables.	Lecture / Group Discussion	Assignment / Class Test /Final Exam	CLO2
15	Analytic functions and their properties, harmonic functions.	Lecture / Group Discussion	Assignment / Class Test /Final Exam	CLO2
16	Line integral over rectifiable curves, Cauchy's theorem for simple contours, Cauchy's integral formula.	Lecture / Group Discussion	Assignment / Class Test /Final Exam	CLO3
17	Zeros, singularities, poles, and residues. Taylor's and Laurent's series, expansion of functions. Cauchy's residue theorem.	Lecture/ Group Discussion	Assignment / Class Test /Final Exam	CLO4
18	Theorems of Liouville and Morera, fundamental theorem of algebra.	Lecture / Group Discussion	Assignment / Class Test /Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. **Dewan Abdul Quddus**, *Linear algebra,* 3rd edition, Barnali offset printers, June 1998.

Supplementary Readings:

1. **Professor Amulya Chandra Mandal et al.**, *linear Algebra,* 4th edition, Composed by Nadi Publications, august 2017.

Part A

Course No./Course Code :	MAT213
Course Title :	Statistics and Probability
Course Type	General Course

Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
This course is designed to provide fundamental concepts of statistics and basic concepts of probability, probability distribution. Also this course describes the sampling technique, Index number, Survey Methodology and statistical hypothesis testing to test the validity of data.

Course Objectives:
This course provided some elementary ideas about the basic concepts in statistical theory and probability theory with their applications. In part 1 of this course, the basics of the statistical data, data description, statistical measures and measures of dispersion can be understood. In Part 2, we will use this framework to understand the Measures of Dispersion, Linear Regression & Correlation, Sampling and Test of Significance. In Part 3, we will learn the fundamental probability concepts, theory of distribution of random variables, the concept of Bayes' theorem, Probability distribution and Survey Methodology**.** In Part 4, we will discussed include displaying and describing statistical inference, confidence intervals and hypothesis tests with applications in the real world, Forecasting and Time series Analysis, Index Numbers. The objective of this course is to provide an understanding for the undergraduate science and engineering students. After taking this course, students will be able to use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, to perform simple and sophisticated analyses for large samples.

Course Learning Outcomes: At the end of the Course, the Student will be able to:

CLO1	**Define** primary and secondary data, Frequency distribution, mean, median and mode, probability, discrete and continuous random variables, Conditional and joint probability distribution and Understand various Figure of statistical data, basic statistical concepts and measures, the basic knowledge on fundamental probability concepts, including random variable, probability of an event, additive rules and conditional probability and perform hypotheses testing.
CLO2	**Apply** the concepts of mean, median and mode, quartile deviation, mean deviation, Standard deviation, Box plot, Karl Pearson's and Bowley's coefficient of Skewness.
CLO3	**Apply** the concepts of probability independents and depends events, Bayes' Theorem, Binomial, Poisson and normal distribution, Moment generating function, some sampling Distributions, Test of Significance such as Hypothesis testing, Coefficient of rank correlation, Forecasting Methods, Components of Time Series, trend equation, Types of Index Numbers such as Unweighted, weighted, Laspeyre's, Fisher's, etc.
CLO4	**Evaluate** typical simple and moderately complex problems of selected topics and of the linked topics of all science and engineering courses.

Mapping of Course Learning Outcomes to Program Learning Outcomes-

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture/ Group Discussion	Class Test /Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Assignment/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Introduction and source of data, methods of data CLOlection.	Lecture	Class Test	CLO1
02	Constructing a Frequency distribution table and related others distributions.	Lecture/ Group Discussion	Assignment / Class Test /Midterm Exam	CLO1
03	Graphical presentation in different statistical data.	Lecture	Assignment / Presentation/ Midterm Exam	CLO1
04	Introduction, arithmetic mean, the Geometric mean and Harmonic mean for group and ungrouped data.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Introduction, the sample mean, weight mean, median, mode of a grouped data, Missing frequency.	Lecture	Assignment/ Midterm Exam	CLO2
06	Introduction, measure of dispersion, range, mean deviation, variance and standard deviation.	Lecture	Assignment / Midterm Exam	CLO2

07	Introduction, coefficient of correlation**,** the measures of correlation and significance of correlation coefficient.	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Regression Analysis, least Square principles drawing the regression line, the standard error of estimate.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Midterm Exam				
09	Definition of probability and related concepts, Discrete and random variables, Mathematical expectations.	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
10	Conditional probability, Joint probability, Function and probability density function, Marginal density function.	Lecture	Assignment	CLO3
11	Probability distribution and discontinuous probability distribution, e.g. Binomial, Position and Continuous probability distributions.	Lecture	Assignment / Final Exam	CLO3
12	Normal and exponential, Stochastic processes, Discrete time, Markov chain and continuous time Markov Chain.	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Purposive, simple random and stratified random sampling, Introduction to systematic.	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Two stage cluster and double sampling, Ratio and regression methods of estimation. Forms and schedules of statistical inquiry.	Lecture	Presentation/ Class Test / Final Exam	CLO2/ CLO3
15	Birth and death rates, Growth rates, Components of population growth rates, Migration population projection, Life table, Construction of life table.	Lecture/ Group Discussion	Assignment/ Final Exam	CLO4
16	Introduction, components of time series, Time series analysis, Trend projection methods.	Lecture	Assignment / Midterm Exam/ Final Exam	CLO4

17	Time series analysis, Trend projection methods.	Lecture/ Group Discussion	Assignment / Class Test Final Exam	CLO4
18	Introduction, Types of index number, Weighted and Un-weighted indices, chain index, CPI, TRT, FRT.	Lecture	Presentation/ Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. R E Walpole and R H Myers, S L Myers and K. Ye., *Probability Statistics for Scientist and Engineers*, 9th Editions, Pearson, New York.

Supplementary Readings:

1. Professor M. Nurul Islam, *An Introduction to Statistics and Probability*, 4th Editions, 2015, Mullick & Brothers, 160-161, Dhaka Newmarket, Dhaka-1205.

Part A

Course No./Course Code :	MAT 217
Course Title :	Ordinary and Partial Differential Equations
Course Type	Non Major Course
Year /Level/Semester/Term :	Second Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Ordinary and partial differential equations is a branch of applied mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Along with fields like engineering physics and engineering geology, both of which may belong in the wider category engineering science, engineering mathematics is an interdisciplinary subject motivated by engineers' needs both for practical, theoretical and other considerations out with their specialization and to deal with constraints to be effective in their work. Historically, this course consisted mostly of applied analysis, most notably: differential equations; ordinary differential equation, and partial differential equations.

Course Objective:
The subject Ordinary and Partial Differential Equations Students should learn a particular set of mathematical facts and how to apply them; more importantly, such a course should teach students how to think logically and mathematically. To achieve these goals, this text stresses mathematical reasoning and the different ways problems are solved. Students will be able to apply the concepts and methods described in the syllabus. They will be able to solve problems using the differential equation. They will know a number of applications. The text and class discussion will introduce the concepts, methods, applications, and logical arguments. Students will practice them and solve problems on daily assignments, and they will be tested on quizzes, midterms, and the final.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** Differential equation, Ordinary differential equation, Partial differential equation, Formation of differential equation, Formation of partial differential equation.
CLO2	**Apply** Separation of Variables, Homogenous equation, Equation reducible to homogenous, Exact equation, Linear Equation, Reducible to Linear Equation, Linear Differential Equations with Constant Coefficients, Linear Differential Equation with right-hand side non zero, Variation of parameter, Method of Successive approximation to solve ordinary differential equation**.**
CLO3	**Apply** Linear and Non-Linear first-order equation, Standard forms, Linear Equation of higher order, Partial Differential Equations with Constant Coefficients, Equation of second order with variable coefficients, Particular solution with boundary and initial conditions to solve partial differential equations.
CLO4	**Evaluate** mathematical models of physical systems, CR circuit, Wave equations, Boundary value problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Define Differential equation, Ordinary differential equation, Partial differential equation	Lecture	Quiz	CLO1
02	Formation of differential equation, Formation of partial differential equation	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Apply Separation of Variables, Homogenous equation, Equation reducible to homogenous	Lecture	Assignment / Midterm Exam	CLO2
04	Exact differential equation, Integrating Factor	Lecture	Assignment / Class Test /Midterm Exam	CLO2
05	Linear Equation, Reducible to Linear Equation	Lecture	Assignment / Class Test /Midterm Exam	CLO2
06	Linear Differential Equations with Constant Coefficients	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
07	Linear Differential Equation with right-hand side non zero	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
08	Variation of parameter	Lecture	Assignment / Class Test /Midterm Exam	CLO2
09	Method of Successive approximation to solve ordinary differential equation	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Midterm Exam				
10	Apply Linear and Non-Linear first-order equation, Standard forms	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
11	Linear Equation of higher order	Lecture	Assignment / Class Test / Final Exam	CLO3

12	Partial Differential Equations with Constant Coefficients	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO3
13	Equation of second order with variable coefficients	Lecture	Assignment / Final Exam	CLO3
14	Particular solution with boundary conditions to solve partial differential equations	Lecture	Assignment / Class Test / Final Exam	CLO3
15	Particular solution with initial conditions to solve partial differential equations	Lecture	Assignment / Class Test / Final Exam	CLO3
16	Evaluate mathematical models of physical systems	Lecture / Group Discussion	Presentation/ Final Exam	CLO4
17	CR circuit	Lecture / Video Tutorial	Mini Project/ Final Exam	CLO4
18	Wave equations, Boundary value problems.	Lecture/ Group Discussion	Assignment/Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, 19th ed., India: S.Chand & Company LTD.

Supplementary Readings:

1. S. L. Ross and S.L. Ross II, *Introductory Ordinary Differential Equations*, 3rd ed., NY,USA: John Wiley & Sons.
2. Denis J Zill and Michael R. Cullen, *Differential Equation*, 7th ed., BM,USA: Brooks/Cole.
3. Martin Braun, *An Introduction to Differential Equation and Applications*, 4th ed., NY,USA: Springer.
4. Dr. B. D. Sharma, *Differential Equations*, 3rd ed., India: Kedar Nath Ram Nath.

Part A

Course No./Course Code :	MAT 219
Course Title :	Coordinate Geometry and Vector Analysis
Course Type	General Course
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	Differential and Integral Calculus
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Coordinate Geometry and vector analysis combines the number and shape. In algebra we have 1st, 2nd and higher order equations which have geometrical shape. Geometrical problem can be solved by algebra and algebraic problem can be solved by geometry. So geometrical conception is essential for engineering students. Also the purpose of the course is to provide an understanding of the basic relations of vector analysis, to demonstrate practical applications of vector analysis and to train the engineering student in problem formalization and in methods of solution.

Course Objectives:

Geometry etymologically means measurement of earth thanks to the Greeks. It is a branch of mathematics concerned with questions of shape, size, relative position of figures, and the properties of space. Geometry arose independently in a number of early cultures as a practical way for dealing with lengths, areas, and volumes. This course will cover the study of plane Euclidean and coordinate geometry. We will start with a discussion of the fundamental concepts of geometry, which include the properties of points, lines, planes, and angles. Then we will cover inductive and deductive reasoning and how theorems are proved and emphasis will be placed on developing critical thinking skills as they relate to logical reasoning and argument. We will start with a discussion of the fundamental concepts of geometry, which include the properties of three-dimensional Cartesian coordinates, Rectangular, Cylindrical and Spherical coordinates, plane, straight line, sphere, cylinder and cone, coincide. Topics to be covered in this course include, basic vector, coordinate bases, gradient, divergence, and curl, Green's, Gauss' and Stokes' theorems.

Course Learning Outcomes: At the end of the Course, the Student will be able to:

CLO1	**Define** Cartesian and polar co-ordinates, System of circles, Direction cosines and direction ratios, Dot and cross product of vectors, Gradient, divergence and curl, Line, Surface and Volume Integrals.
CLO2	**Understand** the translation and rotation of axes, General equation of second degree and reduction to standard forms, relationship between planes and lines, Vector applications to geometry and mechanics. Differentiation of vectors with application.

CLO3	**Apply** the concepts of translation and rotation of axes, reduction to standard forms, Properties of pair of straight lines, General properties, orthogonally of two circles, Parabola, Ellipse and hyperbola.
CLO4	**Apply** the Projection, Angles between two lines, Angle between two planes and distance of a point form a plane. Equation of sphere, shortest distance between two straight lines, Integral forms of Gradient, Divergence and Curl, Vector integration, Independent of path
CLO5	**Evaluate** Physical signification problem of gradient, divergence and curl and moderately complex problems of selected topics and of the linked topics of all science and engineering courses.

Mapping of Course Learning Outcomes to Program Learning Outcomes:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√				√							
CLO3	√				√							
CLO4	√				√							
CLO5	√				√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture/ Group Discussion	Class Test /Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Final Exam
CLO4	Lecture / Group Discussion	Assignment/ Class Test / Final Exam
CLO5	Lecture	Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Cartesian and polar co-ordinates, transformation of co-ordinates	Lecture	Class Test/ Midterm Exam	CLO1
02	Translation and rotation of axes, in variants	Lecture/ Group Discussion	Assignment / Midterm Exam	CLO1
03	Pair of straight lines	Lecture	Assignment / Presentation/ Midterm Exam	CLO2
04	General equations of second degree, Conic sections	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO2
05	Circles and system of circles	Lecture	Assignment/	CLO2

			Midterm Exam	
06	Parabola, Ellipse, Hyperbola	Lecture	Assignment / Midterm Exam	CLO3/ CLO5
07	Equations of conics in polar and parametric forms	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Three dimensional coordinates, Distance between two points, directions cosines and directions ratios.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO1
09	Plane	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
Midterm Exam				
10	Straight line and relationship between planes and lines.	Lecture	Assignment	CLO3
11	Shortest between two straight lines,	Lecture	Assignment / Final Exam	CLO3/ CLO5
12	Sphere	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Definition of vector, Addition and subtraction of vectors, Dot and cross product of vectors.	Lecture / Group Discussion	Presentation/ Final Exam	CLO1
14	Vector applications to geometry and mechanics, Vector triple and multiple products.	Lecture	Presentation/ Class Test / Final Exam	CLO2/ CLO3
15	Differentiation of vector fields, Gradient, divergence and curl.	Lecture/ Group Discussion	Class Test/ Final Exam	CLO4/ CLO5
16	Line, Surface and volume integrals over vector fields.	Lecture	Assignment / Final Exam	CLO1
17	Greens theorem and Gauss's theorem and their applications.	Lecture/ Group Discussion	Assignment / Final Exam	CLO5
18	Stoke's theorem and their applications.	Lecture	Final Exam	CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70

Make-up Procedures	As per university rules

Part D

Learning Materials

Recommended Readings:

1. S. L. Loney, *Co-ordinate Geometry*, 5^{th} Edition, 2013, Pragati Prakashan, Meerut City, India.
2. M. L. Khanna, *Solid Geometry*, 19^{th} Edition, 2003, Jai Prakash Nath & Co., Educational Publications, Meerut City, India.

Supplementary Readings:

1. Rahman & Bhattacharjee, *Co-ordinate Geometry with Vector Analysis*, 10^{th} Flat Edition, 2020, New Book Place, 68-69 Pyaridash Road, Bangla Bazar, Dhaka- 1100.

Part A

Course No./Course Code :	MAT 323
Course Title :	Numerical Analysis
Course Type	General Course
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	MAT 112
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Numerical analysis is a technique by which the mathematical problems are formulated, so that can be solved with arithmetic. Numerical analysis is the branch of mathematics that is used to find approximations to difficult problems such as finding the roots of non-linear equations, interpolation, numerical differentiation and integration and numerical solutions of the differential equations. Most of the Mathematical problems that arise in science and engineering are very hard and sometime impossible to solve exactly. Thus, an approximation to a difficult Mathematical problem is very important to make it easier to solve. This course is studying the use of Numerical Analysis in modelling and simulation of engineering process.

Course Objective:

The course Numerical Analysis is a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. In part 1 of this course, the basics of the functions, operators, non-linear equations, system of linear equations, differential equations, and integration can be understood. In Part 2, we will use this concept to understand the numerical techniques. In Part 3, student will learn these numerical methods to find the roots of non-linear equations, numerical solutions of ordinary and partial differential equations and solution of system of linear equations, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods. In Part 4, we will focus our study to apply the appropriate numerical techniques for real life problem, interpret the results, and assess accuracy.

To enhance the problem solving skills of engineering students using an extremely powerful problem solving tool namely numerical methods. The tool is capable of handling large system of equations, non-linarites and complicated geometries that are not uncommon in engineering practice and that are often impossible to solve analytically.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** Difference operator, Algebraic and transcendental equations, Interpolation, Extrapolation, Differential Equations, Fundamental theorem of definite integral, Spline, Error analysis.
CLO2	**Apply** the concepts of numerical methods to solve Algebraic and Transcendental equations, Differential Equations in various fields of Science and Engineering.
CLO3	**Apply** mathematical technique to solve interpolation and extrapolation from a data set, linear systems by direct method and iterative techniques, and Non-linear system
CLO4	**Work out** numerical differentiation and integration whenever and wherever routine methods are not applicable.
CLO5	**Evaluate** typical physical problems of science/engineering courses by analyzing them properly.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2		√										
CLO3	√				√							
CLO4		√			√							
CLO5		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lecture	Class Test / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Assignment / Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/Mini Project/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Basic concept of operators, Algebraic and transcendental equations	Lecture	Quiz	CLO1
02	**Solution of Equation in one variable:** Bisection algorithm, Method of false position.	Lecture	Assignment / Class Test /Midterm Exam	CLO2
03	**Solution of Equation in one variable:** Fixed point iteration, Newton-Raphson Method.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO2
04	**Solution of Equation in one variable:** Error Analysis for iterative method, Accelerating limit of convergence.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1/CLO2
05	**Interpolation and polynomial approximation:** Taylor Polynomials, Interpolation and Lagrange polynomial.	Lecture	Assignment/ Midterm Exam	CLO2
06	**Interpolation and polynomial approximation:** Iterated interpolation, Extrapolation.	Lecture	Assignment / Midterm Exam	CLO2
07	**Differentiation and Integration:** Numerical differentiation (Three points-Five points formula for finding derivatives), Richardson's extrapolation	Lecture	Assignment / Class Test /Midterm Exam	CLO4
08	**Differentiation and Integration:** Elements of Numerical Integration, Trapezoidal rule, Simpson’s rule, Composite Numerical Integration, Adaptive Quadrature method, Romberg's integration, Gaussian quadrature.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO4
Midterm Exam				

09	**Solutions of linear systems:** Cramer's rule, Gaussion elimination and backward substitution, Gauss-Seidal method.	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
10	**Solutions of linear systems:** Linear algebra and Matrix inversion, Determinant of a matrix, Pivoting strategies, Direct factorization of matrices.	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO3
11	**Iterative technique of Matrix algebra**: Iterative techniques for solving linear systems.	Lecture	Assignment / Final Exam	CLO3
12	**Iterative technique of Matrix algebra**: LU-Decomposition, Error estimates and Eigenvectors.	Lecture	Assignment / Class Test / Final Exam	CLO3
13	**Numerical solution of Non-linear system:** Fixed point for functions of several variables, Newton's method, Quasi-Newton's method.	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	**Initial value problem for O.D.E:** Euler's method, Higher order Taylor's methods.	Lecture / Video Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO4/ CLO5
15	**Initial value problem for O.D.E:** Runge-Kutta methods, Multi-step methods.	Lecture/ Group Discussion	Assignment/ Mini Project/Final Exam	CLO4
16	**Initial value problem for O.D.E:** Variable step size multistep methods, Extrapolation method.	Lecture	Assignment / Midterm Exam/ Final Exam	CLO4
17	**Boundary value problem:** Linear shooting method, shorting method for nonlinear BVP.	Lecture	Assignment / Class Test Final Exam	CLO4/ CLO5

18	**Boundary value problem:** Linear shooting method, shorting method for nonlinear BVP.	Lecture / Group Discussion	Presentation/ Final Exam	CLO4/ CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Recommended Readings:

1. Richard L. Burden and J. Douglas Faires, *Numerical Analysis*, Ninth edition, ISBN-10: 0-538-73351-9, 2013.

Supplementary Readings:

1. S. S. Sastry, *Introductory Methods of Numerical Analysis*, 4th edition, Vikram Sarabhai Space Centre, ISBN: 81-203-2761-6, 2006.
2. James B. Scarborough, *Numerical Mathematical Analysis*, George Banta Publishing Company, 1930.
3. Steven Chapra and Raymond Canale, *Numerical Methods for Engineers*, 7th edition, ISBN-13: 978-0073397924, 2020.

General Education Courses (Group IV: Interdisciplinary Courses)

Part A

Course No./Course Code :	MEC 112
Course Title :	Engineering Drawing
Course Type	Electrical
Year /Level/Semester/Term :	First semester
Fall 2021	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	None
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
An engineering drawing is a type of technical drawing used to define the requirements for engineering products or components. Typically, the purpose of an engineering drawing is to clearly and accurately capture all geometric features of a product or component so that a manufacturer or engineer can produce the required item. It may also describe the process of making the item, may be used to convey engineering ideas during the design process, or may provide a record of an existing item.

Course Objective:
This course is designed to provide Electrical engineering undergraduates with basic understanding of the theory and practice of engineering drawings in hand and software. Students will learn to read and construct all architectural, structural and other drawings by means of discussions and drawing examples related to existing buildings or projects. It includes lettering, plane geometry, different geometric constructions, types of lines, perspective projections, orthographic projections, structural floor plan of a building.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Drawing** on the concept taught in the **laboratory and demonstrating** the ability to work as an individual and within a team.
CLO2	**Design** a floor with specific instructions using AutoCAD Software.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to the Engineering Drawing	2	CLO1, CLO2
02	Introduction to traditional drawing tools, instruments and their use.	2	CLO1, CLO2
03	Standard engineering lettering and numbering.	2	CLO1, CLO2
04	Different Geometric Constructions and type of lines.	2	CLO1, CLO2
05	Concept of Dimensioning and sectioning.	2	CLO1, CLO2
06	Orthographic projections and isometric drawing of solid geometric figures (horizontal)	2	CLO1, CLO2
07	Orthographic projections and isometric drawing of solid geometric figures (vertical)	2	CLO1, CLO2
08	Structural drawing – Plan view, Elevation view and Cross sectional view.	2	CLO1, CLO2
09	Detail floor Plan for residential, Commercial building.	2	CLO1, CLO2
10	Detail floor Plan for Commercial building.	2	CLO1, CLO2
11	**Mini Project**		
12	Introduction & basic instruction for drawing in AutoCAD software.	2	CLO1, CLO2
13	Different Geometric Constructions and type of lines in AutoCAD software.	2	CLO1, CLO2
14	Drawing of a detailed floor for residential building in the AutoCAD software.	2	CLO1, CLO2
15	Drawing of a detailed floor for Commercial building in the AutoCAD software.	2	CLO1, CLO2
16	Assignment on design of a floor with specific requirements in A4 paper and implement with the AutoCAD software.	2	CLO1, CLO2
17	Project: Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial

Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Paul F. Richard,***Introduction to AutoCAD 2020: A modern Perspective,***Macromedia Press; 1st edition (July 29, 2019).

Supplementary Readings:

1. David A. Madsen, David P. Madsen **Engineering Drawing and Design (Drafting Series),** Cengage Learning; 5th edition (June 8, 2011)
2. William H. Clark**, *Electrical Design Guide for Commercial Buildings***,McGraw-Hill Education TAB; 1st edition (July 22, 1998)

Part A

Course Code:	CSE 121
Course Title:	Structured Programming Language
Course Type:	Inter Disciplinary Course
Year/ Level/ Semester/ Term:	Second Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	CSE 111 Computer Fundamentals
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
The C programming language is one of the most popular and widely used programming languages and is commonly used to program operating systems such as UNIX. It is a general-purpose programming language and one of the main advantages of programming in C is that it allows the programmer to write directly to memory. After completing this course student will have fundamental knowledge and skill in computer programming using C language. After completing this course successfully, students will be able to write simple programs in C and also be able to develop small projects.

Course Objective: The objective of this course is:

- Introduce students with the computer programming language.
- Teach the students the syntax of C programming
- Teach array and structure data types.

