Learning Outcome Based Curriculum

Department of Electrical & Electronic Engineering
Premier University
Batch (17 to 31)

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Contents

Premier University, Chittagong
Department of Electrical & Electronic Engineering

Learning Outcome Based Curriculum
for B.Sc. in Electrical & Electronic Engineering

INTRODUCTION:

The modern life is inconceivable without Electrical and Electronic Engineering. From radio to cell phones, biomedical instrumentation e.g. pacemaker, computer aided tomography, X-ray imaging, MRI-save lives, microelectronics- turns sand to CPUs and memory, nanotechnology- develops new device and materials, consumer electronics- meets the entertainment and every day necessities from toast makers to shaving razors and ultimately the fuel to all these goods and systems that is electrical power generation and transmission safely to the consumers; all have been made possible by the Electrical and Electronic Engineers. However, the overwhelming demand in this field of technology is always a challenge to meet which requires a broad educational background and a long time commitment to learn and research. Considering this challenge, the Department of Electrical and Electronic Engineering at Premier University was established in January 2008. The vision of this department is to be recognized as the very best program of Electrical and Electronic Engineering education and research in this region and the mission is to provide quality education and to transfer highly skilled manpower to the community.

The department of Electrical and Electronic Engineering is facilitated with well-equipped labs on circuits and electronics, machines and power systems, communication and microprocessor as well as three well-furnished computer labs for control system, digital signal processing, microwave engineering and VLSI with necessary software and interfacing units. The curriculum of the department is mainly concentrated on three majors: Power, Communication and Electronics. The curriculum is designed heading to make the students capable of doing independent research works and skilled to bring together the theoretical concepts practically which are formulated by 1-year project/thesis works as well as industrial training/attachments. And the excellent faculty members of the department bring all these plans, visions and missions into reality with their cordial and professional cooperation.

The department of Electrical and Electronic Engineering at Premier University provides broad training to individuals that would make them adaptable to the future challenge in the arena of electrical power generation, transmission and distribution, signal processing, telecommunications, sensors, microelectronics, nanotechnology and Microsystems not only across the country but also globally as technology evolves making them successful throughout the career.

1. VISION & MISSION OF THE PROGRAM:

1.1) Vision of Program:

The vision is to produce professionals with in-depth knowledge in electrical & electronic engineering to cope with the dynamic challenges of industries & society and stimulate environments for ethical & quality research entrepreneurs.

1.2) Mission:

1. To produce electrical and electronic engineers with leadership qualities built on the foundation of technical abilities to contribute to sustainable development.
2. To increase the collaboration between the industries and academia in order to improve the adaptative quality with new technology.
3. To develop recognized and relevant research enthusiasm that helps graduates to contribute to society through innovation and ethical values.

2. OBJECTIVES AND LEARNING OUTCOMES OF THE PROGRAM:

Actually, there are no well-defined objectives and learning outcomes stated in the curriculum of the program. However, the followings may be considered as objectives and learning outcomes of the program:

2.1) Program Educational Objectives (PEOs):

PEO1: Graduates will excel to make way to give solutions to real-time problems through technical knowledge and operational skills in the field of Electrical Engineering.
PEO2: Graduates will demonstrate their ability on research to acquaint with the ongoing trends in the field of Electrical Engineering for addressing the social aspects.
PEO3: Graduates will communicate effectively as team players to cope with building a prospective career.
PEO4: Graduates of the program will act with integrity and have inter-personal skills in catering the need-based requirements blended with ethics and professionalism.

2.2) Mapping Between Mission & PEOs:

PEOs	Mission-1	Mission-2	Mission-3
PEO 1	√	√	
PEO 2			√
PEO 3	√	√	
PEO 4		√	√

2.3) Program Outcomes (POs):

PO1: Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

PO10: Communication: 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.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long Learning: Recognize the need for and have the preparation and ability to Engage in independent and life- long learning in the broadest context of technological Change

2.4) Mapping Between Mission & PEOs:

POs	Knowledge	PEO 1	PEO 2	PEO 3	PEO 4
PO 1	Engineering Knowledge	√			
PO 2	Problem Analysis	√	√		
PO 3	Design/ Development of Solutions	√		√	
PO 4	Conduct investigations of complex problems		√		
PO 5	Modern Tool Usage:	√	√		
PO 6	The Engineer and Society			√	
PO 7	Environment and Sustainability			√	
PO 8	Ethics			√	
PO 9	Individual and Team Work				√
PO 10	Communication.				√
PO 11	Project Management and Finance				√
PO 12	Life-long Learning		√		√