- Teach pointer variables, functions and file processing in C.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the basic structure of C programming, declaration and usage of variables.
CLO2	**Understand** the appropriate decision making and looping statements while writing programs in C.
CLO3	**Apply** arrays and functions to solve computational problems.
CLO4	**Apply** appropriate data structures like pointers, structures and user defined functions to solve computational real-life problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3		√										
CLO4		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Getting started, Introduction to C: Data types	Lecture	Mid-term, Class Test, Assignment	CLO1
02	Keywords, Variables	Lecture	Mid-term, Class Test, Assignment	CLO1

03	Operators and Expressions	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1
04	Decision Making and Control flow: If, else if, switch statements	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2
05	Loops: For loop, Nesting of for loop	Lecture	Mid-term, Class Test, Assignment	CLO2, CLO4
06	While loop, Do-while loop	Lecture	Mid-term, Class Test, Assignment	CLO1, CLO3
07	Array: One dimensional, Two-dimensional array	Lecture	Mid-term, Class Test, Assignment	CLO3, CLO4
08	String operation: String variables, String I/O operations	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO3, CLO4
Midterm Exam				
09	Standard library string functions, Array of pointers to string	Lecture	Final Exam, Class Test, Assignment	CLO1, CLO3
10	Functions: Scope rules of function	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
11	Nesting and recursion of function	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3
12	Call by value and call by reference	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4
13	Passing array elements to a function	Lecture	Final Exam, Class Test, Assignment	CLO3
14	Structure: Structure elements	Lecture	Final Exam, Class Test, Assignment	CLO3
15	Array structures	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
16	Structure I/O in C	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
17	File Management in C	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO1, CLO3
18	Introduction to python	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO1, CLO3

Final Exam

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Brian W. Kernighan, *C Programming Language,* Pearson; 2nd edition (March 22, 1988)

Supplementary Readings:

1. Byron S. S. Gottfried, *Schaums' Outline of Programming with C,* McGraw-Hill Education; 2nd edition (June 22, 1996)
2. Peter J. Schwaller*, Cpi-C Programming in C: An Application Developer's Guide to Appc/Book,* Computing McGraw-Hill; Pap/Dis edition (September 1, 1994)

Part A

Course Code:	CSE 122
Course Title:	Structured Programming Language Lab
Course Type:	Inter Disciplinary Course
Year/ Level/ Semester/ Term:	Second Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	CSE 121
Credit Value:	1.5
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Structured Programming Language Lab will substantialize the notions related to the basic programming into practice. Thus, the students will be able to understand the insights of programming adroitly based on what they learned in the related theory course.

Course Objective:
The objective of this course is to verify the theories and concepts taught in CSE 121. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to write different programs and run them in the compiler as well as apply appropriate modern technologies to an assigned task.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Presentation/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to the Electronic Circuits Lab	2	N/A
02	Practice of writing different simple program like area of a circle, temperature conversion etc.	2	CLO1, CLO2
03	Implement Branching: The IF statement (break and continue statement), Branching: SWITCH statement, GOTO statement	2	CLO1, CLO2
04	Implementation of Looping: FOR statement (break and continue)	2	CLO1, CLO2
05	Implementation of Looping: WHILE and DO WHILE statement	2	CLO1, CLO2
06	Implementation of Library Functions	2	CLO1, CLO2
07	Implement Argument Passing and Value Receiving, Functions: Pass-by-value, Pass-by-reference	2	CLO1, CLO2
08	Value Receiving Functions: Command Line Parameter and, Arrays: Initialization, Access, Passing and Receiving	2	CLO1, CLO2
09	Arrays: 2D handling, Arrays: String Handling, Structure: Initialization, Access, Passing and Receiving, Structure: Union and Bit-fields	2	CLO1, CLO2
10	Implementation of Structures and Sorting and Searching program	2	CLO1, CLO2

11	Write program to handle Pointers	2	CLO1, CLO2
12	Compiler and Linker, Segment and Memory Model, Video Adapter, Modes, Graphics Initialization, Graphics Functions	2	CLO1, CLO2
13	**Mini Project**		
14	Write program for Text File Handling, Binary File Handling, Data File Management	2	CLO1, CLO2
15	Write a program that read an array and write and write in a file	2	CLO1, CLO2
16	Write a program that read n numbers from a file and display in output screen	2	CLO1, CLO2
17	**Project Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture, Group Discussion, Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

2. Brian W. Kernighan, *C Programming Language*, Pearson; 2nd edition (March 22, 1988)

Supplementary Readings:

3. Byron S. S. Gottfried, *Schaums' Outline of Programming with C*, McGraw-Hill Education; 2nd edition (June 22, 1996)
4. Peter J. Schwaller, *Cpi-C Programming in C: An Application Developer's Guide to Appc/Book*, Computing McGraw-Hill; Pap/Dis edition (September 1, 1994)

Part A

Course No./Course Code :	ENS 121
Course Title :	Environmental Science and Sustaianbility
Course Type	Inter Disciplinary Course
Year /Level/Semester/Term :	**TBA**
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	N/A
Credit Value :	3

Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

The human civilization has been facing the climate change impacted phenomena for a couple of decades. Moreover, there have seen an extensive range of challenges like flood, cyclone, sea level rise and storm surge in Bangladesh. But, the root cause of global warming is the emission of green house gas in a large scale. So, the renewable energy and efficient technology are quite required in the present context. In this regard, the course environmental science would be able to create a huge awareness among the students.

Course Objective:

Environmental Science is specifically designed for students who are not pursuing a program to learn more about the physical, biological processes and energy flow that shape our environment. Our planet, and its living and non-living parts, makes up the biosphere, which itself is a complex web of interactions. We investigate these interrelationships by studying the underlying processes in terms of their biology and chemistry.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the basic components of the environment, ecology, atmosphere, hydrosphere, lithosphere, and biosphere, green house gas
CLO2	**Understand** the relation between biotic and a-biotic components, climate, climate change, global warming, global environmental change, greenhouse mechanism, sedimentation process, sustainable development.
CLO3	**Analyze** the impacts of sea-level rise, storm surge, cyclone, floods, droughts etc.
CLO4	**Analyze** the present laws and regulations in the context of Bangladesh like Bangladesh Climate change Strategy Action Plan, National Adaptation Programme of Action

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1							√					
CLO2							√					
CLO3						√	√					
CLO4						√	√					√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam

CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Concept of Environment, Component of Environment, Environmental Science, Environmental Science – Multi-subjective approach Approach	Lecture	Quiz	CLO1
02	Difference between Environmental Science and Environmental Studies Difference between Environmental Scientist and Environmentalist, Importance of Environmental Science	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Hydrologic Cycle / Water Cycle Bangadesh: A flood prone country	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Atmosphere, Significance of Atmosphere, vertical Structure of atmosphere	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Permanent Gas, Variable Gas, Law of Thermodynamics, Green House Gas Sources of Green House Gas	Lecture	Assignment/ Midterm Exam	CLO1
06	Weather and Climate, Climate change, Global Warming, Global Environmental Change	Lecture	Assignment / Midterm Exam	CLO2
07	Climate Change and Frequency of Cyclone, Storm surge and sea level rise mechanism, Coastal Region and Impacts	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Climate Change Adaptation Climate Change Mitigation	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Mid Term Exam				

09	Food Security Sustainable Agriculture	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
10	Sedimentation Processes in Bangladesh	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO3
11	Thunderstorm, Lightening and its physics	Lecture	Assignment / Final Exam	CLO3
12	Drought Drought Adaptation	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Pollution (Pollutant &Standard) Source of Pollutant (Point Source & Non-point Source)	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Water Pollution, Eutrophication, Arsenic Contamination	Lecture / Video Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO3
15	Waste, Sources of Waste, Waste Management	Lecture/ Gro up Discussion	Assignment/ Mini Project/Final Exam	CLO3
16	Flash flood, Landslide and Current issues	Lecture	Assignment / Midterm Exam/ Final Exam	CLO3
17	Bangladesh Climate Change Strategy Action Plan 2009	Lecture	Assignment / Class Test Final Exam	CLO3
18	National Adaptation Programme of Action 2005	Lecture / Group Discussion	Presentation/ Final Exam	CLO4/ CLO5
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings

1. G. Tyler Miller and Jr. Scott Spoolman, ***Environmental Science,***Cengage Learning Provate Limited, New Delhi, India, 2nd Edition, 2012.

Supplementary Readings:

1. Botkin, D. B. and Keller, E. A. ***Environmental Science***, Tata McGraw -Hill, New Delhi, India, 2009.
2. William P. Cumningham and Mary Ann Cunningham, ***Princiles of Environmental Science***, 4th Edition, 2007.
3. S.S Dara, ***A Text Book of Environmental Chemistry and Pollution Control***, Chand & Company Ltd, 2010.

Part A

Course Code:	EEE 111
Course Title:	Electrical Circuits I
Course Type:	Core Course
Year/ Level/ Semester/ Term:	First Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	N/A
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Being the fundamental course, this course is designed such that students will be able to develop the paramount notions which will be required onward for the rest of their academic journey, else they might mislay their scattered assumptions, leading to poor engineering performances.

Course Objective:
This is a basic foundation course for the undergraduate students of electrical and electronic engineering. In electrical and electronic engineering, almost every device is modeled through electrical circuits and the device performances are then predicted for either DC or AC excitation. To model any electrical or electronic device or system, the knowledge of electrical circuit and circuit performance under DC excitation is a must. Thus, students should have crystal clear idea about the network theorems and network solution methods. The objective of this course is to teach the students the fundamentals of electrical circuit solution techniques, network theorems and transient analysis of RL and RC circuits under DC excitations.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic laws of circuits such as Ohm's law, Kirchhoff's laws.
CLO2	**Solve** linear dc circuits using different methods and circuit theorems.
CLO3	**Analyze** the transient response of RC and RL circuits.
CLO4	**Explain** fundamental properties and laws of magnetic circuits.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Circuit variables and elements: Voltage, current, power, energy.	Lecture	Mid-term, Class Test, Assignment	CLO1
02	Independent and dependent sources, resistance.	Lecture	Mid-term, Class Test, Assignment	CLO1
03	Basic laws: Ohm's law, Kirchhoff's current and voltage laws.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1
04	Simple resistive circuits: Series and parallel circuits.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2
05	Voltage and current division, wye-delta transformation.	Lecture	Mid-term, Class Test, Assignment	CLO2
06	Circuit Theorem: Nodal and mesh analysis including super-node and super-mesh, source transformation.	Lecture	Mid-term, Class Test, Assignment	CLO2
07	Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources.	Lecture	Mid-term, Class Test, Assignment	CLO2
08	Maximum power transfer condition and reciprocity theorem.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2
Midterm Exam				
09	Energy storage elements: Inductors and capacitors.	Lecture	Final Exam, Class Test, Assignment	CLO3
10	Series parallel combination of inductors and capacitors.	Lecture	Final Exam, Class Test, Assignment	CLO3

11	Responses of RL and RC circuits.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3
12	Step, impulse and ramp functions.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3
13	Natural and step responses.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3
14	Magnetic quantities and variables: Flux, permeability and reluctance.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
15	Magnetic field strength, magnetic potential.	Lecture	Final Exam, Class Test, Assignment	CLO4
16	Flux density, magnetization curve.	Lecture	Final Exam, Class Test, Assignment	CLO4
17	Laws in magnetic circuits: Ohm's law and Ampere's circuital law.	Lecture	Final Exam, Class Test, Assignment	CLO4
18	Analysis of series, parallel and series-parallel magnetic circuit.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. C. K Alexander and M. N O Sadiku, *Fundamentals of Electric Circuits*, McGraw-Hill Education; 6th edition (January 13, 2016)

Supplementary Readings:

1. Robert L. Boylestad, *Introductory Circuit Analysis*, Pearson; 13th edition (March 23, 2015)
2. J. David Irwin**,** *Basic Engineering Circuit Analysis,* Wiley; 11th edition (January 20, 2015)

3. David E. Johnson, *Basic Electric Circuit Analysis*, Wiley; 5th edition (January 15, 1995)
4. James W. Nilsson, *Electric Circuits,* Pearson; 11th edition (January 9, 2018)

Part A

Course No./Course Code :	EEE 121
Course Title :	Electrical Circuit II
Course Type	Core Course
Year /Level/Semester/Term :	Second semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 111
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Electromagnetic waves influence modern life in a variety of smaller-scale (but more immediate) ways: our mobile phone, wifi connection, microwave, and medical imaging methods such as x-ray and MRI are all powered by electromagnetic waves. Understanding the characteristics of light, its passage through tissue, scattering and absorption effects, and changes in the state of polarization requires an understanding of EM.

Course Objective:

The objective of this course is to introduce the fundamental knowledge for AC circuit analysis. The students will be able to solve AC circuits using network theorems and different analysis techniques. This course aims to introduce the concepts of three-phase systems, magnetically coupled circuits and resonant circuits. The students will achieve adequate knowledge to analyze and extract different parameters from these circuits.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basics of sinusoids and phasor algebra; and solve AC circuits in phasor domain using techniques such as nodal analysis, mesh analysis and network theorems.
CLO2	**Calculate** RMS value, complex power, real power, reactive power and power factor in AC circuits.
CLO3	**Solve** three-phase balanced and unbalanced circuits in phasor domain.
CLO4	**Solve** magnetically coupled circuits and electrical resonant circuits.

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√	√										
CLO2		√										

CLO3		√										
CLO4		√										
CLO5		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Bloom's Taxonomy Domain /Level	Teaching-Learning Strategy	Assessment Strategy
CLO1	Cognitive/L2	Class Lecture	Mid-term Exam, Class Test, Assignment
CLO2	Cognitive/L3	Class Lecture	Mid-term Exam, Final Exam, Class Test, Assignment
CLO3	Cognitive/L3	Class Lecture	Final Exam, Class Test.
CLO4	Cognitive/L3	Class Lecture	Final Exam, Class Test, Assignment

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1-2	**Definitions** of AC voltage, current, power, volt-ampere and various factors including the peak and form factors. **Introduction to sinusoidal steady state analysis:** Sinusoidal sources, instantaneous and effective voltage and currents, average power, phasors and complex quantities, impedance, real and reactive power, maximum power transfer, power factor and its improvement	Class Lecture	Assignment	CLO1
3-6	**Introduction to sinusoidal steady state analysis:** Sinusoidal sources, instantaneous and effective voltage and currents, average power, phasors and complex quantities, impedance, real and reactive power, maximum power transfer, power factor and its improvement. **Analysis of single-phase AC circuits:** Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in AC circuits, circuits with non-sinusoidal excitations, transients in AC circuits.	Class Lecture	Class Test /Midterm Exam	CLO1, CLO2

7-8	**Analysis of single-phase AC circuits:** Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in AC circuits, circuits with non-sinusoidal excitations, transients in AC circuits.	Class Lecture	Assignment / Class Test /Midterm Exam	CLO2
Mid Term Exam				
9-10	**Analysis of three phase circuits:** three phase supply, balanced and unbalanced circuits, power calculation.	Class Lecture	Assignment / Final Exam	CLO3
11-12	**Analysis of three phase circuits:** three phase supply, balanced and unbalanced circuits, power calculation.	Class Lecture	Class Test / Final Exam	CLO3
13-14	**Passive filters:** Basic types. characteristic impedance and attenuation, practical composite filters.	Class Lecture	Assignment / Final Exam	CLO3
15-16	**Resonance in AC circuits:** Series and parallel resonance.	Class Lecture	Assignment/Class Test / Final Exam	CLO4
17-18	**Magnetically coupled circuits.**	Class Lecture	Assignment / Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Charles K Alexander and Mathew N O Sadiku, ***Fundamental of Electric Circuits***, McGraw Hill, 5th edition, 2012

Supplementary Readings:

1. George F. Corcoran, Russell M Kerchner, ***Alternating-Current Circuits***, Wiley, 4th edition, 2014

2. Robert L. Boylestad, ***Introductory Circuit Analysis***, Prentice Hall CLOlege Div, 8th edition (August 13, 1996)
3. James W. Nilsson and Susan Riedel, ***Electric Circuits***, Pearson Education, 9th edition (January 01, 2010)

Part A

Course Code:	EEE 122
Course Title:	Electrical Circuits Lab
Course Type:	Core Course
Year Level/Semester/Term:	Second semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**
Pre-requisite:	EEE111 and EEE121
Credit Value:	1.5
Contact Hours:	18
Total Marks:	100

Rationale of the Course:
This course is intended to develop the fundamental tools of linear circuit analysis which will be useful to all engineers. It will help to learn the "alphabet" of circuits, including wires, resistors, capacitors, inductors, voltage and current sources.

Course Objective:
In this course students will perform experiments to verify practically the theories and concepts based in EEE 111 and EEE 121. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment's and their functions.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Build** and **measure** or **simulate** different electrical circuits using experimental and simulation tools.
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1					√							
CLO2		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**

CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course plan specifying content, CLOs, co-curricular activities (if any), Teaching learning and assessment strategy mapped with CLOs.

Week	Experiment Name	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
1	Introduction to laboratory	Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
2	Introduction to PSPICE	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
3	Verification of Kirchhoff's Voltage & Current law	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
4	Maxwell Loop Current Technique using 2-3 Meshes and 1-2 D.C. voltage sources.	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
5	Verification of Superposition theorem using 1-2 D.C. sources.	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
6	Verification of Thevenin's theorem and Norton's theorem	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
7	Verification of maximum power theorem	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
Mid Exam				

8	Simulating different ac and dc Circuits in PSPICE	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
9	Determination of Equivalent Resistance and Circuit analysis with source and resistance analysis	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
10	AC Transient Analysis of R-L circuits	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
11	AC Transient Analysis of R-L-C circuits	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
12	Steady-State AC Analysis and Frequency Response	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
13	Power measurement of 3 phase system using two wattmeter method	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
14	Determination of phase sequence of a 3 phase system	Lab demonstration Lecture	Lab Performance, Report and Lab Final Exam	CLO1, CLO2
Lab Final				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

4. Charles K Alexander and Mathew N O Sadiku, ***Fundamental of Electric Circuits***, McGraw Hill, 5th edition, 2012

Supplementary Readings:

2. George F. Corcoran, Russell M Kerchner, ***Alternating-Current Circuits***, Wiley, 4th edition, 2014
5. Robert L. Boylestad, ***Introductory Circuit Analysis***, Prentice Hall CLOlege Div, 8th edition (August 13, 1996)
6. James W. Nilsson and Susan Riedel, ***Electric Circuits***, Pearson Education, 9th edition (January 01, 2010)

Part A

Course Code:	EEE 211
Course Title:	Electronic Circuits I
Course Type:	Core Course
Year/ Level/ Semester/ Term:	Third Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Prerequisite:	EEE 121 Electrical Circuits II
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
This is the basic electronics course that will help the students to develop the obligatory knowledge for designing advanced electronic circuits. In addition to that, learning about the biasing of different transistors will be pivotal to many extents.

Course Objective:
Electronics is a science about the devices and processes that use electromagnetic energy conversion to transfer, process and store energy, signals and data in energy, control and computer systems. This science plays an important role in the world progress. Implementation of electronic devices in various spheres of human activity largely contributes to the successful development of complex scientific and technical problems, productivity increase of physical and mental labor, and production improvement in various forms of communications, automation, television, radiolocation, computer engineering, control systems, instrument engineering as well as lighting equipment, wireless technology and others. The goal of this

syllabus is to introduce a reader to the basics of electronic engineering. Here, students may get their first knowledge of electronic concepts and basic components. They also familiarize with the analysis and design of basic transistor amplifier circuits, frequency response and wave shaping characteristics of different circuit elements. After completing this syllabus, the students can proceed to advanced topics in electronics.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** the characteristics and operations of semiconductor devices like diodes, BJT, FET.
CLO2	**Demonstrate** applications of diodes in rectifiers, clippers, clampers, logic gates and voltage regulators.
CLO3	**Explain** different characteristics and applications of BJT and MOSFET under DC and AC excitations.
CLO4	**Design** circuits consisting of Diodes, BJT and FET.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2		√										
CLO3		√										
CLO4			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	**Topic**	**Teaching Learning Strategy**	**Assessment Strategy**	**Corresponding CLOS**
01	P-N junction as a circuit element: Intrinsic and extrinsic semiconductors,	Lecture	Mid-term, Class Test, Assignment	CLO1

	operational principle of p-n junction diode.			
02	Contact potential, current-voltage characteristics of a diode, simplified large and small signal models.	Lecture	Mid-term, Class Test, Assignment	CLO1
03	Iteration and graphical analysis, dynamic resistance and capacitance.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1
04	Half wave and full wave rectifiers, rectifiers with filter capacitor.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2
05	Characteristics of a Zener diode, Zener shunt regulator, clamping and clipping circuits.	Lecture	Mid-term, Class Test, Assignment	CLO2, CLO4
06	Bipolar Junction Transistor (BJT) as a circuit element: Current components, BJT characteristics and regions of operation.	Lecture	Mid-term, Class Test, Assignment	CLO1, CLO3
07	BJT as an amplifier, biasing the BJT for discrete circuits.	Lecture	Mid-term, Class Test, Assignment	CLO3, CLO4
08	Small signal equivalent circuit models, BJT as a switch.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO3, CLO4
Midterm Exam				
09	Single stage mid-band frequency BJT amplifier circuits: Voltage and current gain.	Lecture	Final Exam, Class Test, Assignment	CLO1, CLO3
10	Input and output impedance of a common base, common emitter and common CLOlector amplifier circuits.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
11	Field Effect Transistor (FET): Introduction to Junction Field-Effect-Transistor (JFET).	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3
12	Metal Oxide Semiconductor Field Effect Transistor (MOSFET) as circuit element.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4

13	Structure and physical operation of an enhancement MOSFET.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4
14	Threshold voltage, Body effect.	Lecture	Final Exam, Class Test, Assignment	CLO3
15	Current-voltage characteristics of an enhancement MOSFET.	Lecture	Final Exam, Class Test, Assignment	CLO3
16	Biasing discrete and integrated MOS amplifier circuits.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
17	Single stage MOS amplifiers.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
18	MOSFET as a switch, CMOS inverter.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO1, CLO3
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Adel S. Sedra, *Microelectronic Circuits*, Oxford University Press; 8th edition (November 15, 2019)

Supplementary Readings:

1. Robert Boylestad, *Electronic Devices and Circuit Theory*, Pearson; 11th edition (April 20, 2012)
2. Thomas L. Floyd, *Electronics Fundamentals: Circuits, Devices and Applications*, Pearson; 8th edition (June 23, 2009)
3. Neamen, *Semiconductor Physics and Devices*, MC GRAW HILL INDIA; 4th edition (January 1, 2013)
4. Muhammad H. Rashid, *Microelectronics Circuits: Analysis & Design*, CL Engineering; 2nd edition (April 19, 2010)

Part A

Course No./Course Code :	EEE 213
Course Title :	Energy Conversion I
Course Type	Core Course
Year /Level/Semester/Term :	Third Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 121 Electrical Circuits II
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, an electrical diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

Course Objective:

Energy Conversion: Review of law of energy conversions, electro-mechanical energy conversions. **DC generator:** Construction, winding, types of losses, no-load voltage characteristics, build-up of a self-excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics, voltage regulation, armature reaction and commutation. **DC motor:** Torque, counter EMF, rotational speed, torque-speed characteristics, starting and speed control, regulation, braking. **Transformer:** Principle, construction of ideal transformer, practical transformer, transformation ratio, no-load and load vector diagrams; actual transformer's equivalent circuit, regulation, short circuit and open circuit tests, parallel operation of transformers, auto transformer, instrument transformers, 3-phase transformers, different connection and their applications.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** the generation action, motor action and transformer action and **Understand** different factors like armature reaction and commutation, torque, counter EMF, load-voltage characteristic.
CLO2	**Explain** the constructions, operating principles and main features of common Electrical Machines: DC generator, DC motor, transformer.
CLO3	**Discuss** short circuit and open circuit tests, parallel operation of transformers, auto transformer, instrument transformers, 3- phase transformers, different connections and their applications.
CLO4	**Compare** between different machines and mention practical uses.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3	√											
CLO4		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	**Energy Conversion:** Review of law of energy conversions, electro-mechanical energy conversions	Lecture	Quiz	CLO1
02	DC generator construction	Lecture	Class Test /Midterm Exam	CLO2
03	DC generator winding, types of losses, no-load voltage characteristics.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Voltage build-up of a self-excited shunt generator, critical field resistance, load-voltage characteristic.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Effect of speed on no-load and load characteristics. Voltage regulation,	Lecture	Assignment/ Midterm Exam	CLO2

	armature reaction and commutation.			
06	DC motor construction, Torque, counter EMF, rotational speed.	Lecture	Assignment / Midterm Exam	CLO2
07	DC motor torque-speed characteristics	Lecture	Assignment / Midterm Exam	CLO2
08	Starting and speed control, regulation, braking.	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Mid Term Exam				
09	Transformer principle	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2
10	Construction of ideal transformer, practical transformer	Lecture/ Group Discussion	Assignment/ Class Test	CLO2
11	Transformation ratio, no-load & Full load loss.	Lecture	Assignment / Final Exam	CLO3
12	load vector diagrams; actual transformer's equivalent circuit	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Transformer regulation and maximum efficiency	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Short circuit and open circuit tests	Lecture	Presentation/ Class Test / Final Exam	CLO3
15	Parallel operation of transformers.	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
16	Auto transformer, instrument transformers.	Lecture/ Group Discussion	Assignment/ Final Exam	CLO3
17	Introduction of three phase transformer.	Lecture	Assignment / Midterm Exam/ Final Exam	CLO3
18	Different connection and their applications	Lecture	Assignment / Class Test/ Final Exam	CLO3/ CLO4
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Stephen J Chapman; *Electrical Machinery Fundamentals*, Mcgraw-Hill CLOlege; 2nd edition, 1991.

Supplementary Readings:

1. Rosenblatt, Firedman, *Direct and Alternating Current Machinery,* McGraw-Hill (January 1, 1963).
2. A.F. Punhntein & T.C Lioud, *Alternating Current Machines*, John Wiley & Sons; 3rd edition, 1954.
3. B.L. Thereja & A.K. Thereja, *A text book of Electrical Technology (AC, DC Machines)*, S. Chand & Company Ltd, 2006.

Part A

Course No./Course Code :	EEE 221
Course Title :	Electronic Circuits II
Course Type	Core Course
Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 211 Electronic Circuits I
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The electrons in physical objects are affected by various real-world events or interactions. Electronic circuits assist us in detecting, measuring, and manipulating these electronic impulses so that we can use them to improve our lives. At a higher level, we are able see that all necessities, devices, extravagances of advanced life on Soil are made conceivable by Electronic Circuits as it were.

Course Objective:

The objective of this course is to give the students the basis and the importance of electronic circuits in electronic systems. At the end of the course, students will be able to analyze electronic circuits especially Op-Amp based electronic circuits to deal with real life mathematical application and they will understand how to design op-amp based amplifier and Oscillator with feedback. Consequently they learn how to stabilize the amplifier in term of the gain and frequency response. Moreover, they would be able to understand and design the Power amplifier, active filter and voltage regulator as well.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the frequency response of multistage amplifiers.
CLO2	**Analysis** the performance of power amplifiers.
CLO3	**Design** mathematical applications and signal generator using Op-amp.
CLO4	**Construct and analysis** the Op-Amp based active filter for noise elimination.
CLO5	**Design and performance** analysis of voltage stabilizer.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√		√				√	√		
CLO4		√	√									
CLO5		√	√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture/ Group Discussion	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/Tutorial	Class Test / Final Exam
CLO5	Lecture/Group Discussion	Assignment/Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

01	**Frequency response of amplifiers:** Poles, zeros and Bode plots, amplifier transfer function, frequency response of single-stage and cascade amplifiers, determining bandwidth of amplifier circuits with 3dB frequencies response.	Lecture/ Group Discussion	Quiz	CLO1
02	**Introduction to power amplifier:** Class A, Class B, Class C	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Push Pull Power Amplifier, efficiency comparison among the different type of power amplifier.	Lecture / Group Discussion// Video Tutorial	Assignment / Presentation/ Midterm Exam	CLO2
04	**Differential Amplifier:** Basic Circuits of Differential Amplifier, Operation of Differential Amplifier, Common Mode and Differential Mode Signal, Double Ended Input Operation of DA, Voltage Gain of DA, Common Mode Rejection Ratio (CMMR)	Lecture / Group Discussion	Assignment / Midterm Exam	CLO3
05	DC Analysis of Differential Amplifier, Overview of Differential Amplifier, Output Offset Voltage and Input Offset Current, AC Analysis of Differential Amplifier with Math and Common Mode Voltage Gain of Differential Amplifier	Lecture/ Group Discussion	Assignment/ Midterm Exam	CLO3
06	**Operational Amplifier:** Properties of ideal Op-Amps, schematic model of different type of Operational Amplifier, Voltage Gain of Operational Amplifier, Open Loop Voltage Gain and Closed Loop Voltage Gain	Lecture	Assignment / Midterm Exam	CLO3
07	DC/AC Analysis Of Op-Amp, Bandwidth of an Op-Amp, Slew Rate of an Op-Amp	Lecture/ Group Discussion	Class Test /Midterm Exam	CLO2/ CLO3

08	Feedback Configuration of Op-Amp, Op-Amp with Negative Feedback, Input Resistance With Feedback, Output Resistance with Feedback, Bandwidth with Feedback and Virtual Ground	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO3
Mid Term Exam				
09	**Application of Op-Amp:** Inverting Amplifier, Non Inverting Amplifier, Emitter Follower, Summing Amplifier, Sub-tractor,	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
10	Differentiator and Integrator, Mathematical equation solution with OP-Amp	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO3
11	**Electronic Active Filter:** Types of Filters, Active Filters such as Low Pass Active Filter/ First Order Butterworth Low Pass Filter, Second Order Butterworth	Lecture	Assignment / Final Exam	CLO4
12	Low Pass Active Filter, High Pass Active Filter, Band Pass Active Filter, Band Stop/ Band Rejection/ Band Elimination Filter	Lecture	Assignment / Class Test / Final Exam	CLO4
13	**Oscillator design with/without Op-amp**: Oscillator Principle, Frequency Stability, Phase Shift Oscillator, Win Bridge Oscillator,	Lecture / Group Discussion/ Video Tutorial	Presentation/ Final Exam	CLO3
14	Voltage Controlled Oscillator, Blocking Oscillator,	Lecture / Video Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO3
15	Multi-vibrator, Square Wave Generator, Triangular/ Saw-tooth Wave Generator	Lecture/ Group Discussion	Assignment/ Mini Project/ Presentation/ Final Exam	CLO3
16	Comparator, Zero Crossing Detector, Schmitt Tiger, PLL and 555 IC Timer	Lecture	Assignment / Midterm Exam/ Final Exam	CLO4
17	**Voltage Regulation:** Series Voltage Regulation, Shunt Voltage Regulation	Lecture	Class Test/Final Exam	CLO4/ CLO5

18	Shunt Voltage Regulator Using Op-Amp, IC 7805	Lecture / Group Discussion	Presentation/ Final Exam	CLO4/ CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Robert F. Coughlin & Frederick F DrisCLOl , *Operational Amplifiers and Linear Integrated Circuits* 6th Ed. Prentice Hall, 2001

2. Robert L. Boylestad, Louis Nashelsky, *Electronics Devices and Circuits Theory*, 5th Ed. Prentice Hall,1992

Supplementary Readings:

1. Ramakant. A. Gayakwad, *Op-Amps and Linear Integrated Circuits*, 3rd Ed. Prentice Hall, 1992

2. Millman and C.C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, 1st Ed. **J**McGraw-Hill, 1972

3. Sedra and Smith, *Microelectronic Circuits,* 7th Ed. Oxford University Press, 2014

4. V. K. Metha and Rohit Metha, *Principle of Electronics***,** 40th Ed. **S**. Chand Publishing, 2020

Part A

Course Code:	EEE 222
Course Title:	Electronic Circuits Lab
Course Type:	Core Course
Year/ Level/ Semester/ Term:	Fourth Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	EEE 211 Electronic Circuits I
Credit Value:	1.5

Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Electronic Circuits Lab will substantialize the notions related to electronics into practice. Thus, the students will be able to design some sophisticated projects adroitly based on what they learned in the theory courses prior to the lab.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 211 and EEE 221. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Demonstrate** experiments based on diodes, transistors and Op-Amps.
CLO3	**Design** and **implement** a suitable project using diodes, transistors and Op-Amps that fits the course curricula using experimental and simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2	√				√							
CLO3			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO3	Lab demonstration/ Lecture	Mini Project/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to the Electronic Circuits Lab	2	N/A
02	Study of diode characteristics and its applications	2	CLO1, CLO2

03	Study of clipping and clamping circuits	2	CLO1, CLO2
04	Study of Zener Diode characteristics and its applications	2	CLO1, CLO2
05	Study of BJT Amplifiers (with Frequency Response) and Switches	2	CLO1, CLO2
06	Study of small signal transistor amplifiers	2	CLO1, CLO2
07	Study of Operational amplifier as an inverter, Inverting amplifier, Adder, Integrator, Differentiator, Non-Inverting Amplifier, Voltage follower (Buffer) and Comparator	2	CLO1, CLO2
08	Design and implementation of 1st and 2nd order Low-Pass and High-Pass Butterworth Filter	2	CLO1, CLO2, CLO3
09	Study of Operational Amplifier as Triangular wave generator and Astable Multivibrator	2	CLO1, CLO2
10	Study of dc characteristics of an enhancement type MOSFET	2	CLO1, CLO2
11	Study of Source-Drain characteristic of JFET	2	CLO1, CLO2
12	Study of CLOpitts & Hartley oscillators using Op-Amps and Transistors	2	CLO1, CLO2
13	**Mini Project**		
14	Study of Wien Bridge and Voltage-controlled oscillators	2	CLO1, CLO2
15	Checking the conversion efficiency and the figure of merit in a Class-A amplifier with DC current flowing through the load	2	CLO1, CLO2
16	Checking the characteristics of a complementary symmetry push-pull amplifier	2	CLO1, CLO2
17	**Project Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture, Group Discussion, Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. **Adel S. Sedra**, *Microelectronic Circuits*, Oxford University Press; 8th edition (November 15, 2019)
2. Robert F. Coughlin, *Operational Amplifiers and Linear Integrated Circuits*, Pearson; 6th edition (December 15, 2000)

Supplementary Readings:

4. Robert Boylestad, *Electronic Devices and Circuit Theory*, Pearson; 11th edition (April 20, 2012)
5. Thomas L. Floyd, *Electronics Fundamentals: Circuits, Devices and Applications*, Pearson; 8th edition (June 23, 2009)
6. Ramakant A. Gayakwad, *Op-amps and Linear Integrated Circuits*, Pearson Education; Fourth edition (31 March 2021)
7. William Stanley, *Operational Amplifiers with Linear Integrated Circuits*, Pearson; 4th edition (May 25, 2001)

Part A

Course No./Course Code :	EEE 223
Course Title :	Energy Conversions II
Course Type	Electrical
Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	**EEE 213**
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Communication theory provides a way of talking about and analyzing key events, processes, and commitments that together form communication. Theory can be seen as a way to map the world and make it navigable; communication theory gives us tools to answer empirical, conceptual, or practical communication questions.

Course Objective:
The aim of this course is to introduced with the essential approaches, fundamental concepts and design issues in communication engineering which help the students to pursue further studies in communications engineering as well as some other related engineering disciplines including electrical engineering. It will also help to solve communication engineering related circuit for real world problems.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**State** operating Principle of Polyphase & single-Phase Induction motor and **explain** their characteristics and **Solve** related mathematical problems.
CLO2	**Discuss** the working principle and characteristics of alternator and **solve** related mathematical problems.
CLO3	**Examine** the Synchronous motor's construction, operation and their characteristics and **solve** related mathematical problems.
CLO4	**Describe** the construction and operation of different types of special machines.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture,Discussion	Mid-term, Class Test, Assignment.
CLO2	Lecture,Discussion	Final Exam, Class Test, Assignment.
CLO3	Lecture,Discussion	Final Exam, Class Test, Assignment.
CLO4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1	Overview of the Course	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
2	Principle of rotation of rotor, slip, frequency of rotor current, Relation between torque and rotor power factor	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
3	Starting torque of a squirrel-cage motor, Starting torque of a Slip-ring motor, Condition of maximum starting torque,	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
4	Effect of change in supply voltage on starting torque, Rotor E.M.F and reactance under running conditions	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
5	Condition for maximum torque under running conditions Relation between torque and slip, Effect of change in supply voltage on torque and speed	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**

6	Effect of change in supply frequency on torque and speed, Full load torque and maximum torque	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
7	Power stages of Induction motor, Plugging of an Induction Motor, Induction motor operating as a generator, Starting of Induction Motors , Speed Control of Induction Motor, Mathematical problems analysis.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
8	Single phase induction motors, equivalent circuit	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
9	starting of induction motors, Capacitor start and run motors, repulsion type motors.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
Midterm Examination				
10	Alternator principle and construction	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
11	Excitation systems, equivalent circuit. Parallel operation	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
12	vector diagrams at different loads, factors affecting voltage regulation	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
13	synchronous impedance, synchronous impedance method of predicting voltage regulation and its limitations	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
14	Necessary conditions, synchronizing, circulating current and vector diagram.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
15	Synchronous motor, Operation, ,	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
16	starting methods, effect of loading under different excitation condition	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**

17	effect of changing excitation, V-curves, power developed by motors.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
18	Special Machine	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Mid-term, Class Test, Assignment, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Stephen Chapman, *Electric Machinery Fundamentals*, McGraw-Hill Education - Europe (January 1, 2001).

Supplementary Readings:

1. B.L Theraja and A.K Theraja, *A Textbook of Electrical Technology in S.I Units, Vol. 2,* S Chand & Co Ltd; 23rd edition (January 1, 2006).
2. Rosenblatt and Friedman, *Direct and Alternating Current Machinery, CBS* Publishers And Distrubutors Pvt Ltd; 2nd edition (February 28, 2001)
3. V.K. Mehta and Rohit Mehta, *Objective Electrical Technology*, S Chand; 2nd Rev Edn 2005 edition (January 1, 2018).
4. A.E. Fitzgerald, Charles Kingsley, JR., Stephen D., *Electric Machinery*, McGraw-Hill; 6th edition (September 1, 2005).

Part A

Course No./Course Code :	EEE 224
Course Title :	Energy Conversions Lab
Course Type	Electrical
Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**

Pre-requisite :	EEE 213 & EEE 223 (Energy Conversions I & Energy Conversions II)
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The Electrical Machines Laboratory is the one of the important Laboratory of Electrical Engineering Department. This Laboratory caters the need of Under Graduate Students to enable them to easily understand the basics and adapt to advanced experiments like modelling of Electrical Machines and special Electrical Machines. Also, the Laboratory is used for research activities in machines using MAGNET Software and to carry out project works in the design of Electrical Machines.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE213 & EEE223. The students will carry out lab experiments. They will gain exposure to machinery equipment in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Measure** various characteristics parameters of Transformers and Energy Converters using experimental setup.
CLO2	**Write** comprehensive reports on the work done in Laboratory and demonstrate the ability to work as an individual or as a team.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to Energy Conversion Lab	2	CLO1, CLO2
02	Determination of the polarity of transformer windings and Observation of the connection of transformer winding of a single phase transformer in series aiding and opposing.	2	CLO1, CLO2
03	Study of Single Phase Transformer & Three Phase Transformer and determination of turns ratio	2	CLO1, CLO2
04	Determination of the equivalent circuit parameters of a transformer and calculation of efficiency and regulation.	2	CLO1, CLO2
05	Study of Operation of Transformers in Parallel	2	CLO1, CLO2
06	Study of Characteristics of a DC Shunt Generator	2	CLO1, CLO2
07	Study of Speed Control of a DC Shunt Motor and observation of the existence of Back EMF/Generator	2	CLO1, CLO2
08	Study of Characteristics of Split phase Induction Motor	2	CLO1, CLO2
09	Study of Characteristics of Squirrel case Induction Motor	2	CLO1, CLO2
10	Mini Project		
11	Determination of Performance Characteristics of an Induction motor with the help of Circle Diagram.	2	CLO1, CLO2
12	Determination of the ‘V’ Curves of a Synchronous Motor.	2	CLO1, CLO2
13	Study of Characteristics of Synchronous Generator under Resistive Load, Inductive Load & Capacitive Load	2	CLO1, CLO2
14	To study and obtain the losses and efficiency of a dc shunt generator by hopkinson’s test	2	CLO1, CLO2
15	To study speed control of separately excited dc shunt motor by ward-leonard method	2	CLO1, CLO2
16	Determination of OCC curves of DC Generator	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion	
Marks Distribution	Continuous Assessment:	60
	Summative:	40

Make-up Procedures	As per university rules

Part D

Learning Materials

Recommended Readings:

1. Stephen J. Chapman, *Electric Machinery Fundamentals*,4rd ed. NY,USA; McGraw-Hill Publications,2006.

Supplementary Readings:

1. B. L. Theraja and A. K. Theraja, *A Text Book of Electrical Technology* - Vol. II,2nd edition, India: S Chand & Company LTD, 2003.
2. C. I. Hubert, *Electric Machines*, 2nd ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2015.
3. Jack Rosenblatt, Friedman, *Direct and Alternating Current Machinery*, 2nd ed. Upper Saddle River, NJ: Pearson CLOlege Div, 1984.

Part A

Course No./Course Code:	EEE 225
Course Title:	Signals and Linear System Analysis
Course Type	Core Course
Year /Level/Semester/Term:	Fourth semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**
Prerequisite:	**N/A**
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:

Electromagnetic waves influence modern life in a variety of smaller-scale (but more immediate) ways: our mobile phone, wifi connection, microwave, and medical imaging methods such as x-ray and MRI are all powered by electromagnetic waves. Understanding the characteristics of light, its passage through tissue, scattering and absorption effects, and changes in the state of polarization requires an understanding of EM.

Course Objective:

Signals and Linear Systems Analysis is a rudimentary course to comprehend digital signal processing properly. So many advanced and sophisticated areas like speech processing, image processing, sensor data processing, analog and digital communication systems are directly contingent upon Signal processing. This course mirrors and assembles the basic concepts for linear and continuous-time signals and systems. Signals and systems course also represents both time and frequency domains. In this course Fourier series, Fourier transform and Laplace

Transform are demonstrated precisely for comprehending the magnitude and phase analysis of sinusoidal and non-sinusoidal signals. These above materials of this course carry a significant value to be mastered in Digital signal processing.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Define** different types of signals and systems
CLO2	**Understand** the stability of LTI system
CLO3	**Understand** Fourier series, Fourier transform and **identify** responses of LTI systems under different excitations.
CLO4	**Apply** Fourier transform and Laplace transform in analyzing analog and mechanical signals in time and frequency domain.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√											
CLO3	√											
CLO4			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Class Lecture	Mid Term Exam, Class Test, Assignment
CLO2	Class Lecture	Mid Term Exam, Final-Exam, Class Test, Assignment.
CLO3	Class Lecture	Final Exam, Class Test, Assignment
CLO4	Class Lecture	Final Exam, Class Test, Group assignment

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	**Topic**	**Teaching Learning Strategy**	**Assessment Strategy**	**Corresponding CLOS**
1-3	**Introduction to linear systems and signal classification:** signals-classification, basic operation on signals,	Class Lecture	Assignment/ Class Test	CLO1

	elementary signals, representation of signals using impulse function; systems-classification.			
4-5	**Properties of Linear Time Invariant (LTI) systems:** Linearity, causality, time invariance, memory, stability, invertibility.	Class Lecture	Assignment /Midterm Exam	CLO2
6-8	**Time domain analysis of LTI systems:** Differential equations- system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response- convolution integral, determination of system properties; state variable basic concept, state equation and time domain solution.	Class Lecture	Class Test /Midterm Exam/Final Exam	CLO2
Mid Term Exam				
9-13	**Frequency domain analysis of LTI systems:** Fourier series- properties, harmonic representation, system response, frequency response of LTI systems; Fourier transformation properties, system transfer function, system response and distortion-less systems	Class Lecture	Assignment / Final Exam	CLO3
14-15	**Applications of time and frequency domain analyses:** solution of analog electrical and mechanical systems.	Class Lecture	Assignment / Final Exam	CLO3
16-18	**Laplace transformation:** Fourier to Laplace, Properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.	Class Lecture	Class Test / Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70

Make-up Procedures	As per university rules

Part D

Learning Materials

Recommended Readings:

1. S. S. Soliman and M. D Srinath, *Continuous and discrete signals and systems*, 3rd edition, Prentice Hall, New Delhi, India, 2004.

Supplementary Readings:

1. Lathi, B. P., & Green, R. A, *Linear systems and signals*, 3rd edition, New York: Oxford University Press, 2018.
2. Oppenheim, A. S., Willsky, A. S., & Young, I. T, *Signals and systems*, 2nd edition, Pearson, 1996.

Part A

Course No./Course Code :	EEE 227
Course Title :	Electromagnetic Fields and Waves
Course Type	Core Course
Year /Level/Semester/Term :	Fourth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	PHY 111 and EEE 121
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Electromagnetic waves influence modern life in a variety of smaller-scale (but more immediate) ways: our mobile phone, wifi connection, microwave, and medical imaging methods such as x-ray and MRI are all powered by electromagnetic waves. Understanding the characteristics of light, its passage through tissue, scattering and absorption effects, and changes in the state of polarization requires an understanding of EM.

Course Objective:
The goal of this course is to introduce basic electromagnetic and establish the fundamentals of devices in electromagnetic applications, as required by engineers in energy systems, telecommunications, computing and other technologies. Students will become familiar with electromagnetic applications such as capacitors, inductors, transformers, transmission lines, Smith charts, impedance matching circuits, waveguides and antennas, that are used in the

designs and implementations of electrical power systems and modern wireless communications systems.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** Gauss's law, Ampere's and Faraday's Laws and **Use** them in the context of electrical devices.
CLO2	**Solve** boundary value problems using Poisson's and Laplace equations in different coordinate systems.
CLO3	**Explain** the physical significance of Maxwell's equation and **derive the Helmholtz** equation from Maxwell's equations.
CLO4	**Explain** phase velocity, group velocity, instantaneous power and average power densities of EM waves.
CLO5	**Analyze** plain wave characteristics in lossless and lossy dielectric and good conductors.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2		√										
CLO3	√											
CLO4	√											
CLO5	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lecture , Slides, Tutorial	Assignment / Midterm Exam
CLO2	Lecture , Slides, Tutorial	Assignment / Class Test /Midterm Exam
CLO3	Lecture , Slides, Tutorial	Midterm Exam/ Final Exam
CLO4	Lecture , Slides, Tutorial	Presentation/ Class Test / Final Exam
CLO5	Lecture , Slides, Tutorial	Presentation/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1-2	**Vector Analysis:** Vector algebra, Coordinate system and transformation and Vector calculus.	Lecture , Slides, Tutorial	Assignment	CLO1
3-6	**Electrostatic Fields:** Static electric field: Postulates of electrostatics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application. Electric potential due to charge distribution, conductors and dielectrics in static electric fields. Flux density- boundary conditions; capacitance- electrostatic energy and forces, energy in terms of field equations.	Lecture , Slides, Tutorial	Assignment / Class Test /Midterm Exam	CLO1
7-8	**Electrostatic Boundary- Value Problems:** Poisson's and Laplace's equations in different coordinate systems	Lecture , Slides, Tutorial	Assignment / Class Test /Midterm Exam	CLO2
Mid Term Examination				
9-10	**Steady electric current:** Ohm's law, continuity equation, Joule's law, resistance calculation	Lecture , Slides, Tutorial	Midterm Exam/ Final Exam	CLO1
11-12	**Magneto-static Fields:** Postulates of magnetostatics, Biot-Savart's law, Ampere's law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability.	Lecture , Slides, Tutorial	Presentation/ Class Test / Final Exam	CLO1
13	**Magnetic Forces, Materials, and Devices:** Magnetic energy, magnetic forces, torque and inductance of different geometries	Lecture , Slides, Tutorial	Assignment / Final Exam	CLO1
14-15	**Maxwell's Equations:** Faraday's law of electromagnetic induction, Maxwell's equations - differential and integral forms, derivation of Helmholtz equation from Maxwell's equations. Boundary conditions, potential functions;	Lecture , Slides, Tutorial	Assignment/ Class Test / Final Exam	CLO3

	time harmonic fields and Poynting theorem.			
16-18	**Electromagnetic Wave Propagation:** Plane wave in lossless media- Doppler effect, transverse electromagnetic wave, polarization of plane wave; plane wave in lossy media- low-loss dielectrics. Good conductors; group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization	Lecture , Slides, Tutorial	Presentation/ Final Exam	CLO4, CLO5
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Matthew N. O. Sadiku, ***Elements of Electromagnetics***, Oxford University Press, 7th edition (January 3, 2018)

Supplementary Readings:

1. D. K. Cheng, ***Field and Wave Electromagnetics***, Pearson India, 2nd edition (January 1, 2014) 2nd edition
2. Simon Ramo, John R. Whinnery, Theodore Van Duzer, ***Fields and Waves in Communication Electronics***, John Wiley & Sons, Inc., 3rd edition (March 31, 1994)
3. David M. Pozer, ***Microwave engineering***, Wiley, 4th edition (November 22, 2011)

Part A

Course No./Course Code :	EEE 311
Course Title :	Communication Theory
Course Type	Core course
Year /Level/Semester/Term :	Fifth semester

Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 225, EEE 211
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Communication theory provides a way of talking about and analyzing key events, processes, and commitments that together form communication. Theory can be seen as a way to map the world and make it navigable; communication theory gives us tools to answer empirical, conceptual, or practical communication questions.