3. CHRONOLOGY OF EVENTS

December 2007 : Electrical and Electronic Engineering (EEE) Program was launched.
July 2012 : Students of first batch of EEE program graduated.
Fact Sheet Program : Undergraduate
Name of Degree : Bachelor of Science in Electrical and Electronic Engineering [B. Sc. Engg. in EEE]
Duration : 4 Years
Semester : 8
Total Theory Courses : 40
Total Lab Courses : 27
Project/Thesis : 1
Total Credits : 160

4. COURSE LIST AND CODE

There are five different types of Course in Curriculum:

1) Language & Generals Education Courses.
2) Basic Science & Mathematics Courses.
3) Other Engineering Courses.
4) Core Courses.
5) Elective Courses

For Graduation, A student Have to complete 160 Credit of course from those course groups.

Students have to choose five elective theory courses with two Laboratory courses from Elective Courses.
A list of course type & required Credit is Given bellow:

Sl. NO	**Course Type**	**Credit Hours**	**Percentage of Total Credit Hours (Approximate)**
1.	Language & Generals Education Courses.	19	12
2.	Basic Science & Mathematics Courses.	22.5	14
3.	Other Engineering Courses.	11	7
4.	Core Courses.	85.5	53
5.	Elective Courses	22	14
	Total	160	100%

4.1 Course List (Group Wise):

1. Language & Generals Education Courses:

SL.	**Course Code**	**Course Title**	**Credit Hour**
1	ACC 101	Basic Accounting	3
2	ECO 201	Basic Economics	3
3	ENG 101	General English	3
4	ENG 103	Developing English Skills	2
5	ENG 401	Technical Writing & Presentation	2
6	MGT 203	Industrial and Business Management	3
7	MGT 251	Organizational Behavior	3

2. Basic Science & Mathematics Courses:

SL.	Course Code	Course Title	Credit Hour
1	CHE 101	Chemistry	3
2	CHE 102	Chemistry Laboratory	0.75
3	MAT 105	Engineering Mathematics I	3
4	MAT 107	Engineering Mathematics II	3
5	MAT 201	Engineering Mathematics III	3
6	MAT 203	Engineering Mathematics IV	3
7	PHY 101	Engineering Physics I	3
8	PHY 103	Engineering Physics II	3
9	PHY 104	Engineering Physics II Laboratory	0.75

3. Other Engineering Courses:

SL.	Course Code	Course Title	Credit Hour
1	CE 102	Civil Engineering Drawing Laboratory	1
2	CSE 110	Introduction to Computer Systems (Laboratory)	2
3	CSE 301	Computational Methods for Engineering Problems	3
4	CSE 302	Computational Methods for Engineering Problems Laboratory	1
5	ME 102	Mechanical Engineering Drawing & CAD (Laboratory)	1
6	ME 201	Basic Mechanical Engineering	3

4. Core Courses:

SL.	Course Code	Course Title	Credit Hour
1	EEE 101	Electrical Circuits I	3
2	EEE 102	Electrical Circuits I Laboratory	1.5
3	EEE 103	Electrical Circuits II	3
4	EEE 104	Electrical Circuits II Laboratory	1.5
5	EEE 106	Electrical Circuit Simulation Laboratory	1.5
6	EEE 201	Signals & Systems	3
7	EEE 202	Signals & Systems Laboratory	1
8	EEE 211	Electronics I	3
9	EEE 212	Electronics I Laboratory	1.5
10	EEE 213	Electronics II	3
11	EEE 214	Electronics II Laboratory	1.5