Course Objective:
The aim of this course is to introduce with the essential approaches, fundamental concepts and design issues in communication engineering which help the students to pursue further studies in communications engineering as well as some other related engineering disciplines including electrical engineering. It will also help to solve communication engineering related circuit for real world problems.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** the fundamental elements and parameter of communication system.
CLO2	**Describe** in detail the analog modulation and demodulation and **solve** related problems.
CLO3	**Understand** the sampling theorem and **Examine** the digital modulation.
CLO4	**Discuss** the multiple access techniques and **describe** the effects of noise in communication system and related problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Mid-term, Class Test, Assignment.
CLO2	Lecture Tutorial	Mid-term, Class Test, Assignment.

CLO3	Lecture Tutorial	Final Exam, Class Test, Assignment.
CLO4	Lecture Tutorial	Final Exam, Class Test, Assignment.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Overview of Communication Systems	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
02	Transmission types- base-band transmission, carrier transmission; transmission media types, bandwidth, and transmission	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
03	Introduction to Bandwidth	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
04	Introduction to Amplitude Modulation	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
05	double side band, single side band	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO2**
06	vestigial side band, quadrate; spectral analysis of each type, envelope and synchronous detection	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
07	Angle Modulation	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
08	frequency modulation (FM) and phase modulation (PM)	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
09	Spectral analysis, demodulation of FM and PM	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
Midterm Examination				
10	Pulse Code modulation	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**

11	Digital modulation (ASK), (PSK), (FSK)	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
12-13	Multiplexing & FDM	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
14-15	Multiplexing& TDM	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
16	Communication system design	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
17-18	Noise	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Mid-term, Class Test, Assignment, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Simon Haykin.,*Communication Systems*, Wiley; 5th edition (March 16, 2009)
2. B. P. Lathi, Zhi Ding. ,*Modern Digital and Analog Communication Systems*,Oxford University Press; 5th edition (February 9, 2018)

Supplementary Readings:

1. B.L Theraja and A.K Theraja, *A Textbook of Electrical Technology - Volume IV: Electronic Devices and Circuits, Schand;* 1st MultiCLOour Edn. 2006 edition (June 1, 2006)
2. Bernard Sklar.,*Digital Communications Fundamentals and Applications,Pearson;* 2nd edition (November 30, 2008)

Part A

Course No./Course Code :	EEE 312
Course Title :	Communication System Lab
Course Type	Communication

Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 311
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Communication engineering is the field of study concerned with the transmission of information either in analog or digital form. Though digital communication is more robust technology over analog communication, Analog communication system is still very popular due to its lower cost & less complicated circuitry. Analog transmission is a method of sending voice, data, image, signal, video etc. using a continuous time signal. Whereas digital communication enables the data to be transmitted in an efficient manner through the use of digitally encoded information. Analog & digital Communication laboratories mainly focus on training the students of transmission and reception of signals. Learning the concepts along with practical applications give the students immense pleasure and real motivation toward their studies.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 312. The students will carry out experiments using hardware along with simulation tool. They will gain exposure to equipment and simulation tool in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their calculations.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Measure** different communication parameters using kit and others equipment and **Simulate** using MATLAB.
CLO2	**Write** reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lab demonstration/ Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introductory class	2	CLO1, CLO2
02	AM Modulator & Demodulator	2	CLO1, CLO2
03	DSB-SC Modulator and Demodulator	2	CLO1, CLO2
04	SSB Modulator and Demodulator	2	CLO1, CLO2
05	FM Modulator & Demodulator	2	CLO1, CLO2
06	TDM Multiplexer & De-multiplexer	2	CLO1, CLO2
07	FDM Multiplexer & De-multiplexer	2	CLO1, CLO2
08	Verification of sampling theorem	2	CLO1, CLO2
09	Analog to Digital Converter	2	CLO1, CLO2
10	Digital to Analog Converter	2	CLO1, CLO2
11	Mini Project		
12	Frequency synthesizer	2	CLO1, CLO2
13	Switch Faults	2	CLO1, CLO2
14	ASK Modulator & Demodulator	2	CLO1, CLO2
15	FSK Modulator & Demodulator	2	CLO1, CLO2
16	PSK Modulator & Demodulator	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Simon Haykin & Michael Moher, *An Introduction to Analog and Digital Communications*, 4th Edition.

Supplementary Readings:

1. B.P. Lathi, *Modern Digital and Analog Communication Systems*, 3rd Edition.

2. Bernard Sklar & Pabitra Kumar Ray, *Digital Communications: Fundamentals & Applications*, 2nd Edition.
3. Behrouz A. Forouzan, *Data communications and networking,* 4th Edition.

Part A

Course No./Course Code :	EEE 313
Course Title :	Measurements and Instrumentation
Course Type	Core Course
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 211 Electronic Circuits I
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Instrumentation is a field of physics that deals with measuring and regulating variables in the process industry, as well as the instruments used to measure and control the process variables and their calibration. Level, pressure, temperature, humidity, flow, pH, force, and speed are examples of industrial process variables. Instrumentation technology refers to the technology used to create and build instruments for measurement and control.

Course Objective:
The objectives of this course are to make the students understand the various measurement techniques available. This subjective course will help them to introduce (working principles and some other important aspects) students to several examples of each of the functional elements of a generalized measurement system. They can be able to understand the errors in measurements and their rectification. It will aid them to find out information on and select the proper instrumentation for making measurements of physical quantities. Finally, it engaged them by introducing the students to the basics of the causes of signal impairment in a measurement device and their mitigation.

Course Content:
Introduction: Applications, functional elements of a measurement system and classification of instruments. Current and potential transformer. Transducers: mechanical, electrical and optical. Measurement of non-electrical quantities: Temperature, pressure, flow, level, strain, force and torque. Basic elements of DC and AC signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits. Data Transmission and Telemetry: Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices using Microcontroller based Data acquCSEion system and applications.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** different types of errors, **Explain** and **Demonstrate** the construction, configuration and operation of mechanical and electrical instruments used to control dynamics of processes.
CLO2	**Design** A/D and D/A converters for given specifications.
CLO3	**Analyze** the operation of transducers for strain, pressure, temperature and fluid flow measurement.
CLO4	**Design and Analyze** the analog and digital data acquCSEion systems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2			√									
CLO3		√										
CLO4		√	√									

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lecture ,Slides	Mid-Exam, Final Exam, Class Test, Assignment.
CLO2	Lecture ,Slides	Mid-Exam, Class Test, Assignment.
CLO3	Lecture ,Slides	Mid exam, Final Exam, Presentation, Assignment.
CLO4	Lecture ,Slides	Final Exam, Class Test, Presentation, Group project.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	**Topic**	**Teaching Learning Strategy**	**Assessment Strategy**	**Corresponding CLOS**
1-2	**Introduction**: Important terminologies of measurement systems, Applications of measurement systems, Functional elements of a generalized measurement system, Classifications of	Lecture ,Slides	Mid-Exam, Final Exam, Class Test, Assignment.	CLO1

	instruments, errors in measurement, Measurement of electrical quantities ,errors in measurement			
3-4	**Galvanometer**: D'Arsonval type, Its construction, Torque equation, Dynamic behavior and Equation of motion Underdamped, undamped, critically damped and overdamped motion of galvanometer	Lecture ,Slides	Mid-Exam, Class Test, Assignment.	CLO1
5-6	**Ammeters, voltmeters:** (DC/AC) PMMC, Temperature compensation, Dc Ammeter and Voltmeter, Rectifier-based AC meters, Electrodynamometer type meter	Lecture ,Slides	Mid-Exam, Assignment	CLO1
7-8	**Power measurement:** Electrodynamometer type, induction type, single phase and three phase wattmeter, compensation, two wattmeter method	Lecture ,Slides	Mid-Exam, Class Test, Assignment	CLO1
Mid Term Examination				
9-10	**Energy measurement**: Induction type single phase and three phase energy meter, compensation, creep, error, testing **Localization of faults:** Murray and Varley loop test	Lecture ,Slides	Final Exam, Assignment	CLO1
11	**Instrument transformers**: **CT & PT**: Introduction, uses, advantages, design considerations etc.	Lecture ,Slides	Final Exam, Class Test, Presentation	CLO1
12-13	**AC Bridges**: General balance equation of Wheatstone Bridge, measurement of self-inductance by Maxwell's bridge, Hay's bridge, Owen's bridge, measurement of capacitance by Schearing bridge, Wagner's earthing device, Kelvin's double bridge.	Lecture ,Slides	Final Exam, Class Test, Presentation	CLO1

14-15	**Transducer:** Electrical Transducers, Strain Gauges, Resistance thermistors, Thermocouples, Variable inductance type transducers, Capacitive Transducers, Piezo-Electric transducers, Optical Transducer, Photodiodes, and Photovoltaic Cell.	Lecture ,Slides	Final Exam, Class Test, Presentation	CLO3
16	**Measurement of non-electrical quantities:** Temperature, pressure, flow, level, strain, force and torque.	Lecture ,Slides	Final Exam, Presentation , Group project.	CLO3
17	**Basic elements of DC and AC signal conditioning:** Instrumentation amplifier, noise and source of noise, noise elimination compensation, function generation and linearization, A/D and D/A converters, sample and hold circuits.	Lecture ,Slides	Final Exam, Presentation , Group project.	CLO2,CLO4
18	**Data Transmission and Telemetry:** Methods of data transmission, DC/AC telemetry system and digital data transmission. Recording and display devices. Data acquCSEion system and microprocessor applications in instrumentation.	Lecture ,Slides	Final Exam, Presentation , Group project.	CLO4
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Presentation/ Class test/ Group Discussion	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Reading:

1. A.K. Sawhney, *A course in Electrical and Electronic Measurements and Instrumentation*, Shree Hari Publications, 5th edition (1 January, 2021)

Supplementary Readings:

1. David A. Bell, *Electronic Instrumentation and Measurements*, Oxford University Press India, 3rd edition (12 April, 2013)

2. Albert D. Helfrick &William D. Cooper, *Modern Electronic Instrumentation and Measurement techniques*, Pearson Education India, 1st edition (1 January, 2015)

Part A

Course No./Course Code :	EEE 314
Course Title :	Measurements and Instrumentation Lab
Course Type	Electrical
Year /Level/Semester/Term :	5th Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 211 Electronic Circuits I
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
With the numerous amount of processes involved, accurate instrumentation is required to make sure operations run smoothly. Engineers must be aware of many factors such as pressure, fluid level, temperature and more. Inaccurate readings can lead to personnel injuries. This course help to deal with these problems.

Course Objective:
This course's goal is to validate the theories and concepts taught in EEE 313. Students will do lab experiments as well as simulations. They will be exposed to laboratory equipment and simulation tools, as well as understand experimental procedures. The students will examine their data and draw meaningful inferences based on their comprehension, while keeping in mind the mistakes and uncertainties in their measurements. This course's goal is to validate the theories and concepts taught in EEE 313.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** functions of the different measuring instruments showing experimental setup.
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture/Tutorial	Lab report/Project/Final exam
CLO2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Conversion of Galvanometer to Ammeter of multiple range.	2	CLO1, CLO2
02	Conversion of Galvanometer to Voltmeter of multiple range.	2	CLO1, CLO2
03-04	Measurement of unknown resistance/ capacitance using Wheatstone Bridge.	2	CLO1, CLO2
05	Study of megger to measure the insulation.	2	CLO1, CLO2
06	Study of Earthing and measurement of earth resistance using the Fall of Potential Method.	2	CLO1, CLO2
07-08	Study on Current transformer (CT) and Potential Transformer (PT) to measure high current and high voltage.	2	CLO1, CLO2
09	Measurement of energy using a single phase energy meter.	2	CLO1, CLO2
10	Power factor measurement using Wattmeter (induction type).	2	CLO1, CLO2
11-12	Introduction to Analog to Digital (A/D) and Digital to Analog (D/A) conversions	2	CLO1, CLO2
13	Mini Project		
14-15	Design of Ac voltmeter using dc voltmeter and rectifier circuit	2	CLO1, CLO2
16-17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Project/Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Reading:

1. A.K. Sawhney, *A course in Electrical and Electronic Measurements and Instrumentation*, Shree Hari Publications, 5th edition (1 January, 2021)

Supplementary Readings:

1. David A. Bell, *Electronic Instrumentation and Measurements*, Oxford University Press India, 3rd edition (12 April, 2013)

2. Albert D. Helfrick &William D. Cooper, *Modern Electronic Instrumentation and Measurement techniques*, Pearson Education India, 1st edition (1 January, 2015)

Part A

Course No./Course Code :	EEE 315
Course Title :	Digital Electronics
Course Type	Core Course
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 211 Electronic Circuits I
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Earlier, Logic circuits were built using bulky and unreliable components such as transistors, resistors, and vacuum tubes, etc. These components existed individually, and circuits built using these components did not perform as expected, mainly due to the interconnections issues that were common in these circuits. The development of integrated circuits played a significant role in solving the problems of logic circuits. These integrated circuits facilitated to place of a large number of transistors and on a single chip.

Course Objective:
Digital Electronics, which are the basic building blocks of a microprocessor, field programmable gate array (FPGA), microcontroller, microcontroller base digital signal

processor (DSP), as well as computer, are introduced in this course to let the students know what activities it does behind the computing environment. This course portrays excellent ideas of the logic gates available and data processing to make students understand the concept better with the analogue and digital signals while computing. This subject presents the theoretical and practical basis for the structure, operation and design of embedded systems with an in-depth treatment of modern hardware components.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** electronic switch with transistor and design the electronic switch with RTL, TTL and CMOS.
CLO2	**Apply** Boolean Algebra, K-map and Tabular method to simplify digital logic circuits.
CLO3	**Construct** basic combinational circuits like Encoder/ Decoder, MUX/ DEMUX, ALU, PLA, ROM and verify their functionalities.
CLO4	**Design** sequential circuits such as Register, Counter, RAM, and verify their Functional Operation.
CLO5	**Design and develop** solution for real life problems

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√	√						√	√		
CLO4		√	√						√	√		
CLO5			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Mini Project/ Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/Mini Project

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

01	Introduction to Digital Electronics	Lecture	Quiz	CLO1
02	Logic Gate: NOT, NOR, OR, NAND, AND, XOR and XNOR,	Lecture	Assignment / Class Test /Midterm Exam	CLO1
03	Logic Families: DTL and ECL	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
04	Logic Families: RTL and CMOS	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Number System: Binary Number, Hex Number, Octal Number, Decimal Number and Number System Conversion	Lecture	Assignment/ Midterm Exam	CLO2
06	Number System: Decimal Number and Number System Conversion	Lecture	Assignment / Midterm Exam	CLO2
07	Boolean Algebra, Numerical Algebra, Application of Boolean Algebra, Practical problem about Boolean algebra	Lecture	Assignment / Class Test /Midterm Exam	CLO2
08	Logic Simplification Method: K-Map and Tabular Method	Lecture / Group Discussion	Presentation/ Midterm Exam	CLO2
Midterm Exam				
09	Combinational Logic Circuit, Encoder, Key Board Design,	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO3
10	Decoder, Seven Segment Display, BCD to Seven Segments Decoder	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO3
11	Multiplexer, De-multiplexer	Lecture	Assignment / Final Exam	CLO3
12	Half adder, Full Adder, 4 bits or N bits Parallel Adder Design , Sub-tractor	Lecture	Assignment / Class Test / Final Exam	CLO3
13	Multiplier and Divisor	Lecture / Group Discussion	Presentation/ Final Exam	CLO3
14	Arithmetic Unit, Logic Unit and ALU design.	Lecture / Video Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO3/ CLO5

15	Flip Flop, Latch, S R Flip Flop, D Flip Flop, J-K Flip Flop, Master Slave Flip Flop	Lecture/ Group Discussion	Assignment/ Mini Project/Final Exam	CLO4
16	Counter, Asynchronous/Synchronous Counter, Up/Down Counter	Lecture	Assignment / Midterm Exam/ Final Exam	CLO4
17	ROM Design and Basic Concept about PLA and PLD	Lecture	Assignment / Class Test Final Exam	CLO4/ CLO5
18	Register, Shift Register, RAM	Lecture / Group Discussion	Presentation/ Final Exam	CLO4/ CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. M. Morris Mano, *Digital Logic and ComputerDesign*, 4th ed.India, Pearson, 2017
2. R P Jain, *Modern Digital Electronics*, 4th ed.India, Tata McGraw-Hill Education, 2009

Supplementary Readings:

1. S Brown and Z Vranesic, *Fundamentals of Digital Logic with Verilog Design*, 3rd ed. McGraw Hill Education, 2013
2. Ronald J. Tocci, Neal Widmer, Greg Moss, Digital *Systems Principles and Applications*, 11th ed. India, Pearson, 2010
3. Malvino and Brown, *Digital Computer Electronics*, 3rd ed. McGraw-Hill Education, 1992

Part A

Course No./Course Code :	EEE 316
Course Title :	Digital Electronics Lab
Course Type	Electronics
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 315 (Digital Electronics)
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The Digital Electronics Laboratory provides students with state-of-the-art computer-based and discrete electronic test equipment to enhance their understanding and experience in digital logic circuit design. Moreover it helps students to understand how digital hardwire works.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 316. This course consists of two parts. In the first part, students will perform experiments to verify practically the theories and concepts learned in EEE 316. In the second part, students will design simple systems using the principles learned in EEE 316. They will carry out experiments using hardware along with software tools. They will gain exposure to equipment and software in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and demonstrate the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to design and analyze the circuits by hardware implementation as well as apply appropriate modern technologies to an assigned task.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy

CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to Digital Laboratory Equipment& ICs	2	CLO1, CLO2
02	To Design a NOT Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation Under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.	2	CLO1, CLO2
03	To Design a NAND/ AND Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation Under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.	2	CLO1, CLO2
04	To Design a NOR/OR Gate Using TTL/RTL Logic and Verify Its Functional Logic Operation under Consideration of Both TTL/RTL Logic and IC of 74LSXX Series.	2	CLO1, CLO2
05	To Design an EX-OR/EX-NOR Gate Using Basic Logic Gate and Verify Its Functional Logic Operation and Also Justify Its Behaviors Using EX-OR/EX-NOR.	2	CLO1, CLO2
06	To Design an All Basic Logic Gate Using NAND/NOR Gate and Verify their Functional Logic Operation.	2	CLO1, CLO2
07	To Design a J-K/S-R Flip Flop Using Only universal Gate and Verify Its Functional Operation and Also Justify Its Behaviors Using Direct J-K Flip Flop IC of 74LSXX Series.	2	CLO1, CLO2
08	To Design 4 Bit Shift Register Using a Flip Flop and Verify Its Functional Operation and Also Justify Its Behaviors Using Direct 4 Bit Shift Register IC of 74LSXX Series.	2	CLO1, CLO2
09	To Design a Mod-4/Mod-10/Mod-12 Ripple Counter Using J-K Flip Flop and Verify Its Functional Operation.	2	CLO1, CLO2
10	To Design 2-4 Decoders Using Only Basic logic Gate and also study of BCD to Seven Segment Decoder.	2	CLO1, CLO2
11	To Design an 8-3/4-2 Encoder Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Encoder.	2	CLO1, CLO2
12	To Design an 8-1/4-1 Multiplexer Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Multiplexer.	2	CLO1, CLO2
13	Mini Project		
14	To Design a 1-8/1-4 De-multiplexer Using Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of De-multiplexer.	2	CLO1, CLO2

15	To Design a Single Bit Full Adder Logic Circuit Using only Basic Logic Gate and Verify Its Functional Operation and Also Test the IC of Single Bit Full Adder.	2	CLO1, CLO2
16	To Design a 4-Bit Parallel Adder Using Single Bit Full Adder Logic Circuit and Verify Its Functional Operation and Also Test the IC of 4-Bit Parallel Adder. Finally Display the Output on Digital Screen using BCD to 7 Segment Decoder.	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. M. Morris Mano, *Digital Logic and ComputerDesign*, 4th ed.India, Pearson, 2017
2. R P Jain, *Modern Digital Electronics*, 4th ed.India, Tata McGraw-Hill Education, 2009

Supplementary Readings:

1. S Brown and Z Vranesic, *Fundamentals of Digital Logic with Verilog Design*, 3rd ed. McGraw Hill Education, 2013
2. Ronald J. Tocci, Neal Widmer, Greg Moss, Digital *Systems Principles and Applications*, 11th ed. India, Pearson, 2010
3. Malvino and Brown, *Digital Computer Electronics*, 3rd ed. McGraw-Hill Education, 1992

Part A

Course No./Course Code :	EEE 318
Course Title :	Electrical and Electronic Circuit Simulation Lab
Course Type	Core course
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 121 Electrical Circuits II and EEE 221 Electronic Circuits II

Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Electrical and Electronic Engineering (EEE) education is now in a transitional period. On the one hand, EEE courses throughout the world are becoming more specialized. The usage of specialist CAD and simulation software as instructional aids is growing. To improve students' skills, widely used tools like as SPICE, Proteus and MATLAB have been introduced into the undergraduate program.

Course Objective:

This course's goal is to validate the theories and concepts taught in EEE 111, EEE 121, EEE 211, and EEE 221 using simulation tool.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Design and Simulate** different circuits using modern simulation tools. (PSPICE, Proteus).
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	**Teaching-Learning Strategy**	**Assessment Strategy**
COL1	Lab demonstration/ Lecture/Tutorial	Lab report/Project/Final exam
COL2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	**Experiment title**	**Hrs**	**CLOs**

1	PSPICE simulation of different types of theorems for dc circuits.	2	CLO1, CLO2
2	Simulation of Transient response of RLC Circuit To an input (i) step (ii) pulse and (iii) Sinusoidal signals using PSPICE.	2	CLO1, CLO2
3	PSPICE Simulation Of Different Types Of Theorems For Ac Circuits.	2	CLO1, CLO2
4	PSPICE Simulation Of Experiment 2, 3, 4 Using Netlist Coding.	2	CLO1, CLO2
5	Modeling of transformer and PSPICE simulation of a lossy transmission line.	2	CLO1, CLO2
6-7	Study of Operational amplifier as an inverter, Adder, Integrator using PSPICE.	4	CLO1, CLO2
8	Study of Differentiator, Non-Inverting Amplifier, Voltage follower (Buffer) and Comparator using Proteus Simulation.	2	CLO1, CLO2
9	Proteus Simulation of different types of active filters using Operational Amplifier.	2	CLO1, CLO2
10-11	Draw V-I Characteristics of PN Junction Diode using both PSPICE and Proteus.	2	CLO1, CLO2
12	Study of wave shapes of different types of clipping and clamping circuit's simulation using both PSPICE and Proteus.	4	CLO1, CLO2
13	Study of Common Emitter, Common Collector, Common Base BJT characteristics using both PSPICE and Proteus.	2	CLO1, CLO2
14	Introduction to PCB design using Proteus.	2	CLO1, CLO2
15-16	PCB design of Voltage regulator using Proteus.	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Project/Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Muhammad H. Rashid, ***Introduction to PSpice using OrCAD for Circuits and Electronics***, Pearson Education India, 3rd edition (1 January 2015)
2. George Shopov, ***Proteus PCB design Examples,*** Pearson Education India,(4 September, 2019)

Supplementary Readings:

1. Robert Boylestad, ***Electronic Devices and Circuit Theory***, Pearson; 11th edition (20 April, 2012).

2. Ramakant A. Gayakwad, ***Op-amps and Linear Integrated Circuits,*** Pearson Education; Fourth edition (31 March 2021)
3. C. K Alexander and M. N O Sadiku, ***Fundamentals of Electric Circuits***, McGraw-Hill Education; 6th edition (January 13, 2016)

Part A

Course No./Course Code :	EEE 321
Course Title :	Power System I
Course Type	Core Course
Year /Level/Semester/Term :	Sixth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 103
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Power systems are complex networks of generators and loads interconnected via transmission line, distribution lines, and various types of equipment and apparatus (transformers, circuit breakers, switchgear etc). Modern power systems have grown larger and more geographically expansive with many interconnections between neighboring systems and neighboring countries power systems. An overview of modern power systems meeting present and future challenges involves understanding the fast-changing structure of this system, the behavior of its components under steady state, and dynamic and transient conditions. This course helps with an understanding to evaluate the response of this complex system to variable loads, and to determine how this system can be controlled to supply the loads reliable quality power i.e the variation of voltage and frequency at the user end should within the tolerance. After completing this course successfully students should be able to work efficiently in design and operation of a modern power system.