12	EEE 221	Electrical Machines I	3
13	EEE 222	Electrical Machines I Laboratory	1.5
14	EEE 223	Electrical Machines II	3
15	EEE 224	Electrical Machines II Laboratory	1.5
16	EEE 241	Electromagnetic Fields and Waves	3
17	EEE 302	Electronic Appliances Laboratory	1.5
18	EEE 309	Communication Engineering	3
19	EEE 310	Communication Engineering Laboratory	1.5
20	EEE 311	Digital Electronics	3
21	EEE 312	Digital Electronics Laboratory	1.5
22	EEE 313	Measurement and Instrumentation	3
23	EEE 314	Measurement and Instrumentation Laboratory	1.5
24	EEE 315	Power System Analysis	3
25	EEE 316	Power System Analysis Laboratory	1.5
26	EEE 322	Electrical Machine Design Laboratory	1
27	EEE 333	Switchgear and Protection	3
28	EEE 334	Switchgear and Protection Laboratory	1.5
29	EEE 351	Transmission & Distribution of Electrical Power	3
30	EEE 356	Electrical and Electronic Engineering Services (Laboratory)	1.5
31	EEE 371	Microprocessors & Microcontrollers	3
32	EEE 372	Microprocessors & Microcontrollers Laboratory	1.5
33	EEE 373	Control Systems	3
34	EEE 374	Control Systems Laboratory	1.5
35	EEE 400	Project/Thesis (Two semesters long course, i.e., for 7^{th} & 8^{th} semesters)	4
36	EEE 411	Semiconductor Physics & Devices	3
37	EEE 477	Digital Signal Processing	3
38	EEE 478	Digital Signal Processing Laboratory	1.5

4. Elective Courses:

SL.	**Course Code**	**Course Title**	**Credit Hour**
1	EEE 403	Microwave and Antenna Engineering	3
2	EEE 435	Cellular Mobile & Satellite Communication	4
3	EEE 437	Wireless Communication	3
4	EEE 441	Industrial Power Electronics	3
5	EEE 442	Industrial Power Electronics Laboratory	1.5
6	EEE 443	VLSI Design	3

7	EEE 444	VLSI Design Laboratory	1.5
8	EEE 445	Introduction to Robotics Engineering	3
9	EEE 447	Introduction to Image Processing	3
10	EEE 448	Introduction to Image Processing Laboratory	1.5
11	EEE 451	Power Plant Engineering	3
12	EEE 453	Power System Reliability	3
13	EEE 463	VHDL	3
14	EEE 464	VHDL Laboratory	
15	EEE 471	Renewable Energy	3
16	EEE 485	Analog Integrated Circuit Design	3
17	EEE 493	Embedded System Design	3
18	EEE 487	Cyber Security & IOT	4

4.2 Course List (Semester Wise):

1st Semester:

SL No	Course Code	Course Title	Credit
1	CHE 101	Chemistry	3
2	CHE 102	Chemistry Laboratory	0.75
3	CSE 110	Introduction to Computer Systems (Laboratory)	2
4	EEE 101	Electrical Circuits I	3
5	EEE 102	Electrical Circuits I Laboratory	1.5
6	ENG 101	General English	3
7	MAT 105	Engineering Mathematics I	3
8	ME 102	Mechanical Engineering Drawing & CAD (Laboratory)	1
9	PHY 101	Engineering Physics I	3

2nd Semester:

SL No	Course Code	Course Title	Credit
1	ACC 101	Basic Accounting	3
2	EEE 103	Electrical Circuits II	3
3	EEE 104	Electrical Circuits II Laboratory	1.5
4	EEE 106	Electrical Circuit Simulation Laboratory	1.5
5	ENG 103	Developing English Skills	2
6	MAT 107	Engineering Mathematics II	3
7	ME 201	Basic Mechanical Engineering	3
8	PHY 103	Engineering Physics II	3
9	PHY 104	Engineering Physics II Laboratory	0.75

3rd Semester:

SL No	Course Code	Course Title	Credit
1	CE 102	Civil Engineering Drawing Laboratory	1
2	ECO 201	Basic Economics	3
3	EEE 241	Electromagnetic Fields and Waves	3
4	EEE 211	Electronics I	3
5	EEE 212	Electronics I Laboratory	1.5
6	EEE 221	Electrical Machines I	3
7	EEE 222	Electrical Machines I Laboratory	1.5
8	MAT 201	Engineering Mathematics III	3

4th Semester:

SL No	Course Code	Course Title	Credit
1	CSE 301	Computational Methods for Engineering Problems	3
2	CSE 302	Computational Methods for Engineering Problems Laboratory	1
3	EEE 213	Electronics II	3
4	EEE 214	Electronics II Laboratory	1.5
5	EEE 223	Electrical Machines II	3
6	EEE 224	Electrical Machines II Laboratory	1.5
7	EEE 201	Signals & Systems	3
8	EEE 202	Signals & Systems Laboratory	1
9	MAT 203	Engineering Mathematics IV	3