Course Objective:
The objective of this course are to:

1. Explain the importance of power system and operation of different types of power plants.
2. Demonstrate the modeling of power system and transmission lines.
3. Introduce the methods of load flow study in a power system.
4. Discuss the symmetrical and asymmetrical fault analysis in power system.

Course Content:

Introduction: Objective and importance of the course, Course Outcomes, an overview of power system of Bangladesh, AC and DC transmissions. Review of basic concepts of AC circuits. Network representation: single line and reactance diagram of power system and per unit representation. Line representation: equivalent circuit of short, medium and long lines. Reactive compensation of lines. Power flow control: Tap Changing transformer, Phase shifting, booster and regulating transformer and shunt capacitor. Load flow: Gauss-Siedel and Newton-Raphson Methods. Fault analysis: Symmetrical and Unsymmetrical fault analysis. Power plants: types, general layout of thermal power plant, and major components of gas turbine, steam turbine and combined cycle power plants. Load curves: Demand factor, diversity factor, load duration curves, energy load curves, load factor, capacity factor and plant factor. Protection: Introduction to circuit breakers. Typical Layout of a substation.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Explain** the operation of different types of power plants, load curves and **Comprehend** the transmission line modeling in power system.
CLO2	**Analyze** the load flow in power system applying Gauss-Seidel/Newton-Raphson methods.
CLO3	**Simulate** a specific power system using MATLAB/Power world simulator for load flow study and determine the real and reactive power flow.
CLO4	**Develop** the solution for fault analysis in power system.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√	√										
CLO3	√	√	√									
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Class Test / Midterm Exam/ Final Exam

CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Introduction: Objective and importance of the course, Course Outcomes, an overview of power system of Bangladesh.	Lecture	Quiz	CLO1
02	AC and DC transmissions.	Lecture	Class Test/Midterm Exam	CLO1
03	Review of basic concepts of AC circuits.	Lecture / Group Discussion	Assignment / Class Test / Midterm Exam	CLO1
04	Network representation: single line and reactance diagram of power system and per unit representation.	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
05	Line representation: equivalent circuit of short, medium and long lines.	Lecture	Assignment/ Midterm Exam	CLO1
06	Reactive compensation of lines.	Lecture	Assignment / Class Test/ Midterm Exam	CLO3
07	Power flow control	Lecture/ Group Discussion	Class Test / Midterm Exam	CLO3
08	Tap Changing transformer, Phase shifting, booster and regulating transformer and shunt capacitor.	Lecture / Group Discussion	Presentation/ Class Test/ Midterm Exam	CLO1
Mid Term Examination				
09	Load flow: Gauss-Siedel method	Lecture / Group Discussion	Presentation/ Class Test / Final Exam	CLO2

10	Load flow: Newton-Raphson Method	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam	CLO2
11	Fault analysis: Symmetrical fault analysis.	Lecture/ Group Discussion	Class Test / Final Exam	CLO4
12	Fault analysis: Unsymmetrical fault analysis.	Lecture/ Group Discussion	Assignment / Class Test / Final Exam	CLO4
13	Power plants: types, general layout of thermal power plant.	Lecture / Group Discussion	Presentation/ Final Exam	CLO1
14	Power plants: major components of gas turbine, steam turbine and combined cycle power plants.	Lecture	Presentation/ Class Test / Final Exam	CLO1
15	Load curves: Demand factor, diversity factor.	Lecture/ Group Discussion	Class Test/ Final Exam	CLO1
16	Load duration curves, energy load curves.	Lecture/ Group Discussion	Assignment/ Final Exam	CLO1
17	Load factor, capacity factor and plant factor	Lecture/ Group Discussion	Assignment / Midterm Exam/ Final Exam	CLO1
18	Protection: Introduction to circuit breakers. Typical Layout of a substation.	Lecture/ Group Discussion	Assignment / Class Test/ Final Exam	CLO1
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. D P Kothari & I. J. Nagrath; *Power System Engineering*, MC GRAW HILL INDIA;

3rd edition, January 1, 2019.

Supplementary Readings:

1. J. Grainger and W. D. Stevenson, *Power System Analysis*, McGraw-Hill Education, 1st edition, January 1, 1994.

Part A

Course No./Course Code :	EEE 322
Course Title :	Electrical Service Design
Course Type	Electrical
Year /Level/Semester/Term :	Fifth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	MEC 112 (Engineering Drawing)
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Design of Electrical Services for Buildings provides a basic grounding for students and graduates in the field. It covers methods of wiring, schemes of distribution and protection for lighting and power installations. Systems such as alarms and standby supplies are also covered.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 322. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Design** a floor with electrical wiring in AUTOCAD Software.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1									√	√		

CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam
CLO2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to the Electrical Service Design	2	CLO1, CLO2
02	Introduction to Electrical & Electronic symbols. Tools: Screw drivers, Pliers, Hammers, Wooden saw, Hand drill, Twist drill.	2	CLO1, CLO2
03	Wire Splicing & Termination: Necessity of wire splicing & termination, Western Union Splice, Married Joint Splice.	2	CLO1, CLO2
04	Single Branch Splice, Double Branch Splice, Tap Joint for Stranded Wires, Flexible Cord Splicing, Pigtail joint.	2	CLO1, CLO2
05	Switches: Surface Switch, Flush Switch, Pull Switch, Grid Switch, Architrave Switch, Rotary Snap Switch	2	CLO1, CLO2
06	Push Button Switch, Quick Break Knife Switch, Lamp Holders, Socket Outlet, Main Switch, Distribution Fuse Board.	2	CLO1, CLO2
07	Protective devices: Relay, Circuit Breaker	2	CLO1, CLO2
08	Protective devices: Fuse.	2	CLO1, CLO2
09	Illumination: Fluorescent Lamp with thermal starter & glow starter.	2	CLO1, CLO2
10	Problems on Illumination Theory.	2	CLO1, CLO2
11	Internal wiring of a building with 3φ Supply	2	CLO1, CLO2
12	Internal wiring of a building with 1φ Supply	2	CLO1, CLO2
13	Mini Project		
14	Lamp circuits: Simple circuit for bed room & staircase, series parallel circuit.	2	CLO1, CLO2
15	Introduction to AUTOCAD software with basic symbols and instruction.	2	CLO1, CLO2
16	Design a floor with electrical wiring in AUTOCAD Software.	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Paul F. Richard,*Introduction to AutoCAD 2020: A modern Perspective***,**Macromedia Press; 1st edition (July 29, 2019).

Supplementary Readings:

1. David A. Madsen, David P. Madsen, *Engineering Drawing and Design (Drafting Series)***,** Cengage Learning; 5th edition (June 8, 2011)
2. William H. Clark**,** *Electrical Design Guide for Commercial Buildings*,McGraw-Hill Education TAB; 1st edition (July 22, 1998)

Part A

Course No./Course Code :	EEE 323
Course Title :	Digital Signal Processing
Course Type	Core Course
Year /Level/Semester/Term :	Sixth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 225 Signals and Linear Systems Analysis
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Digital Signal Processors (DSP) take real-world signals like voice, audio, video, temperature, pressure, or position that have been digitized and then mathematically manipulate them. Signal processing is integral in searching for life beyond Earth. An important aspect to effective communications across satellite, video, radio and wireless systems, signal processing makes the processing and transmission of data more efficient. Digital signal processing (DSP) is the use of digital processing, such as by computers or more specialized digital signal processors, to perform a wide variety of signal processing operations. The digital signals processed in this manner are a sequence of numbers that represent samples of a continuous variable in a domain such as time, space, or frequency.

Course Objective:

Digital signal processing is mathematically modeled as a function or a sequence of numbers that represent the state or behavior of a physical system. This course provides the fundamental theories and techniques to construct modern information systems. The course offers the ability to represent signals in time, frequency, z and discrete frequency domains as well as to analyze the systems and to design digital filter.

The course is a prerequisite course for further studying of other multimedia related courses, such as speech processing, image processing, audio and video data compressing, pattern recognition, communication systems, biomedical signal processing etc. To accomplish thesis and research on modern interests and topics, this course is necessary step.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Remember** the definitions of signal, systems and their discrete-time and continuous time representation using the concepts of trigonometry, complex algebra and acquire knowledge about Systems.
CLO2	**Apply** Fourier transform and z-transform in solving real life problems.
CLO3	**Apply** different properties of the transform equations to design, implement, analyze and compare the digital filters for processing of discrete-time signals.
CLO4	**Analyze** various transfer domain representation in designing filters and integrate computer-based tools for engineering applications and employing signal processing strategies.
CLO5	**Develop** creative and innovative designs that achieve desired performance criteria within specified objectives and constraints.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									
CLO4			√	√	√							
CLO5			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Class Test/ Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/ Mini Project/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01-02	Introduction to Digital Signal Processing	Lecture, Group discussion	Quiz/ Mid-term/ Assignment	CLO1, CLO3, CLO4
03-05	Discrete-Time Signals and Systems	Lecture, Group discussion	Mid-term/ Class Test/ Assignment	CLO2, CLO3, CLO4
06-08	The z-Transform and Its Application to the Analysis of LTI Systems	Lecture, Group discussion	Mid-term/ Class Test/ Assignment	CLO2, CLO3, CLO4
09-10	Frequency Analysis of Signals	Lecture / Group Discussion	Assignment / Presentation/ Midterm Exam	CLO2
Midterm Exam				
11-12	The Discrete Fourier Transform: Its Properties and Applications	Lecture / Group Discussion/ Video presentation	Presentation/ Class Test / Final Exam	CLO2, CLO3
13-14	Frequency-Domain Analysis of LTI Systems	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO2, CLO3, CLO4
15-18	Design of Digital Filters	Lecture/ Group discussion/ Video presentation	Final Exam/ Mini Project/ Presentation/ Assignment	CLO2, CLO3, CLO4, CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. John G. Proakis & Dimitris K Manolakis, *Digital Signal Processing: Principles, Algorithms & Application* (4^{th} Edition), Prentice Hall, 2006.

Supplementary Readings:

1. S. Mitra, *Digital Signal Processing-A computer based approach*, The MIT Press, 2007.
2. B.P. Lathi, *Signal Processing and Linear System (1^{st} Edition)*, Oxford University Press, USA, 2000
3. Robert J. Schilling, S.L. Harris, *Fundamental of Digital Signal Processing using MATLAB* (2^{nd} Edition), CL-Engineering, 2011.
4. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, *Discrete Time Signal Processing* (2^{nd} Edition), Prentice Hall, 1999.
5. Sen M. Kuo, Bob H. Lee, Wenshun Tian, *Real-Time Digital Signal Processing: Implementation and Application* (2^{nd} Edition), *Wiley, 2006*.

Part A

Course No./Course Code :	EEE 324
Course Title :	Digital Signal Processing Lab
Course Type	Core course
Year /Level/Semester/Term :	Sixth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 323 (Digital Signal Processing)
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
The area of digital signal processing has advanced rapidly over the last four decades. This advancement is attributed to the progress in digital computer technology and integrated circuit fabrications. This lab introduces students to DSP design and analysis techniques that are core knowledge for DSP engineers, and which serve as solid grounding for advanced level work in DSP. This lab aims at supporting the teaching and research activities in the area of DSP, which are either currently being.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 333. The students will carry out experiments using hardware along with simulation tool. They will gain exposure to equipment and simulation tool in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their calculations.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group

	project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge for signal generation, processing and filter design using MATLAB and also by hardware implementation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam/ Peer Review/ Observation
CLO2	Lab demonstration/ Lecture	Lab report/Final exam/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	*Topics*	*Hrs*	*CLOs*
1	Introduction to MATLAB and Generation of Continuous time signal and Discrete time signal using MATLAB.	2	CLO1
2	Generation of different types of basic signals (Unit step signal, Impulse signal, Ramp signal, Exponential signal) using MATLAB.	2	CLO1
3	Frequency-domain representation of discrete-time signals and systems.	2	CLO1
4	Summation and Multiplication of sinusoidal signal for both Continuous time and Discrete time signal using MATLAB.	2	CLO1
5	Verification of Sampling Theorem, Aliasing and Spectrum analysis of sampled signals.	2	CLO1
6	DTFT of finite-length signals in MATLAB and their spectra.	2	CLO1
7	Impulse response of a given system.	2	CLO1
8	Linear Convolution of two given systems.	2	CLO1
9	Folding and Time Shifting operation of any sinusoidal signal using MATLAB.	2	CLO1
10	Auto correlation of a given sequence and verification its properties.	2	CLO1
11	z-Transformation and LTI system analysis in MATLAB.	2	CLO1

12	Write the MATLAB code for Fast Fourier Transform of any sinusoidal signal.	2	CLO1
13	FIR/IIR Filters using pole-zero placement.	2	CLO1, CLO2
14	Linear phase FIR filter design using window method in MATLAB.	2	CLO1, CLO2
15	IIR filter design using impulse invariance.	2	CLO1, CLO2
16	Perform Fast Fourier Transform of any sinusoidal signal using FPGA board.	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial/ Presentation	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. John G. Proakis & Dimitris K Manolakis, *Digital Signal Processing: Principles, Algorithms & Application* (4^{th} Edition), Prentice Hall, 2006.

Supplementary Readings:

1. S. Mitra, *Digital Signal Processing-A computer based approach*, The MIT Press, 2007.
2. Robert J. Schilling, S.L. Harris, *Fundamental of Digital Signal Processing using MATLAB* (2^{nd} Edition), CL-Engineering, 2011.
3. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, *Discrete Time Signal Processing* (2^{nd} Edition), Prentice Hall, 1999.

Part A

Course No./Course Code:	EEE 325
Course Title:	Electrical Properties of Materials
Course Type	Core Course
Year /Level/Semester/Term:	Fifth semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**

Prerequisite:	PHY 201, CHEM 301
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Electrical property refers to the response of a material to an applied electric field. The electric conductivity is one of key properties. One of the principal characteristics of materials is their ability (or lack of ability) to conduct electrical current. Indeed, materials are classified by this property, that is, they are divided into conductors, semiconductors, and nonconductors. With the advancement of material science and the techniques for processing materials, a wide range of materials are now available for any imaginable applications particularly in the field of electrical engineering.

Course Objective:
The advancement of material science and the techniques for synthesizing materials, a wide range of materials are now ubiquitous for any applications and in fact, in the field of electrical engineering. When selecting a material for a given application the material properties must satisfy the function and the operating conditions of the component or the structure being designed. One of the most important properties of material is electrical properties, which directly influence the choice of material. Electrical properties are their ability to conduct electrical current. Various electrical properties are resistivity, electrical conductivity, temperature coefficient of resistance, dielectric strength and thermoelectricity. This course will help to understand and evaluate Electrical, Thermal, Optical and Magnetic properties of materials so that a thorough understanding of the characteristics of materials can be obtained to facilitate the manufacturing technology.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the crystal structures of the materials, concept of solids, and band theory of solids.
CLO2	**Understand** classical theory of electrical and thermal conduction in solids.
CLO3	**Explain** the wave nature of electrons, Schrödinger's equation, one dimensional quantum problems infinite quantum well, potential step and potential barriers, Heisenberg's uncertainty principle and quantum dot.
CLO4	**Explain** the dielectric and magnetic properties of materials and **familiarize** with the concepts of super conductivity and nanotechnology.

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√	√										
CLO2	√											
CLO3	√											
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid-term exam, Assignment, Class Test
CLO2	Class Lecture	Mid-term exam, Assignment, Class Test
CLO3	Class Lecture	Final exam, Assignment, Class Test
CLO4	Class Lecture	Final exam, Assignments, Class Test

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1-2	**Crystal structures**: Types of crystals, lattice and basis, Bravais lattice and Miller indices.	Class Lecture	Mid Term Exam/Class Test.	CLO1
3-5	**Classical theory of electrical and thermal conduction**: scattering, mobility and resistivity, temperature dependence of metal resistivity, Mathiessen's rule, Hall effect and thermal conductivity.	Class Lecture	Mid Term Exam/Assignment/Class Test.	CLO1, CLO2
6-8	**Band theory of solids**: Band theory from molecular orbital, Bloch theorem, Kronig-Penny model, effective mass, density of states. **Carrier statistics**: Maxwell-Boltzmann and Fermi-Dirac distributions, Fermi energy.	Class Lecture	Mid Term Exam/Assignment.	CLO1,CLO2
Mid Term Exam				
9-11	**Introduction to quantum mechanics**: Wave nature of electrons, Schrödinger's equation, one dimensional quantum problems, infinite quantum well, potential step and potential barriers, Heisenberg's uncertainty principle and quantum box.	Class Lecture	Assignment/ Class Test/ Final Exam	CLO3
12-14	**Dielectric properties of materials**: Dielectric constant, polarization-electronic, ionic and orientational; internal field, Clausius-Mosotti equation, spontaneous polarization, frequency, dependence of dielectric	Class Lecture	Class Test / Final Exam	CLO4

	constant, dielectric loss and piezoelectricity.			
15-16	**Magnetic properties of materials**: Magnetic moment, magnetization and relative permittivity, different types of magnetic materials, origin of ferromagnetism and magnetic domains.	Class Lecture	Assignment / Final Exam	CLO4
17-18	**Magnetic properties of materials**: Introduction to superconductivity: Zero resistance and Meissner effect, Type I and Type II superconductors and critical current density.	Class Lecture	Class Test / Final Exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. S.O. Kasap, *Principles of Electronic Materials and Devices* ,3rd ed. NY, USA; McGraw-Hill Publications,2006.

Supplementary Readings:

1. Robert F. Pierret, *Advanced Semiconductor Fundamentals*, 2nd ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2015.
2. L. Solymar, D. Walsh, R.R.A. Syms, *Electrical properties of materials*, 9th ed. Oxford, UK: Oxford University Press, 2014.
3. Rolf E. Hummel, *Electrical properties of materials*, 4th ed. NY, USA: Springer Publications,2011.

Part A

Course No./Course Code :	EEE 328
Course Title :	Industrial Power Electronics Lab
Course Type	Core Course

Year /Level/Semester/Term :	Sixth Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 327 Industrial Power Electronics
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Power electronics studies the application of semiconductor devices to the conversion and control of electrical energy. The field is driving an era of rapid change in all aspects of electrical energy. The laboratory course provides instruction in general lab practices, measurement methods, and with the design and operation of several common circuits relevant to the field of power electronics. It also provides experience with common components such as motors, batteries, magnetic devices, and power semiconductors. The course has a significant design component.

Course Objective: By the end of this course, students should be able to:
1. CLOlect data and revise an experimental procedure iteratively and reflectively,
2. Evaluate the process and outcomes of an experiment quantitatively and qualitatively,
3. Extend the scope of an investigation whether or not results come out as expected,
4. Communicate the process and outcomes of an experiment,
5. Conduct an experiment CLOlaboratively and ethically.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** experiments based on power electronics devices and **Design** real life applications.
CLO2	**Write** comprehensive reports on the work done in laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1			√		√							
CLO2										√		

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
1	Introduction to Industrial Power Electronics	2	CLO1, CLO2
2	Study of Diode characteristics and Zener diode characteristics.	2	CLO1,CLO2
3	Study of the switching properties of BJT and MOSFET.	2	CLO1,CLO2

4	Study of the switching properties of SCR, TRIAC	2	CLO1,CLO2
5	Study of the switching properties of DIAC and IGBT.	2	CLO1,CLO2
6	Study of single-phase uncontrolled half wave and full wave rectifiers.	2	CLO1,CLO2
7	Study of single phase controlled half wave and full wave rectifiers.	2	CLO1,CLO2
8	Study of Buck and Boost converter	2	CLO1,CLO2
9	Study of Buck-Boost and Cuk converters.	2	CLO1,CLO2
10	Study of Sepic and Zeta converters.	2	CLO1,CLO2
11	Study of single-phase half bridge inverter.	2	CLO1,CLO2
12	Study of single-phase full bridge inverter.	2	CLO1,CLO2
13	**Mini Project**		
14	Study of three phase inverter circuit.	2	CLO1,CLO2
15	Study of single-phase voltage controller.	2	CLO1,CLO2
16	Study of three phase voltage controller.	2	CLO1,CLO2
17	**Project Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Muhammad Rashid, *Power Electronics: Circuits, Devices & Applications, Pearson; 4th edition (July 19, 2013)*

Supplementary Readings:

1. Ned Mohan, *Power Electronics: A First course, Wiley; 1st edition (October 18, 2011)*
2. Jhon willy, *Principles of electric machines and power electronics, Wiley; 3rd edition (September 23, 2013)*
3. Timothy J. Maloney, *Modern Industrial Electronics, Prentice Hall; 5th Revised ed. edition (July 30, 2003)*

Part A

Course Code :	EEE 411
Course Title:	**Microprocessors and Embedded Systems**

Course Type:	Core Course
Year Level/Semester/Term:	Sixth semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**
Pre-requisite:	CSE 121, EEE 315
Credit Value:	3
Contact Hours:	36
Total Marks:	100

Rationale of the Course:

Microprocessors, microcontroller and assembly language have been the most used methods of incorporating intelligence into automated devices. It is, therefore, necessary to develop a good understanding of their operation and how they can be used as building blocks for automated systems and control applications. This course explores the inner workings of a microprocessor from the programmer's perspective and several laboratory exercises will be based on microprocessor utilizing the assembly language.

Course Objective:

Microprocessor as well as microcontroller is a required course for under-graduate students in the EEE program. The purpose of this course is to teach students the fundamentals of microprocessor and microcontroller systems. The student will be able to incorporate these concepts into their electronic designs for other courses where control can be achieved via a microprocessor or controller implementation. Topics include Semiconductor memory devices and systems, microcomputer architecture, assembly language programming, I/O programming, I/O interface design, I/O peripheral devices, data communications, and data acquisition systems.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the main components and working principals of the 8086 along with 8085 microprocessor.
CLO2	**Interpret** instruction sets in assembly language.
CLO3	**Demonstrate** memory interfacing and input/output device programming in assembly language.
CLO4	**Design** the solution of real life problems using microcontroller and microprocessor.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4			√		√				√			

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exams
CLO4	Lecture Tutorial	Final Exams and Mini project

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), Teaching learning and assessment strategy mapped with CLOs.

Week	Topics	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
1	**Introduction and the 80x85 Microprocessor**	Lecture and Presentation	Assignment, Class test Midterm	CLO1
2-3	**Introduction and the 80x86 Microprocessor**	Lecture and Presentation	Assignment, Class test Midterm	CLO1
4	**Basic Computer Architecture**	Lecture and Presentation	Assignment, Midterm	CLO1
5-7	**Assembly Language Programming**	Lecture and Presentation	Assignment, Class test Midterm and Final exam	CLO2, CLO4
Mid Term Exam				
8-10	**Introduction to 8086 programming with C language**	Lecture and Presentation	Assignment, Class test and Final exam	CLO3, CLO4
11-14	**Hardware Interfacing with Intel 8086 microprocessor**	Lecture and Presentation	Assignment, Class test and Final exam	CLO3, CLO4
15-18	**Introduction to Microcontrollers**	Lecture and Presentation	Assignment, and Final exam	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Barry B. Brey, *The Intel Microprocessors*, 8^{th} Edition, Pearson.

Supplementary Readings:

1. Mohammed Rafiquzzaman, *Microprocessors and Microcomputer-Based System Design*, 2^{nd} Edition, CRC Press.
2. Albert P. Malvino and Jerald A. Brown, *Digital Computer Electronics*, 3^{rd} Edition, MC-GRAW HILL INDIA.
3. Ytha Yu and Charles Marut, *Assembly Language Programming and Organization of the IBM PC*, 1^{st} Edition, McGraw-Hill/Irwin.

Part A

Course Code :	EEE 412
Course Title:	**Microprocessors and Embedded Systems Lab**
Course Type:	Core Course
Year Level/Semester/Term:	Sixth Semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**
Pre-requisite:	EEE 411 (Microprocessor and Embedded Systems)
Credit Value:	1.5
Contact Hours:	36
Total Marks:	100

Rationale of the Course:
Microprocessors and assembly language has been the most used methods of incorporating intelligence into automated devices. It is, therefore, necessary to develop a good understanding of their operation. This course explores the inner workings of a microprocessor from the programmer’s perspective and several laboratory exercises will be based on microprocessor utilizing the assembly language.

Course Objective:
In this course students will perform experiments to verify practically the theories and concepts based in EEE 411. The students will carry out lab experiments and/or will perform simulation. They will learn about different equipment’s and their functions.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** experiments based on Assembly language, MDA trainer board and related software
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√				√							
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course plan specifying content, CLOs, co-curricular activities (if any), Teaching learning and assessment strategy mapped with CLOs.

Weeks	Experiment Name	Hrs	Corresponding CLOs
1	Implementation of mathematical operation in Emulator8085 using Assembly language programming	2	CLO1, CLO2
2	Implementation of addition and subtraction in Emulator8086 using Assembly language programming	2	CLO1, CLO2
3	Implementation of multiplication and division in Emulator8086 using Assembly language programming	2	CLO1, CLO2
4	Solving simple logical problems using Assembly language programming	2	CLO1, CLO2
5	Implementation of shifting and rotation in Emulator8086 using Assembly language programming	2	CLO1, CLO2
6	Finding odd or even numbers in Emulator8086 using Assembly language programming	2	CLO1, CLO2
7	Introducing 8085 and 8086 Trainer Board	2	CLO1, CLO2
8	Executing simple instructions in the 8085 and 8086 Trainer Board	2	CLO1, CLO2
9	Observation Dot matrix using Microprocessor Trainer Board and PC	2	CLO1, CLO2
10	7 segment LED display using Microprocessor Trainer Board and PC	2	CLO1, CLO2
11	Implementation of counter using digital input/output port with PIC/AVR Microcontroller.	2	CLO1, CLO2

12	Interfacing of ultrasonic sensor using timers/PWM module with PIC/AVR Microcontroller.	2	CLO1, CLO2
13	Interfacing of temperature sensor using A/D module with PIC/AVR Microcontroller.	2	CLO1, CLO2
14	Interfacing of GSM module with USART module of PIC/AVR Microcontroller.	2	CLO1, CLO2

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Barry B. Brey, *The Intel Microprocessors*, 8th Edition, Pearson.

Supplementary Readings:

1. Mohammed Rafiquzzaman, *Microprocessors and Microcomputer-Based System Design*, 2nd Edition, CRC Press.
2. Albert P. Malvino and Jerald A. Brown, *Digital Computer Electronics*, 3rd Edition, MC-GRAW HILL INDIA.
3. Ytha Yu and Charles Marut, *Assembly Language Programming and Organization of the IBM PC*, 1st Edition, McGraw-Hill/Irwin.

Part A

Course No./Course Code:	EEE 413
Course Title:	Solid State Device
Course Type	Core Course
Year /Level/Semester/Term:	Seventh semester
Academic Session:	**TBA**
Course Teacher/Instructor:	**TBA**
Prerequisite:	EEE 211 (Electronic circuits I)
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Solid-state devices are the controlling components of both high-tech and very ordinary devices. Their widespread usage is related to the fact that they can be utilized to interface with all human senses. The first applications of solid-state devices were the use of transistors in radios and amplifiers that interface with our sense of hearing. At the beginning of the twenty-first century, there were more solid-state devices produced than any other manufactured thing. More than ten billion components are fabricated onto a single eight-inch silicon wafer. During the 1940s the jobs of simple solid-state devices were performed with vacuum tubes and mechanical relays. The invention of the transistor in 1947 at Bell Laboratories ushered in an electronic age, beginning with telephones and radios and eventually providing ever smaller and faster computers, more efficient lighting, a means to harvest electrical energy from the sun and much more.

Course Objective:
Solid state device is an updated course for comprehending electronics in a depth way. It’s sometimes called semiconductor physics. In this course, students will be given a clear concept of basic quantum mechanics, quantum nature of solids, the formation of energy bands and a detailed discussion of how energy band diagrams come from. In the earlier course of Electronics-I, students were provided the notion of Diode, BJT and MOSFET as their behavior as circuit elements. But in this course, they will be mastered in their physics like how a hole and electron generate and recombine and after that how their energy band will look like and by the end, students will be able to implement their study in process fabrication in near future. The new era is no longer going forward to concise the device size rather accepting an alternative option like choosing semiconductor materials as what we can see in heterojunction devices is built up with mixed materials. This course will also mirror another amazing idea to make devices faster like quantum tunneling using Schottky diodes.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Comprehend** energy band diagram of semiconductors, carrier concentrations **solve** related mathematical problems
CLO2	**Explain** the theory of excess carrier generation and recombination and **solve** related mathematical problems
CLO3	**Interpret** the basic structure and characteristics of P-N junction, Metal-Semiconductor junction and **solve** related mathematical problems
CLO4	**Understand** the construction, operation and characteristics of BJT
CLO5	**Describe** the construction, operation and characteristics of FET and **solve** related mathematical problems

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√											
CLO5	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Class Lecture	Mid Term Exam/Class Test.
CLO2	Class Lecture	Mid Term Exam/Assignment/Class Test.
CLO3	Class Lecture	Mid Term Exam/Final Exam, Assignment.
CLO4	Class Lecture	Final Exam/Assignment/Class Test.
CLO5	Class Lecture	Final Exam/Assignment/Class Test.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1-2	**Semiconductors in equilibrium:** Energy bands, intrinsic and extrinsic semiconductors, Fermi levels, electron and hole concentrations.	Class Lecture	Mid Term Exam/Class Test.	CLO1
3-6	**Semiconductors in equilibrium:** Temperature dependence of carrier concentrations and invariance of Fermi level. **Carrier transport processes and excess carriers:** Drift and diffusion, generation and recombination of excess carriers, built-in-field, recombination-generation SRH formula, surface recombination, Einstein relations, continuity and diffusion equations for holes and electrons and quasi-Fermi level.	Class Lecture	Mid Term Exam/Assignment/Class Test.	CLO1, CLO2
7-8	**PN junction:** Basic structure, equilibrium conditions, contact potential, equilibrium Fermi level, space charge, non-	Class Lecture	Mid Term Exam/ Assignment.	CLO3

	equilibrium condition			
Mid Term Exam				
9-10	**PN junction:** Forward and reverse bias, carrier injection, minority and majority carrier currents, transient and AC conditions, time variation of stored charge, reverse recovery transient and capacitance. **Metal-semiconductor junction:** Energy band diagram of metal semiconductor junctions, rectifying and ohmic contacts, Schottky contact.	Class Lecture	Assignment / Final Exam	CLO3
11-12	**Bipolar Junction Transistor:** Basic principle of pnp and npn transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, terminal currents	Class Lecture	Class Test / Final Exam	CLO4
13-14	**Bipolar Junction Transistor:** coupled-diode model and charge control analysis, Ebers-Moll model and circuit synthesis. BJT non-ideal effects; Hetero-junction transistors.	Class Lecture	Assignment / Final Exam	CLO4
15-16	**MOS structure:** MOS capacitor, energy band diagrams and flat band voltage, threshold voltage and control of threshold voltage, static C-V characteristics, qualitative theory of MOSFET operation	Class Lecture	Class Test / Final Exam	CLO5
17-18	**MOS structure:** Body effect and current-voltage relationship of a MOSFET. Non-ideal characteristics of MOSFET: channel-length modulation and short-channel effects in MOSFETs. MOS scaling.	Class Lecture	Assignment / Final Exam	CLO5
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Neamen, Donald A. *Semiconductor Physics and Devices: Basic Principles*, 4th edition, New York, NY: McGraw-Hill, 2012.

Supplementary Readings:

1. Sze, S. M., Ng, K. K., & Li, Y. *Physics of semiconductor devices*.3rd edition, Hoboken, NJ, USA: Wiley, 2021
2. Streetman, B. G. *Solid State Electronic Devices*, 2nd edition Englewood Cliffs (New Jersey): Prentice-Hall,1990.
3. Pierret, R. F. *Semiconductor device fundamentals*, 2nd edition, New Delhi (India): Pearson/Education,2008.

Part A

Course Code:	EEE 415
Course Title:	Control Systems
Course Type:	Core Course
Year/ Level/ Semester/ Term:	Seventh Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	EEE 327 Industrial and Power Electronics
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:
Control Systems course is a big step forward towards further advanced courses which deal with mathematical modelling as well as physical systems. Students may not be able to gain pragmatic knowledge if they despise this course. Hence, this course can bring a paradigm shift in their cognitive levels. Last but not the least, the course curriculum has been designed deftly to meet the demands of the contemporary era.

Course Objective:

Automatic control encroaches upon many of the defined engineering and mathematics university courses in terms of both theory and practice. In most engineering disciplines it is a topic which is constantly changing in order to keep pace with modern day application requirements. Many new technologies have risen to prominence in the area of control system during the last decade. Significantly the increasing influence of microcomputers has led to a much greater need for an emphasis to be placed on digital aspect of control. With the advent of VLSI design in association with special-purpose machines, higher speed and greater memory capacity computers are becoming available, allowing further control schemes to be considered. The undergraduate students of engineering taking the course as a part of their overall degree must necessarily become aware of the developments in digital control which have now become standard practice in many industrial applications. This is a basic course for engineering students and students need a mathematical background such that Laplace Transform, solutions to differential equations and complex numbers have been taught.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic control engineering and system modeling in the frequency and time domain.
CLO2	**Analyze** system using block diagram representation and SFG.
CLO3	**Analyze** the stability of any particular system by **understanding** Poles and Zeros.
CLO4	**Design** a feedback control system using different techniques like Nyquist plot, polar plot, root-locus technique etc.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3			√									
CLO4			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture/ Group Discussion	Mini Project/ Presentation/ Class Test/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	Basic concepts: Control System Fundamentals.	Lecture	Mid-term, Class Test, Assignment	CLO1, CLO2
02	Notion of feedback, open-loop and closed-loop systems.	Lecture	Mid-term, Class Test, Assignment	CLO1, CLO2
03	Modeling and representations of control systems: Ordinary differential equations.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1, CLO2
04	Transfer functions, Block diagrams, Signal flow graphs (SFG).	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1, CLO2
05	State variables: SFG to state variables.	Lecture	Mid-term, Class Test, Assignment	CLO2, CLO3
06	Transfer function to state variable and state variable to transfer function.	Lecture	Mid-term, Class Test, Assignment	CLO2, CLO3
07	Feedback control system: Closed loop systems, parameter sensitivity, transient characteristics of control systems.	Lecture	Mid-term, Class Test, Assignment	CLO2, CLO3
08	Effect of third pole and zero on the system response and system types and steady state error.	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2, CLO3
Mid Term Exam				
09	Stability: Introduction, stability in state space.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
10	Routh Hurwitz stability criterion for normal and special cases.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
11	Analysis of feedback control system: Root locus method and frequency response method.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4
12	Design of feedback control systems.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4

13	Nyquist plot, polar plot.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO3, CLO4
14	Controllability and observability, root locus.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
15	Frequency response and state variable methods.	Lecture	Final Exam, Class Test, Assignment	CLO3, CLO4
16	Digital control systems: Introduction.	Lecture	Final Exam, Class Test, Assignment	CLO4
17	Sampled data systems.	Lecture	Final Exam, Class Test, Assignment	CLO4
18	Stability analysis in Z-domain.	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Norman S. Nise, *Control System Engineering*, Wiley; 7th edition (November 13, 2014)

Supplementary Readings:

1. U.A. Bakshi & V.U. Bakshi, *Control System Engineering*, Technical Publications; 2nd edition (June 1, 2007)
2. Katsuhiko Ogata, Modern Control Engineering, Pearson; 5th edition (August 25, 2009)
3. R C Dorf and R H Bishop, *Modern Control System*, Pearson; 13th edition (January 5, 2016)

Part A

Course Code:	EEE 416
Course Title:	Control Systems Lab
Course Type:	Core Course

Year/ Level/ Semester/ Term:	Seventh Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	EEE 327 Industrial and Power Electronics
Credit Value:	1.5
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:

Control Systems Lab will substantialize the notions related to the control of different systems into practice. Thus, the students will be able to design some sophisticated projects adroitly based on what they learned in the theory course as well as in the relevant mathematic courses prior to the lab.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE 415. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Design** different types of controllers using experimental and simulation tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√	√	√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab Report/ Final Exam
CLO2	Lab demonstration/ Lecture	Mini Project/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs

01	Introduction to the Control Systems Lab	2	N/A
02	Modeling of physical systems and study of their open loop response	2	CLO1, CLO2
03	Familiarization with Poles and Zeros using MATLAB	2	CLO1
04	Response of different types of unity feedback system	2	CLO1
05	Block Diagram Reduction using MATLAB and SIMULINK	2	CLO1
06	Miscellaneous topic: Topological reduction of a System	2	CLO1
07	Study of PID controller	2	CLO1
08	Nyquist and Polar plot using MATLAB	2	CLO1
09	Design of control system using root-locus technique	2	CLO1, CLO2
10	Study of Steady-State Error Constants and Reduction of Steady-State Error from a System	2	CLO1
11	Design Parameters of a Complete System and Improving the Stability	2	CLO1, CLO2
12	Design a Spring-Damper System and Improve the Stability using PID controller	2	CLO1, CLO2
13	**Mini Project**		
14	Study of stability improvement using root-locus technique	2	CLO1
15	Study of frequency response e.g., Polar plot using MATLAB	2	CLO1
16	Familiarization with PLC	2	CLO1
17	**Project Presentation**		
18	**Final Exam**		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture, Group Discussion, Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Norman S. Nise, *Control System Engineering*, Wiley; 7th edition (November 13, 2014)

Supplementary Readings:

1. U.A. Bakshi & V.U. Bakshi, *Control System Engineering*, Technical Publications; 2nd edition (June 1, 2007)
2. Katsuhiko Ogata, Modern Control Engineering, Pearson; 5th edition (August 25, 2009)
3. R C Dorf and R H Bishop, *Modern Control System*, Pearson; 13th edition (January 5, 2016)

Elective Course (Group I: Power Group)

Part A

Course No./Course Code :	EEE 431
Course Title :	Power System II
Course Type	Electrical
Year /Level/Semester/Term :	Seventh semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	**EEE 321 (Power System I)**
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Students are able to explain in detail and critically evaluate technologies and information systems for operational management of conventional and modern electric power systems as well as methods and algorithms for steady-state network calculation, failure calculation, power system operation and optimization. They are additonally able to apply these methods to real electric power systems.

Course Objective:
This course examines the basic theory, characteristics, construction operation and application of electrical machines. It includes the study of poly phase Induction motors, Single Phase motors, Synchronous Motors, Alternators and Special Machines.

Course Content:
Power System Stability: Stability; Transient, dynamic and steady-state stability; Stability limit; Assumption of classical stability model; Swing equation, its derivation and significance; H-constant; Coherent machine, swing equation of coherent & non-coherent machines; Power angle equation; Equal area criterion of stability: derivation, explanation and applications; Multi-machine system; Factors affecting stability; Related mathematics.

Introduction to switchgear: Definition, essential features, equipment; Faults and abnormalities; short circuit and overload; A typical protective system; primary and back-up protection.

Protective Relays: Definition, functions, fundamental requirements; Classification of relays; Important terms about relay: pick-up current, current setting, plug-setting, PSM, TMS; Overcurrent relay: classification, instantaneous, time-delayed, definite-time, inverse time and IDMT overcurrent relays; Construction and operation: Induction type overcurrent relay, induction type directional power relay, induction type directional overcurrent relay; Related mathematics.

Protection of Alternator: Significance and difficulties, major faults and abnormal conditions, protective schemes; Class A, class B and class C protection; Differential protection; Earth-fault protection; Stator inter-turn protection; Field-failure protection; reverse power protection; under-frequency protection; Related mathematics.

Protection of Transformer: Faults in transformers' auxiliary equipment, internal and external faults; Buchholz relays: construction, operation, advantages and drawbacks; Earth-fault or leakage or overcurrent protection; Problems in application of differential protection; Related mathematics.

Protection of Busbars and Lines: Differential and fault-bus protection; Time-graded overcurrent protection; differential pilot-wire protection; Distance protection.

Fuses: Definition, pros and cons, characteristics, element materials of Fuses; Important terms about fuse: current rating, fusing current, fusing factor, prospective current, cut-off current, pre-arcing and arcing time, operating time, breaking capacity; Types in details; HRC cartridge fuse; HRC fuse with tripping device; drop-out fuse; high voltage fuse; current carrying capacity relation; difference between fuse and circuit breaker.

Circuit Breaker: Definition, functions, operating principle and types; Arc phenomenon and method of quenching; Decay process; oscillogram of voltage and current at arc extinction; Important terms: arc voltage, restriking voltage, recovery voltage, TRV; Factors influencing arc extinction; Construction, working and pros & cons: Oil, SF_6 and vacuum circuit breaker; Breaking capacity, making capacity and short-time rating of circuit breaker; Resistance switching; Related mathematics.

Protection against overvoltage: Voltage surge; causes of overvoltage, lightning; Protection against lightning: earthing screen, overhead ground wires and lightning arresters;Types of LA; Rod gap and horn gap LA; Surge absorber.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Demonstrate** Power System Stability and **Solve** related mathematical problems.
CLO2	**Describe** operation principle of different types of relay and **solve** related mathematical problems.
CLO3	**Explain** alternator, transformer and busbar, overvoltage protection schemes and **solve** related mathematical problems.
CLO4	**Describ**e the construction & operation principle of Fuses and Circuit Breakers and solve related mathematical problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√										
CLO2	√	√										
CLO3	√	√										
CLO4	√	√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture,Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1	Overview of the Course	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
2	Stability; Transient, dynamic and steady-state stability; Stability limit; Assumption of classical stability model,explanation and applications	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
3	Swing equation, its derivation and significance; H-constant; Coherent machine	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
4	swing equation of coherent & non-coherent machines; Power angle equation; Equal area criterion of stability: derivation.	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
5	Multi-machine system; Factors affecting stability; Related mathematics.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**

6	Definition, essential features, equipment; Faults and abnormalities; short circuit and overload; A typical protective system; primary and back-up protection.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
7	Definition, functions, fundamental requirements; Classification of relays; Important terms about relay: pick-up current, current setting, plug-setting, PSM, TMS; Overcurrent relay: classification, instantaneous, time-delayed, definite-time, inverse time and IDMT	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
8	overcurrent relays; Construction and operation: Induction type overcurrent relay,	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
9	Induction type directional power relay, induction type directional overcurrent relay; Related mathematics.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
Mid Term Examination				
10-11	Protection of Alternator, and Busbar lines	Lecture, Group discussion	Final Exam, Class Test, Assignment.	**CLO3**
12-13	Protection of Transformer	Lecture, Group discussion	Final Exam, Class Test, Assignment.	**CLO3**
14-15	Protection of Busbar lines	Lecture, Group discussion	Final Exam, Class Test, Assignment.	**CLO3**
16-17	Fuse, Circuit breaker	Lecture, Group discussion	Final Exam, Class Test, Assignment.	**CLO4**
18	Overvoltage Protection	Lecture, Group discussion	Final Exam, Class Test, Assignment.	**CLO4**
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Mid-term, Class Test, Assignment, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Sunil S. Rao, *Switchgear Protection and Power System*, Khanna Publishers (January 1, 1611)

Supplementary Readings:

1. V.K. Mehta and Rohit Mehta,*Principles of Power System*: S Chand & Co Ltd; 3rd edition (January 1, 2005)
2. Ashfaq Hossain, *Electrical Power System ,CBS Publishers & Distributors;* 5th edition (January 1, 2007)
3. Bhuvanesh A Oza, *Power System Protection and Switchgear,* MC GRAW HILL INDIA; 1st edition (January 1, 2004)
4. Willaim. D. Stevenson, Jr.,*Elements of Power System Analysis,* MC GRAW HILL INDIA; 4th edition (January 1, 1982)

Part A

Course No./Course Code :	EEE 432
Course Title :	Power system Lab
Course Type	Elective Course
Year /Level/Semester/Term :	Seventh Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 415 Power system I, EEE 431 Power system II
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Electrical Power systems lab is one on the most developed lab in electrical engineering department. It is equipped with many advanced Apparatuses and devices to make all of important tests on power systems starting from generation unit with control panel and protection equipment passing through the transmission lines to the load units with power factor correction panel. Power system lab links the theoretical part of power systems with the practical part and provide the students with practical experience with real practical power systems devices and equipment and Making analysis on real power systems starting from generation unit till to the load unit.

Course Objective:
The objective of this course is to verify the theories and concepts taught in EEE 415. They will able to understand the concept of MATLAB programming in solving power systems problems and can understand power system planning and operational studies. The students will acquire knowledge on Formation of Bus Admittance and Impedance Matrices and Solution of Networks. They can able to acquire knowledge on power system analysis methods, load flow study, symmetric and unsymmetrical fault.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Analyze** load flow, voltage control and fault in power system using modern tools.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2		√			√							

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Experiment title	Hrs	CLOs
1	Familiarization with Power System Lab.	2	CLO1, CLO2
2	Formation of Y-bus Matrix Using MATLAB	2	CLO1, CLO2
3	Formation of Z-bus Matrix from Y-bus Matrix Using MATLAB.	2	CLO1, CLO2
4	Study of different voltage control methods.	2	CLO1, CLO2
5	Symmetrical Component Findings from Unbalanced System Using MATLAB.	2	CLO1, CLO2
6	Load Flow Study of a Power System using Gauss-Seidel method.	2	CLO1, CLO2
7	Load Flow Study of a Power System using Newton Raphson Method.	2	CLO1, CLO2

8	Load Flow Study of a Power System using fast decouple method.	2	CLO1, CLO2
9	Three phase symmetrical fault analysis using MATLAB Simulink.	2	CLO1, CLO2
10	Unsymmetrical faults (L-G) analysis using MATLAB Simulink.	2	CLO1, CLO2
11	Unsymmetrical faults (L-L) analysis using MATLAB Simulink	2	CLO1, CLO2
12	Unsymmetrical faults (L-L-G) analysis using MATLAB Simulink.	2	CLO1, CLO2
13	Study of a smart grid system.	2	CLO1, CLO2
14	Observation of three phase series compensation network.	2	CLO1, CLO2
15	Study of Circuit breakers and relays.	2	CLO1, CLO2
16	Layout design of substation.	2	CLO1, CLO2
17	Project: Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. D P Kothari & I. J. Nagrath; *Power System Engineering*, MC GRAW HILL INDIA; 3rd edition, January 1, 2019.

Supplementary Readings:

1. J. Grainger and W. D. Stevenson, *Power System Analysis*, McGraw-Hill Education, 1st edition, January 1, 1994.

Part A

Course Code	EEE 435
Course Title	Electrical Power Transmission and Distribution
Course Type:	Elective
Year Level/Semester/Term	Eight Semester
Academic Session	**TBA**
Course Teacher/Instructor	**TBA**
Pre-requisite	EEE 321 (Power System I)
Credit Value	3
Contact Hours	36
Total Marks	100

Rationale of the Course:
In industry, to operate electrical transmission and distribution systems, the knowledge of its various components by power system and their function is one of the main duties and hence quite important. This course is intended to develop such skills to not only to maintain the proper functioning of power system but also to diagnose and rectify the general problems associated with electrical power transmission and distribution.

Course Objective:
Power T&D is the basic course for an electrical engineer. This course provides knowledge about stability and protection of power system analyzing system faults. To develop power sector in a developing country like us, an electrical engineer should have clear concept and ideas regarding this course.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Analyze** design and construction and features of overhead transmission lines.
CLO2	**Analyze** design and construction and features of overhead and underground distribution lines.
CLO3	**Discuss** about the layout of a typical substations and get familiarized with its protective devices
CLO4	**Describe** the operation of dc transmission system and smart grid.

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2		√										
CLO3		√										
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy

CLO1	Lecture Tutorial	Midterm and Assignment
CLO2	Lecture Tutorial	Midterm, Final Exams and assignment
CLO3	Lecture Tutorial	Assignment and Final Exam.
CLO4	Lecture Tutorial	Final Exams

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), Teaching learning and assessment strategy mapped with CLOs.

Week	Topics	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
1-2	**Mechanical Design of Overhead Lines**	Lecture	Assignment, Class test Midterm	CLO1
3-4	**Supply Systems**	Lecture	Assignment, Midterm	CLO1
5-6	**Electrical Design of Overhead Lines**	Lecture	Assignment, Class test Midterm and Final exam	CLO1
Mid Exam				
7-8	**Performance of Transmission Lines**	Lecture	Assignment, Class test and Final exam	CLO1
8-9	**Underground Cables**	Lecture	Assignment, Class test and Final exam	CLO2
10-13	**Distribution Systems**	Lecture	Assignment, and Final exam	CLO1, CLO2, CLO3
14-18	**Sub-Stations**	Lecture	Assignment, and Final exam	CLO3
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

- S. N. Singh, *Electric Power Generation, Transmission and Distribution*, 2nd Edition, PHI Learning Pvt. Ltd.

Supplementary Readings:

1. W. D. Stevenson, *Elements of Power System Analysis*, Mcgraw-Hill Publishing Company.
2. Sunil S. Rao, *Power System Protection and Switchgear*, 13th Edition, Khanna Publishers.
3. B.L. Theraja, *Electrical Technology. Volume III. Transmission, distribution & Utilization*, Volume III, S Chand & Co Ltd.
4. V.K. Mehta and Rohit Mehta, *Principles of Power System*, 4th Edition, S Chand & Co Ltd.

Part A

Course No./Course Code :	EEE 437
Course Title :	Power Plant Engineering
Course Type	Core Course
Year /Level/Semester/Term :	Eight Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 321_Power System I
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
From small to large power applications, power plays an important role. There are many uses of power in today's society and it can hardly be imagined not to have. Power engineers plan, design, and implement solutions to meet energy demands across the world. Their relevance to society is vital for future needs and must be continued to provide comfortable life.

Course Objective:
The goal of this course is to make the students familiar with power plant systems, terms and definitions, basic power plant engineering design calculations, proper design and application of power plant related equipment, methods of diagnosing and correcting equipment mis-operation or misapplication. They will become familiar with recognized standards utilized in the design and operation of power plant equipment and will prepare & present topical issues relevant to power plant design and operations.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the load curve and **Comprehend** different factors like demand factor, load factor, diversity factor etc. related to power plant and tariff system.
CLO2	**Explain** the operation of Different types of power plant.
CLO3	**Solve** problem related to Hydroelectric Power Plant, Steam turbine Power Plant etc.
CLO4	**Select** the type of Power Plant to chase the Load Curve in a specific area.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

	Program Learning Outcomes (PLOs)											
CLOs	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√											
CLO3		√										
CLO4				√			√					

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture, Group Discussion.	Mid-term, Class Test, Assignment.
COL2	Lecture, Group Discussion.	Mid-term, Class Test, Assignment.
COL3	Lecture, Group Discussion.	Final Exam, Class Test, Assignment.
COL4	Lecture, Group Discussion.	Class Test, Final Exam.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
01	**Introduction**: Importance of electrical energy, sources of energy, calorific value and comparison of fuels.	Lecture		CLO1
02-05	**Variable load on power stations:** Load curves and load duration curves, Important terms and factors, types of loads, selection of generating units, Generation scheduling: deterministic and probabilistic, base load & peak load, methods of meeting the loads.	Lecture / Group Discussion.	Assignment / Class Test /Midterm Exam	CLO1
05-08	**Economics of power generation:** Cost of electrical energy, Expression for cost, Method of	Lecture / Group	Assignment / Presentation	CLO1

	determining depreciations, Importance of high load factor.	Discussion.	/ Midterm Exam	
Midterm Exam				
09-15	**Generating Stations:** General layout and principles, Steam turbine power plant, Gas turbine power plant, Combined cycle gas turbine power plant, Hydro power plant, Power plant instrumentation, Selection of location (Technical, economical and environmental factors).	Lecture / Group Discussion.	Assignment / Presentation / Midterm Exam	CLO1
16	**Tariff:** Desirable characteristics of Tariff, types in details			
17-18	**Renewable Energy:** Solar, Wind, Biomass, Tidal. **Nuclear Energy:** Radioactivity, fissile and fertile materials, Fission reaction and energy, Nuclear fuel cycle, Fuel production, reactor operation and maintenance, Nuclear waste management, Nuclear power and Bangladesh.	Lecture / Group Discussion.	Assignment / Midterm Exam	CLO2
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, and Final Exam.	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Bernhardt G. A. Strutztki, and William A. Vopat, *Power Station Engineering and Economy*, 2nd Edition

Supplementary Readings:

1. M. V. Deshpande, *Elements of Electrical Power Station Design*, 2nd Edition.
2. G. R. Nagpal, *Power Plant Engineering*, 2nd Edition.
3. V.K. Mehta and Rohit Mehta, *Principles of Power System,* 2nd Edition.

Elective Course (Group II: Electronics)

Part A

Course No./Course Code :	EEE 451
Course Title :	VLSI Design
Course Type	Elective Course
Year /Level/Semester/Term :	Eight Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 215 Digital Electronics
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

The technique of constructing an integrated circuit (IC) by integrating millions of MOS transistors onto a single chip is known as very large-scale integration (VLSI). When MOS integrated circuit chips became extensively used in the 1970s, sophisticated semiconductor and communications technologies could be developed. VLSI devices are used in the microprocessor and memory chips. Prior to the development of VLSI technology, most ICs could only execute a restricted range of functions. A CPU, ROM, RAM, and other glue logic may be found in an electrical circuit. VLSI allows IC designers to combine all of these functions into a single chip.

Course Objective:

The objectives of this course are to introduce students to digital integrated circuits. This course helps the students to get familiarized with NMOS, PMOS, CMOS devices and manufacturing technology. It will help them get acquainted with CMOS logic gates and their layout. Students will learn how to calculate propagation delay, noise margins, and power dissipation in digital VLSI circuits and design of combinational (e.g., arithmetic) and sequential circuits and memory in VLSI circuits.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Understand** the basic operation of MOSFET and **Comprehend** different characteristics of MOSFET.
CLO2	**Demonstrate** different devices based on CMOS technology and fabrication process.
CLO3	**Analyze** different types of devices based on various MOS technology, their circuit characteristics and performances.
CLO4	**Design** logic circuits, ADDER, PLA, Multiplier, Memory, ALU, using CMOS, BiCMOS and GaAs technology.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture ,Tutorial	Assignment / Midterm Exam
CLO2	Lecture, Tutorial	Assignment / Class Test /Midterm Exam
CLO3	Lecture, Tutorial	Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Mini Project/ Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1-2	**Introduction to VLSI Circuits**: History of integrated circuits, Basic operation of MOSFETs, Fabrication technology of MOSFETs.	Lecture, Tutorial	Assignment	CLO1
3-4	**Basic electrical properties of MOSFETs**: Ids vs Vds relationships in both saturation and non-saturation region, MOSFET threshold voltage, MOS transistor trans-conductance and output-conductance, Body Effect.	Lecture, Tutorial	Assignment / Class Test /Midterm Exam	CLO1,CLO2
5-7	**Basic VLSI circuits**: Pass transistor, nMOS inverter with resistive load and enhancement and depletion type transistor type loads.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO2

8-9	**CMOS inverter: CMOS inverters**: operation, transfer characteristics, design for equal rise and fall time, propagation delay, rise time, fall time and power consumption estimation.	Lecture / Group Discussion	Midterm Exam/ Final Exam	CLO2, CLO3
Mid Term Examination				
10-12	**Design rules**: CMOS lambda-based design rules. Buffer circuit. **Basic circuit concepts**: Sheet resistance, Area capacitance etc.	Lecture, Tutorial	Mini Project/ Presentation/ Class Test / Final Exam	CLO3,CLO4
13	**Scaling of MOS circuits**: Scaling models, scaling factors: gate area, gate capacitance, parasitic capacitance, channel resistance, gate delay. Effects of scaling.	Lecture	Assignment / Final Exam	CLO3
14	**Subsystem Design**: Inverter, 2-input NAND gate, NOR gate, other gates using nMOS, CMOS logic.	Lecture	Mini Project/ Presentation/ Class Test / Final Exam	CLO4
15-18	**Combinational logic circuit design**: Parity generator, Bus Arbitration logic, Multiplexer, Cellular design or general logic function block, Programmable logic array (PLA) etc. **Sequential logic circuit design**: Two-phase clocking, charge storage, Dynamic register element, Dynamic shift register etc. **Computational elements design**: ALU subsystem: 4-bit adder, multipliers. **Memory**: DRAM, SRAM. BiCMOS, GaAs technology	Lecture / Group Discussion	Mini Project/ Presentation/ Final Exam	CLO3,CLO4
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Class Test/Assignment/Group Discussion/ Presentation/ Project

Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Douglas A. Pucknell, Kamram Eshranghian, *Basic VLSI Design*, Pearson Education Imports: Depositories,3rd edition (October 1,1987)

Supplementary Readings:

1. Linda E. M. Brackenbury, *Design of VLSI Systems, A Practical Introduction Scholium Intl*, Macmillan Publishers Limited, 1st edition (June 1, 1987)
2. Ben G Streetman and Sanjay K. Banerjee, *Solid State Electronic Devices*,Pearson, 7th edition (January 1, 2015)
3. Ming- Bo Lin, *Introduction to VLSI Systems: A logic, Circuit, and System Perspective*, CRC Press, 1st edition (November 28, 2011)
4. Yuan Taur and Tak H.ning, *Fundamentals of Modern VLSI Devices*, Cambridge University Press, 2nd edition (June 24, 2013)

Part A

Course No./Course Code :	EEE 452
Course Title :	VLSI Design Lab
Course Type	Elective
Year /Level/Semester/Term :	Eight Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Prerequisite :	EEE 215 Digital Electronics
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
Design of VLSI circuits provides a basic thoughts for students and graduates in the advanced electronics field. This course covers the lambda based design rules implemented in Microwind as well as helps the students to know about the VERILOG, PSpice and DSCH software.

Course Objective:
This course's goal is to validate the theories and concepts taught in EEE 451. Students will do lab experiments as well as simulations. They will be exposed to laboratory equipment and simulation tools, as well as understand experimental procedures. The students will examine

their data and draw meaningful inferences based on their comprehension, while keeping in mind the mistakes and uncertainties in their measurements. This course's goal is to validate the theories and concepts taught in EEE 451.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Design and Simulate** different digital logic circuits using modern simulation tools. (PSPICE, MICROWIND, DSCH, VERILOG).
CLO2	**Write** comprehensive reports on the work done in the laboratory.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1			√	√	√							
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture/Tutorial	Lab report/Project/Final exam
CLO2	Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Experiment title	Hrs	CLOs
01	Introduction to verilog	2	CLO1, CLO2
2	Analysis of cmos inverter using pspice and verilog	2	CLO1, CLO2
03	Simulation of cmos nand gate using pspice and verilog	2	CLO1, CLO2
04	Introduction to microwind	2	CLO1, CLO2
05	Layout design of a cmos inverter using microwind	2	CLO1, CLO2
06-07	Layout design of a 2-input cmos nand and nor gate for equal rise time and fall time	4	CLO1, CLO2
08	Layout design of a cmos xor and xnor logic gate using microwind	2	CLO1, CLO2
09	Introduction to dsch software	2	CLO1, CLO2
10	Vlsi design using schematic capture	2	CLO1, CLO2
12-13	Layout design of mux and demux using microwind and dsch	4	CLO1, CLO2
13	Simple project		
14	Layout design of 4-bit adder circuit using microwind and dsch	2	CLO1, CLO2
15	Layout design of 4-bit shift register using dsch	2	CLO1, CLO2

16	Layout design of 4-bit alu using dsch	2	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Project/Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Douglas A. Pucknell, Kamram Eshranghian, *Basic VLSI Design*, Pearson Education Imports: Depositories, 3rd edition (1 October 1987)
2. Muhammad H. Rashid, *Introduction to PSpice using OrCAD for Circuits and Electronics*, Pearson Education India, 3rd edition (1 January 2015)

Supplementary Readings:

1. Linda E. M. Brackenbury, *Design of VLSI Systems –A Practical Introduction Scholium Intl*, Macmillan Publishers Limited, 1st edition (June 1, 1987)
2. Ming- Bo Lin, *Introduction to VLSI Systems: A logic, Circuit, and System Perspective*, CRC Press, 1st edition (November 28, 2011)

Elective Course (Group III: Communication)

Part A

Course No./Course Code :	EEE 478
Course Title :	Microwave Engineering Lab
Course Type	Communication
Year /Level/Semester/Term :	**TBA**
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	EEE 477 (Microwave Engineering)
Credit Value :	1.5
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

Microwave engineering pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from electronic engineering. This is because there are different interactions with circuits, transmissions and propagation characteristics at microwave frequencies.

Some theories and devices that pertain to this field are antennas, radar, transmission lines, space based systems (remote sensing), measurements, microwave radiation hazards and safety measures. This lab course will give a practical exposure to students to learn the characteristics of Microwave components. To gain the practical hands on experience by exposing the students to various microwave components.

Course Objective:

In this course students will perform experiments to verify practically the theories and concepts based in EEE 477. The lab course will give a practical exposure to students to learn the characteristics of Microwave components. The laboratory exercises are designed to give students ability to design, build, and analyze the components. A key part of the microwave laboratory experience is to learn how to use microwave test equipment to make measurements of power, frequency, S parameters, SWR, return loss, and insertion loss. More detail on the operation of the equipment can be found in the Operation Manuals in the Microwave Instructional Lab. Scattering parameters of microwave components are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied. The students will have an understanding of the concepts involved in transmission and reception of the microwave signals, characteristics of components. Also students will gain in-depth knowledge in the field of Microwave Engineering.

Course Learning Outcomes (CLO): At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge to understand the concepts involved in transmission and reception of the microwave signals, characteristics of

	components by hardware implementation and gain experience to learn how to use microwave test equipment to make measurements of power, frequency, S parameters, SWR, return loss, and insertion loss.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration/ Lecture	Lab report/Final exam/ Peer Review/ Observation
CLO2	Lab demonstration/ Lecture	Lab report/Final exam/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	*Topics*	*Hrs*	*CLOs*
1	Microwave Oscillator Characterization and Power measurement.	2	CLO1, CLO2
2	Measurement of Standing Wave Ratio, Frequency & Wavelength.	2	CLO1, CLO2
3	Measurement of Unknown Impedance using SMITH chart.	2	CLO1, CLO2
4	Study of Waveguide Components.	2	CLO1
5	Attenuation Measurement in Microwave System.	2	CLO1, CLO2
6	Inverse Square Law of Electromagnetic Wave Propagation.	2	CLO1
7	Study of the Characteristics Features of Various Antennas.	2	CLO1
8	Introduction to Software based Study of Antenna Training System.	2	CLO1
9	Introduction to Antenna Array System.	2	CLO1
10	Study of wave guide horn and its radiation pattern and determination of the Beam width.	2	CLO1, CLO2
11	To measure coupling coefficient, Insertion loss & Directivity of a Directional coupler.	2	CLO1, CLO2
12	To measure attenuation and insertion loss of a fixed and variable attenuator.	2	CLO1, CLO2

13	To measure the standing wave ratio and reflection coefficient in a Microwave Transmission line.	2	CLO1, CLO2
14	To Study working of Doppler Radar , and measure the of the velocity of the object moving in the Radar range.	2	CLO1, CLO2

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial/ Presentation	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Samuel Y. Liao, *Microwave Devices and Circuits*, PHI, 3rd Edition, 1994.
2. M. Kulkarni, *Microwave and Radar Engineering*, Umesh Publications, 1998.

Supplementary Readings:

1. R. E. CLOlin, *Foundations for Microwave Engineering*, IEEE Press, John Wiley, 2nd Edition, 2002.
2. M. L. Sisodia and G. S. Raghuvanshi, *Microwave Circuits and Passive Devices*, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
3. Peter A. Rizzi, *Microwave Engineering Passive Circuits*, PHI, 1999.
4. F. E. Terman, *Electronic and Radio Engineering*, McGraw-Hill, 4th Edition, 1955.
5. R. Chatterjee, *Elements of Microwave Engineering*, Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.

Part A

Course No./Course Code	EEE 483
Course Title	Cellular and Optical Fiber Communication
Course Type	Elective course
Year /Level/Semester/Term	Eight Semester
Academic Session	**TBA**
Course Teacher/Instructor	**TBA**
Pre-requisite	EEE 311 (Communication Theory), EEE 225 Signals and Linear Systems Analysis
Credit Value	3
Contact Hours	36 Hours
Total Marks	100

Rationale of the Course:

To expose the students to understand mobile radio communication principles and to study the recent trends adopted in cellular systems and wireless standards. Wireless communications have enabled the connection of billions of people to the Internet so that they can reap the benefits of today's digital economy.

Fiber-optic communication is a method of transmitting information from one place to another by sending pulses of infrared light through an optical fiber. The light is a form of carrier wave that is modulated to carry information. Fiber is preferred over electrical cabling when high bandwidth, long distance, or immunity to electromagnetic interference is required. This type of communication can transmit voice, video, and telemetry through local area networks or across long distances. To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Course Objective:

This course aims to develop-

1. An understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards.
2. To know the evolution of Mobile communication and cell concept to improve capacity of the system.
3. To know the role of equalization in Mobile communication and to study different types of Equalizers and Diversity techniques.
4. To study the principles and working of Radar and Satellite Communication systems.
5. To build on work presented in earlier years of the program in order to enable you to develop a fuller understanding and appreciation of the factors which affect the design, operation and performance of both digital and analogue optical fiber communication systems.
6. To study many design factors and trade-offs which are involved for the design of an optical fiber system and characteristics, limitations of system components and the factors affecting the performance of different optical fiber communication systems.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** the functioning and evolution of different wireless communication systems with standards and also basic physics related to optical fiber.
CLO2	**Demonstrate** knowledge on cellular concepts like frequency reuse, fading, equalization, GSM, CDMA, FDMA and Comparison of these technologies based on their signal separation techniques and **Explain** the construction and operation of different types of fiber.
CLO3	**Explain** the architecture, functioning, protocols, capabilities and Mobile Radio Propagation with antenna design and satellite system using theoretical knowledge and **implement** the Optical fiber communication system.
CLO4	**Demonstrate** an ability to explain multiple access techniques, equalization and different diversity techniques for Wireless Communication.

CLO5	**Apply** the concept of hand-off and interface to calculate wireless network planning (Link budget and power spectrum calculations) with **understanding** the construction and working principle of Optical sources (LEDs and LASERs) and detectors (PIN, APD etc)
CLO6	**Demonstrate** an ability to evaluate design challenges, constraints and security issues associated with Ad-hoc wireless networks for Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS. And **Design** and **analysis** of Optical networks and link budget.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√		√									
CLO2	√	√										
CLO3		√	√	√								
CLO4	√		√	√	√							
CLO5		√	√	√	√				√	√		
CLO6			√		√				√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Class Test/ Assignment / Midterm Exam
CLO2	Lecture	Assignment / Class Test /Midterm Exam
CLO3	Lecture / Group Discussion	Presentation/ Midterm Exam/ Final Exam
CLO4	Lecture / Group Discussion	Presentation/ Class Test / Final Exam
CLO5	Lecture/ Group Discussion	Assignment/ Final Exam / Presentation
CLO6	Lecture/ Group Discussion	Final Exam/ Assignment/ Mini Project/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

01-03	**Frequency Management and Channel Assignment**	Lecture, Group discussion	Quiz/ Mid-term/ Assignment	CLO1, CLO3, CLO4
04-05	**Cellular Radio Systems**	Lecture, Group discussion	Mid-term/ Class Test/ Assignment	CLO2, CLO3, CLO4
06	**Handoffs and Dropped Calls**	Lecture, Group discussion	Mid-term/ Class Test/ Assignment	CLO2, CLO3, CLO5
07-10	**Diversity Techniques with Digital Cellular Systems**	Lecture / Group Discussion/ Video presentation	Presentation/ Class Test / Final Exam	CLO2, CLO3, CLO4, CLO6
11-12	**Working of Radar & Satellite communication systems**	Lecture/ Group Discussion	Assignment/ Mini Project/	CLO1, CLO2, CLO3
Midterm Exam				
13-15	**Introduction to Fiber Optic Communication System**	Lecture, Group discussion	Quiz/ Mid-term/ Assignment	CLO1
16	**Optical Fiber Basics**	Lecture, Group discussion	Mid-term/ Class Test/ Assignment	CLO1, CLO2
17	**Transmission Characteristics of Optical fiber**	Lecture, Group Discussion	Assignment / Presentation/ Midterm Exam	CLO1
18	**Optical fiber Connections**	Lecture / Group Discussion/ Video presentation	Final Exam, Class Test, Assignment	CLO3
19-20	**Optical Sources: the LASER**	Lecture/ Group Discussion	Final Exam, Class Test, Assignment	CLO4
21-22	**Optical Sources: the Light Emitting Diode**	Lecture/ Group discussion/ Video presentation	Final Exam, Presentation, Assignment	CLO4
23-24	**Optical Detectors**	Lecture/ Group discussion	Final Exam, Presentation, Assignment	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70

Make-up Procedures	As per university rules

Part D

Learning Materials

Recommended Readings:

1. Theodore S. Rappaport, *Wireless Communications principle and practice*, 2nd Edition.
2. John Senior, *Optical Fiber Communications: Principles and Practice*, 3rd Edition, Prentice-Hall, Year.
3. Merrill I. Skolnik, *Introduction to Radar Systems*, 3rd Edition, McGraw-Hill.

Supplementary Readings:

1. GSM system survey-Ericsson
2. W. Stallings, *Wireless Communications and Networking*, Prentice Hall 1st Edition, 2001.
3. Gerd Keiser, *Optical Fiber Communications* (4th Edition, McGraw-Hill).
4. P. M. Shankar, *Introduction to Wireless Systems*, John Wiley, 2002.
5. Sanjay Kumar, *Wireless Communication the Fundamental and Advanced Concepts*, River Publishers, Denmark, 2015 (Indian reprint).
6. Z. Peyton, Jr. Peebles, *Radar Principles*, Wiley India Pvt. Ltd., 2009.
7. Jon W. Mark & Weihua Zhuang – Wireless Communication and Networking Published by PHI Learning Private Limited.
8. Govind P. Agrawal, Fiber Optic Communication Systems (5th Edition, Willey).
9. Joseph C. Palais, *Fiber Optic Communication* (5th Edition, Pearson).

Part A

Course No./Course Code :	EEE 484
Course Title :	Cellular and Opticcal Fiber Communication Lab
Course Type	Communication
Year /Level/Semester/Term :	Eight Semester
Academic Session:	Fall 2022
Course Teacher/Instructor :	Zubaida Azad Shikha
Pre-requisite :	EEE 483 (Cellular and Opticcal Fiber Communication Lab)
Credit Value :	0.75
Contact Hours :	18 Hours
Total Marks :	100

Rationale of the Course:

To perform practical pertaining to the study of the topics studied in the Cellular and Optical Fiber Communication theory course. This lab provides the students with an enriching hands-on experience with concepts and in-depth knowledge of Fiber Optical domain along with cellular concept. The laboratory is equipped with state -of -art Fiber Optic Trainer Kits and

Hard ware Modules. The simulation-based experiments are performed using the powerful optical simulator COMSOL and MATLAB.

With state-of-art simulation platform, user friendly GUI, easy help manual, the student performs experiments to study the digital optical link, understand the components of an Optical Communication System, characteristics of Optical Sources (LED & LD), Optical Detectors (LD & APD) and Optical Fibers(SM & MM).

This lab introduces students to communication link design and analysis techniques that are core knowledge for Communication engineers. This lab aims at supporting the teaching and research activities in the area of cellular, satellite and optical field which are either currently being.

Course Objective:

The objective of this course is to verify the theories and concepts taught in EEE XXX. The students will carry out experiments using hardware along with simulation tool.

- To understand the basic concepts of Optical and Cellular Communication
- To demonstrate the basic optical link design and understand the various components of optical communication system.
- To train students so that can relate theory with elements of design and applications.
- To provide the state-of-art simulation software and hardware for the design of optical communication system and understand the fiber characteristics.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Write** comprehensive reports on the experiments done in laboratory or in a group project, and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Apply** the theoretical knowledge for signal generation, processing and filter design using MATLAB and also by hardware implementation.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1									√	√		
CLO2			√		√							

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Final exam/ Peer Review/ Observation

COL2	Lab demonstration/ Lecture	Lab report/Final exam/ Presentation

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	*Topics*	*Hrs*	*CLOs*
1	Study of Spread Spectrum – DSSS Modulation & Demodulation using Communication Trainer Kits.	1	CLO1
2	Study of Propagation Models and Path Loss Estimation in Cellular Mobile Communication using MATLAB Programming.	1	CLO1
3	Observe signal constellation of GMSK signal and study of Multipath Fading, Power-Delay Profile and Doppler Spectrum for Channel Classification in Cellular Mobile Communication using MATLAB.	1	CLO1
4	Design of Radio Resource Allocations and Scheduling in Cellular Mobile Communication and study of GSM data services and capability.	1	CLO1
5	Design of a satellite communication link and study of change in uplink and downlink frequencies.	1	CLO1
6	Apply RFID technology for real life applications using RFID kit.	1	CLO1
7	Simulate Bluetooth voice transmission to observe effect of AWGN and of interference of 802.11b on transmission using MATLAB and Simulink.	1	CLO1
8	To observe and analyze various fiber optic data links when used for both digital and analog data transmission.	1	CLO1
9	Fiber Splicing and Introduction to the OTDR Measurement of Fiber Length, Attenuation and Splice Loss.	1	CLO1
10	Tracing the angular radiation (or reception) pattern of an optical fiber to determine its numerical aperture and acceptance angle.	1	CLO1
11	Determination of connecting losses due to lateral misalignment, longitudinal displacement, and angular misalignment of fiber cores.	1	CLO1
12	Study of 660nm Analog Transmitter Circuit.	1	CLO1
13	Study of 660nm Digital Transmitter Circuit.	1	CLO1, CLO2
14	Study of 820nm Analog Receiver Circuit.	1	CLO1, CLO2

15	Study of 820nm Digital Receiver Circuit.	1	CLO1, CLO2
16	To determine the coupling efficiency between an emitter and an optical fiber and determine the half power beam width for the TIL24 LED.	1	CLO1, CLO2
17	Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial/ Presentation	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. John Senior, Optical Fiber Communications: Principles and Practice, 3rd Edition, Prentice-Hall, Year.
2. Theodore S. Rappaport, Wireless Communications principle and practice, 2nd Edition.
3. Merrill I. Skolnik, Introduction to Radar Systems, 3rd Edition, McGraw-Hill.

Supplementary Readings:

1. Gerd Keiser, Optical Fiber Communications (4th Edition, McGraw-Hill).

2. W. Stallings, Wireless Communications and Networking, Prentice Hall 1st Edition, 2001.

3. GSM system survey-Ericsson

4. C. J. Coleman, *An introduction to radio frequency engineering*, Cambridge (2004).

5. Saunders, Simon R. Aleja, *Antenna and Propagation for Wireless Communication Systems*.

Elective Course (Group IV: Intelligent System and Information Technology)

Part A

Course No./Course Code :	**CSE 323**
Course Title :	**Computer Networks**
Course Type	Elective course
Year /Level/Semester/Term :	**TBA**
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:
This course helps students to excel in Designing, engineering, and installation of networks to connect digital computers. The key goals are resource sharing, high reliability, increased system performance, and security.

Course Objective:
This course examines the basic concepts of computer networks. It also correlates between the communication and computer engineering.

Course Content:
Introduction to Computer Networks: Basic concept of Computer networks and distributed systems; Goals of networking; General approaches of communication within a network. Network classification;. Uses & Network Software's. Network Topology : Bus, tree, ring, and star topology, transmission. Network Protocol : OSI model, TCP/IP protocol and the Internet, LAN and MAN-topologies, optical fiber bus, MAC protocols, LAN/MAN standards, FDDI and Fast Ethernet, LAN and bridges; Geosynchronous and 1ow orbit satellites, VSATS, protocols for multiple access unlink channel, digital cellular radio, GSM, personal communication services. Network Interconnections : bridges and gateway, connectionless and connection oriented internetworking, routing and fragmentation, firalls, IP protocol and IP addresses, internet Control Protocols - ICMP, ARP, RARP, Domain name and Name servers; Overview of internet applications; Electronic Mail Systems and protocol SMIP and MIME, world wide web, URLS; ISDN user interface and channels, Broadband ISDN, Frame Relay services and protocols, ATM virtual Channels and paths, ATM cells, header error control, ATM switches. Network Security : Introduction to network security authentication protocols and digital signatures, simple network, management protocol.
Network Applications: Client/server programming, RPC techniques; applications- file server, print server, e-mail, directory services, remote login, HTTP, HTML, World Wide Web, web

browser, applications server. **Network Management :** Internet management - management information base(MIB), simple network management protocol (SNMP). **The Network Layer:** The Physical Layer - The Data Link Layer - The Medium Access Control Sub-layer. Transport layer and the application of layers.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** and explain the layered protocol model
CLO2	**Describe** what classful and classless addressing schemes are.
CLO3	**Program** network communication services for client/server and other application layouts and **Use** networking tools to observe and analyze behaviors of networking protocols
CLO4	**Describe**, **analyze** and **evaluate** a number of datalink, network, and transport layer protocols

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√	√										
CLO3	√	√							√			
CLO4	√									√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lecture,Discussion	Mid-term, Class Test, Assignment.
COL2	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL3	Lecture,Discussion	Final Exam, Class Test, Assignment.
COL4	Lecture,Discussion	Final Exam, Class Test, Assignment.

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1	Introduction to Computer Networks: Basic concept of Computer networks and distributed systems	Lecture, Group discussion	Mid-term, Class Test, Assignment.	**CLO1**
2	General approaches of communication within a network.	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
3	Network classification;. Uses & Network Software's. Network Topology : Bus, tree, ring, and star topology, transmission	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO1**
4	Network Protocol : OSI model, TCP/IP protocol and the Internet, LAN and MAN-topologies	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
5	Optical fiber bus, MAC protocols, LAN/MAN standards, FDDI and Fast Ethernet, LAN and bridges;	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
6	Geosynchronous and 1ow orbit satellites, VSATS, protocols for multiple access unlink channel, digital cellular radio, GSM, personal communication services	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
7	. Network Interconnections : bridges and gateway, connectionless and connection oriented	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**

	internetworking, routing and fragmentation			
8	Firewalls, IP protocol and IP addresses, internet Control Protocols - ICMP, ARP, RARP, Domain name and Name servers	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
9	Overview of internet applications; Electronic Mail Systems and protocol SMIP and MIME, world wide web	Lecture Tutorial	Mid-term, Class Test, Assignment.	**CLO2**
Midterm Examination				
10	URLS; ISDN user interface and channels, Broadband ISDN, Frame Relay services and protocols	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
11-13	ATM virtual Channels and paths, ATM cells, header error control, ATM switches. Network Security	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
14	Introduction to network security authentication protocols and digital signatures, simple network, management protocol.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**
15-16	Network Applications: Client/server programming, RPC techniques; applications- file server, print server, e-mail, directory services, remote login, HTTP, HTML, World Wide Web, web	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO3**

	browser, applications server.			
17	Network Management : Internet management - management information base(MIB), simple network management protocol (SNMP).	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
18	The Network Layer: The Physical Layer - The Data Link Layer - The Medium Access Control Sub-layer. Transport layer and the application of layers.	Lecture Tutorial	Final Exam, Class Test, Assignment.	**CLO4**
Final Examination				

Part C

Assessment and Evaluation:

Assessment Strategy	Mid-term, Class Test, Assignment, Final Exam	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Andrew S. Tanenbaum, David J. Wetherall**,** *Computer Networks*, Pearson; 5th edition (September 27, 2010)

2. Douglas Comer, *Internetworking with TCP/IP Volume One*, Pearson; 6th edition (April 25, 2013)

Part A

Course No./Course Code :	CSE 324

Course Title :	Computer Networks Lab
Course Type	Elective course
Year /Level/Semester/Term :	Eight semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	-
Credit Value :	0.75
Contact Hours :	18 Hours
Total Marks :	100

Rationale of the Course:
This course studies the standard models for the layered approach to communication between autonomous machines in a network, and the main characteristics of data transmission across various physical link types. It considers how to design networks and protocols for diverse situations, analyses several application and support protocols from a distributed systems viewpoint, and identifies significant problem areas in networked communications.

Course Objective:
TCP/IP protocol and the Internet, LAN Configuration, bridges and gateway, connectionless and connection oriented internetworking, routing and fragmentation, firalls, IP protocol and IP addresses, internet Control Protocols - ICMP, ARP, RARP, Domain name and Name servers; Client/server programming, RPC techniques; applications- file server, print server, e-mail, directory services, remote login, HTTP, HTML, World Wide Web, web browser, applications server, DHCP, RIP, VLAN, VLSM, FLSM, NAT.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Write** VLSM using CISCO packet tracer and **demonstrate** the ability to work as an individual and within a team.
CLO2	**Analyze** application layer protocols.
CLO3	**Design** and **implement** network protocols.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12

CLO1									√	√		
CLO2			√	√	√							
CLO3												
CLO4				√	√					√		√

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	Teaching-Learning Strategy	Assessment Strategy
COL1	Lab demonstration/ Lecture	Lab report/Final exam
COL2	Lecture	Lab report/Final exam
CLO3	Lecture / Group Discussion	Presentation/ Class Test / Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	*Topics*	*Hrs*	*CLOs*
01	Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.	**1**	CLO1, CLO2
02	Study of Network Devices in Detail.	**1**	CLO1, CLO2
03	Study of network IP.	**1**	CLO1, CLO2
04	Connect the computers in Local Area Network.	**1**	CLO1, CLO2
05	Study of basic network command and Network configuration commands.	**1**	CLO1, CLO2
06	Performing an Initial Switch Configuration	**1**	CLO1, CLO2
07	Performing an Initial Router Configuration	**1**	CLO1,

			CLO2
08	Configuring and Troubleshooting a Switched Network	**1**	CLO1, CLO2
09	Connecting a Switch	**1**	CLO1, CLO2
10	Configuring WEP on a Wireless Router	**1**	CLO1, CLO2
11	Using the Cisco IOS Show Commands	**1**	CLO1, CLO2
12	Examining WAN Connections	**1**	CLO1, CLO2
13	Demonstrating Distribution Layer Functions	**1**	CLO1, CLO2
14	Planning Network-based Firewalls	**1**	CLO1, CLO2
15-16	Mini Project		
17	Project presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Babu Ram Dawadi, Institute of Engineering, Pulchowk Campus, Tribhuvan University ***A Practical Guide to Computer Network & Internet Technologies***

Part A

Course No./Course Code :	CSE 419
Course Title :	Artificial Intelligence
Course Type	Elective Course
Year /Level/Semester/Term :	Seventh Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	Discrete Mathematics, Algorithms, Probability
Credit Value :	3
Contact Hours :	36 Hours
Total Marks :	100

Rationale of the Course:

AI eliminates the risk of human error. AI has the incredible potential to be available 24 hours a day, seven days a week. It includes digital assistance. Besides, AI with unbiased decisions can enable new inventions. Further, it aids in the completion of repeated tasks in day-to-day applications.

Course Objective:

Introduce the vast variety of issues investigated in artificial intelligence, stressing the "core competencies" of intelligent systems - problem solving, reasoning, decision making, and learning - as well as the logical and probabilistic basis of these activities.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Apply** general artificial intelligence techniques for common problem types.
CLO2	**Examine** various problem scenarios to model environments and agents.
CLO3	**Recommend** solutions to real-life artificial intelligence problems by analyzing the existing technique.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1	√											
CLO2	√	√										
CLO3		√										

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	**Teaching-Learning Strategy**	**Assessment Strategy**
COL1	Lecture ,Tutorial	Assignment / Midterm Exam

COL2	Lecture, Tutorial	Assignment / Class Test /Midterm Exam/Final Exam
COL3	Lecture, Tutorial	Midterm Exam/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS
1	**Introduction :** Artificial intelligence, Intelligent Agents	Lecture, Tutorial	Assignment	CLO1
2-3	**Searching:** Search in Complex Environments ,Adversarial Search and Games	Lecture, Tutorial	Assignment / Class Test /Midterm Exam	CLO1,CLO2
4-6	Constraint Satisfaction Problems.	Lecture / Group Discussion	Assignment / Class Test /Midterm Exam	CLO2
7	Review Before Mid	Lecture	Midterm Exam	
Mid-Term Exam				
8-9	Game Trees	Lecture, Tutorial	Presentation /Final Exam	CLO2, CLO3
10	Markov Decision Process	Lecture / Group Discussion	Assignment / Final Exam	CLO2, CLO3
11-12	**Machine Learning** :Learning from Examples ,Learning Probabilistic Models, Deep Learning, Reinforcement Learning	Lecture / Group Discussion	Presentation / Class Test / Final Exam	CLO2, CLO3
13	**Uncertain knowledge and reasoning**: Quantifying Uncertainty, Probabilistic Reasoning over Time, Probabilistic Programming, Making Simple Decisions	Lecture / Group Discussion	Mini Project/ Presentation / Final Exam	CLO2, CLO3
14	Bayes Nets	Lecture / Group Discussion	Mini Project/ Presentation / Final Exam	CLO2, CLO3

Final Exam

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

2. Stuart Russell and Peter Norvig, ***Artificial Intelligence: A Modern Approach***, Pearson Series in Artificial Intelligence,4th edition (December 20,2021)

Supplementary Readings:

1. Richard S. Sutton and Andrew G. Barto, ***Reinforcement Learning: An Introduction,*** Bradford Books, 2nd edition (November 13, 2018)
2. David L. Poole and Alan K. Mackworth, ***Artificial Intelligence: Foundations of Computational Agents***, Cambridge University Press, 2nd edition (September 25, 2017)

Part A

Course No./Course Code :	CSE 420
Course Title :	Artificial Intelligence Lab
Course Type	Elective course
Year /Level/Semester/Term :	Seventh Semester
Academic Session:	**TBA**
Course Teacher/Instructor :	**TBA**
Pre-requisite :	CSE 419
Credit Value :	0.75
Contact Hours :	18 Hours
Total Marks :	100

Rationale of the Course:
To study first-order predicate logic and logical reasoning using Prolog language and implementing various techniques and algorithms of AI used in general problem solving,

optimization problems, and also to familiarize students with various scopes of AI, such as neural network and machine learning.

Course Objective:
The objective of this course is to verify the theories and concepts taught in CSE 411. The students will carry out lab experiments along with simulation. They will gain exposure to equipment and simulation tools in laboratories and learn experimental methods. The students will analyze their results and come to meaningful conclusions within their understanding, being mindful of the errors and uncertainties in their measurements.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Design** an expert system using relevant tools and approaches and **Express** real-world issues as state space problems.
CLO2	**Write** comprehensive reports on the work done in Laboratory and demonstrate the ability to work as an individual or as a team

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	**Program Learning Outcomes (PLOs)**											
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**	**PLO11**	**PLO12**
CLO1			√		√							√
CLO2									√	√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

COLs	**Teaching-Learning Strategy**	**Assessment Strategy**
COL1	Lab demonstration/ Lecture	Lab report/Final exam
COL2	Lab demonstration/ Lecture	Lab report/Final exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Weeks	***Topics***	***Hrs***	***CLOs***
01	How to install python or other software like it	**1**	CLO1,

			CLO2
02	Introduction to Different variables and memory management.	**1**	CLO1, CLO2
03	Familiarization to Different Data types and user input.	**1**	CLO1, CLO2
04	Finding Positive and Negative number.	**1**	CLO1, CLO2
05	Finding Maximum Number out of different Numbers.	**1**	CLO1, CLO2
06	Swapping two numbers.	**1**	CLO1, CLO2
07	Finding prime numbers.	**1**	CLO1, CLO2
08	Mapping and Filtering function	**1**	CLO1, CLO2
09	Zipping and unzipping function	**1**	CLO1, CLO2
10	Reducing function	**1**	CLO1, CLO2
11	Introduction to Local variable and Global variable.	**1**	CLO1, CLO2
12	Implementation of toy problems	**1**	CLO1, CLO2
13	Developing agent programs for real world problems	**1**	CLO1, CLO2
14	Applying deep learning methods to solve an application.	**1**	CLO1, CLO2
15-16	Mini Project		
17	Mini Project Presentation		
18	Final Exam		

Part C

Assessment and Evaluation:

Assessment Strategy	Lecture/ Group Discussion/ Video Tutorial	
Marks Distribution	Continuous Assessment:	60
	Summative:	40
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

3. Stuart Russell and Peter Norvig, ***Artificial Intelligence: A Modern Approach***, Pearson Series in Artificial Intelligence,4th edition (December 20,2021)

Supplementary Readings:

3. Richard S. Sutton and Andrew G. Barto, ***Reinforcement Learning: An Introduction,*** Bradford Books, 2nd edition (November 13, 2018)
4. David L. Poole and Alan K. Mackworth, ***Artificial Intelligence: Foundations of Computational Agents***, Cambridge University Press, 2nd edition (September 25, 2017)

Part A

Course Code:	CSE 425
Course Title:	Web Programming
Course Type:	Elective Course
Year/ Level/ Semester/ Term:	Seventh Semester
Academic Session:	**TBA**
Course Teacher/ Instructor:	**TBA**
Pre-requisite:	N/A
Credit Value:	3
Contact Hours:	36 Hours
Total Marks:	100

Rationale of the Course:

Web Engineering introduces a structured methodology utilized in software engineering to Web development projects. The course addresses the concepts, methods, technologies, and techniques of developing Web sites that collect, organize and expose information resources. Topics covered include requirements engineering for Web applications, design methods and technologies, interface design, usability of web applications, accessibility, testing, metrics, operation and maintenance of Web applications, security, and project management. Specific technologies covered in this course include client-side (HTML, JavaScript, and CSS) and server-side (ASP.NET/PHP).

Course Objective:

Apply basic design principles to present ideas, information, products, and services on websites. Apply basic programming principles to the construction of websites. Effectively manage website projects using available resources.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Analyze** and **design** comprehensive systems for the creation, dissemination, storage, retrieval, and use of electronic records and documents
CLO2	**Learn** and **use** some of the client-side and server-side languages used to manipulate information on the World Wide Web – i.e. PHP, and Java-script.
CLO3	**Learn** techniques and evaluation metrics for ensuring the proper operability, maintenance and security of a web application.
CLO4	**Apply** the web engineering methodologies for Web application development

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes PLOs:

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√	√	√									
CLO2			√		√							
CLO3			√									
CLO4	√											

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy:

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lecture	Assignment/ Midterm Exam
CLO2	Lecture	Assignment/ Class Test/ Midterm Exam
CLO3	Lecture/ Group Discussion	Presentation/ Class Test / Final Exam
CLO4	Lecture/ Group Discussion	Presentation/ Class Test/ Final Exam

Part B

Course plan specifying content, CLOs, co-curricular activities (if any), and assessment learning and assessment strategy mapped with CLOs.

Week	Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOS

01	Short lecture on how a Web server processes Web pages and Active Server Pages.	Lecture	Mid-term, Class Test, Assignment	CLO1
02	programming scripts, Tutorial on additional HTML coding including links, images, lists, and tables.	Lecture	Mid-term, Class Test, Assignment	CLO1
03	Visual Basic Programming: Short lecture on programming concepts	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO1
04	variables and memory	Lecture, Group Discussion	Mid-term, Class Test	CLO2
05	replacement statement, expressions, conditional processing	Lecture	Mid-term, Class Test, Assignment	CLO2
06	looping, Web pages as output	Lecture	Mid-term, Class Test, Assignment	CLO2
07	Interacting with Databases in Visual Basic Programs	Lecture	Mid-term, Class Test, Assignment	CLO2
08	Short lecture on application programming, the ASP object model	Lecture, Group Discussion	Mid-term, Class Test, Assignment	CLO2
Midterm Exam				
09	overview of middleware for connecting to databases	Lecture	Final Exam, Class Test, Assignment	CLO3
10	Web Programming: Introduction to the World Wide Web	Lecture	Final Exam, Class Test, Assignment	CLO3
11	HTTP, Markup with HTML5	Lecture, Group Discussion	Final Exam, Class Test	CLO3
12	Revision Control with Git, Design and Layout with Cascading Style Sheets (CSS)	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
13	Client-Side Programming with JavaScript and the Document Object Model (DOM)	Lecture	Final Exam, Class Test, Assignment	CLO4
14	More JavaScript, More HTML5, APIs, Server-Side Programming with PHP	Lecture	Final Exam, Class Test, Assignment	CLO4
15	Server-Side Programming with PHP (continued)	Lecture	Final Exam, Class Test, Assignment	CLO4

16	Pattern Matching with Regular Expressions, Ajax; Cookies	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
17	Sessions, and Local Storage, Databases with MySQL	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
18	Web Security, JavaScript Libraries	Lecture, Group Discussion	Final Exam, Class Test, Assignment	CLO4
Final Exam				

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	30
	Summative:	70
Make-up Procedures	As per university rules	

Part D

Learning Materials

Recommended Readings:

1. Steflik and Shridharen, *Advanced Java Networking*, Prentice-Hall, january 1,1997.

Part A

Course Code	CSE 426
Course Title	Web Programming Lab
Course Type:	Elective course
Year Level/Semester/Term	Seventh semester
Academic Session	**TBA**
Course Teacher/Instructor	**TBA**
Pre-requisite	CSE 425
Credit Value	0.75
Contact Hours	18
Total Marks	100

Rationale of the Course:

The internet and the web are now an essential part of daily life. This art is crucial to master because it exists in all conceivable dimensions. This course studies both theoretical and practical approach to Web Engineering through various real life problems &solutions. And how state of the art technologies can be learned and used later.

Course Objective:

This course aims to give students a systematic way to gain a thorough understanding of web technologies through practical application. After completing the course, students will be able to learn new technologies, analyze current web applications and systems, and effectively design new ones.

Course Learning Outcomes (CLO):

At the end of the Course, the Student will be able to:

CLO1	**Understand** different programming techniques, protocols available for development
CLO2	**Write** comprehensive reports on the work done in laboratory and/or in a group project, and orally present the project results

Mapping Course Learning Outcomes (CLOs) with the PLOs

CLOs	Program Learning Outcomes (PLOs)											
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2										√		

Mapping Course Learning Outcomes (CLOs) with the Teaching-Leaming& Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Lab demonstration Lecture	Lab Performance, Project Report and Lab Final Exam
CLO2	Lab demonstration Lecture	Lab Report

Course plan specifying content, CLOs, co-curricular activities (if any), Teaching learning and assessment strategy mapped with CLOs.

Weeks	Experiment Name	Teaching Learning Strategy	Hrs	Corresponding CLOs
1	Introduction to laboratory.	Lecture	1	CLO1, CLO2
2	Implementation of a hyper link.	Lab demonstration Lecture	1	CLO1, CLO2
3	Inserting an image on a web page.	Lab demonstration Lecture	1	CLO1, CLO2
4	Creating a form.	Lab demonstration Lecture	1	CLO1, CLO2

5	Applying different properties of css to give a web page a professional look.	Lab demonstration Lecture	1	CLO1, CLO2
6	Using JavaScript to pre-compute the total cost of an order and display it to the customer before the order is submitted to the server for processing.	Lab demonstration Lecture	1	CLO1, CLO2
7	Implementation of bootstrap to make pages responsive.	Lab demonstration Lecture	1	CLO1, CLO2
8	Making a dynamic website.	Lab demonstration Lecture	1	CLO1, CLO2
9	Deleting a record from the database using web interface.	Lab demonstration Lecture	1	CLO1, CLO2
10	Implementation of MVC design pattern through PHP.	Lab demonstration Lecture	1	CLO1, CLO2
11	Implementation of AJAX.	Lab demonstration Lecture	1	CLO1, CLO2
12	Installing Laravel on computer.	Lab demonstration Lecture	1	CLO1, CLO2
13	Implementation of routes on laravel.	Lab demonstration Lecture	1	CLO1, CLO2
14	Creating Model in laravel.	Lab demonstration Lecture	1	CLO1, CLO2
15-16	Mini Project			
17	Presentation			
18	Final Exam			

Part C

Assessment and Evaluation:

Assessment Strategy	Quiz, Assignment, Midterm Exam, Final Exam, Mini project	
Marks Distribution	Continuous Assessment:	60
	Summative:	40

Make-up Procedures	As per university rules

Part D

Learning Materials

Recommended Readings:

1. Steflik and Shridharen, *Advanced Java Networking*, Prentice-Hall, january 1,1997.

Supplementary Readings:

1. Garfinkle and Spafford, *Web Security and Commerc*, O'Reilly, June,1997.

Appendix B : Course Files

01. Course outline

02. Lecture materials/notes

03. Attendance sheet

04. Assignment → copies of best, mediocre and poor

05. Class test/quiz /mid-term test etc → copies of best, mediocre and poor

06. Copies of question papers/assessment tools

07. Rubrics for assessment

08. Course evaluation by course teacher considering feedback from the students

09. Feedback from the students on the course

10. Peer review: Done/Not done

l l. Evaluation of attainment of CLOs

l2. Improvement plan for the better attainment of CLO

In Pursuit of Knowledge

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