5th Semester:

SL No	Course Code	Course Title	Credit
1	EEE 302	Electronic Appliances Laboratory	1.5
2	EEE 309	Communication Engineering	3
3	EEE 310	Communication Engineering Laboratory	1.5
4	EEE 311	Digital Electronics	3
5	EEE 312	Digital Electronics Laboratory	1.5
6	EEE 322	Electrical Machine Design Laboratory	1
7	EEE 351	Transmission & Distribution of Electrical Power	3
8	MGT 203	Industrial and Business Management	3
9	MGT 251	Organizational Behavior	3

6th Semester:

SL No	Course Code	Course Title	Credit
1	EEE 313	Measurement and Instrumentation	3
2	EEE 314	Measurement and Instrumentation Laboratory	1.5
3	EEE 315	Power System Analysis	3
4	EEE 316	Power System Analysis Laboratory	1.5
5	EEE 333	Switchgear and Protection	3
6	EEE 334	Switchgear and Protection Laboratory	1.5
7	EEE 356	Electrical and Electronic Engineering Services (Laboratory)	1.5
8	EEE 371	Microprocessors & Microcontrollers	3
9	EEE 372	Microprocessors & Microcontrollers Laboratory	1.5

7th Semester:

SL No	Course Code	Course Title	Credit
1	EEE 373	Control Systems	3
2	EEE 374	Control Systems Laboratory	1.5
3	EEE 411	Semiconductor Physics & Devices	3
4	ENG 401	Technical Writing & Presentation	2
5		Elective -1	3
6		Elective -1 L	1.5
7		Elective -1	3
8		Elective -1 L	1.5

8th Semester:

SL No	Course Code	Course Title	Credit
1	EEE 477	Digital Signal Processing	3
2	EEE 478	Digital Signal Processing Laboratory	1.5
3		Elective 3	3
4		Elective 4	3
5		Elective 3	3
6		Elective 4	4
7	EEE 400	Project/Thesis (Two semesters long course, i.e., for 7th& 8th semesters)	4

Elective Courses:

SL.	Course Code	Course Title	Credit Hour
1	EEE 403	Microwave and Antenna Engineering	3
2	EEE 435	Cellular Mobile & Satellite Communication	4
3	EEE 437	Wireless Communication	3
4	EEE 441	Industrial Power Electronics	3
5	EEE 442	Industrial Power Electronics Laboratory	1.5
6	EEE 443	VLSI Design	3
7	EEE 444	VLSI Design Laboratory	1.5
8	EEE 445	Introduction to Robotics Engineering	3
9	EEE 447	Introduction to Image Processing	3
10	EEE 448	Introduction to Image Processing Laboratory	1.5
11	EEE 451	Power Plant Engineering	3
12	EEE 453	Power System Reliability	3
13	EEE 463	VHDL	3
14	EEE 464	VHDL Laboratory	
15	EEE 471	Renewable Energy	3
16	EEE 485	Analog Integrated Circuit Design	3
17	EEE 493	Embedded System Design	3
18	EEE 487	Cyber Security & IOT	4

4.3 Teaching-Learning & Student Assessment Strategy:

4.3-a) Teaching-Learning & Student Assessment Strategy for Theory Courses:

Teaching Learning Strategy:

- Class Lecture
- Mathematical Problem solving
- Group Discussion
- Student Presentation

Student Assessment Strategy:

- Attendance – 10%
- Assignment -10%
- Class test- 10%
- Mid Term-20%
- Final Exam -50%

4.3-b) Teaching-Learning & Student Assessment Strategy for Laboratory Courses:

Teaching Learning Strategy:

- Class Lecture
- Experiment done by Students
- Student Presentation
- Student Demonstration
- Project

Student Assessment Strategy:

- Attendance -10%
- Performance During Class- 10%
- Report – 20%
- Final Quiz-50%
- Viva-Voce -10%

4.3-c) Teaching-Learning & Student Assessment Strategy for Final Thesis/Project:

Teaching Learning Strategy:

- Weekly Meeting With Supervisor
- Student Presentation
- Student Demonstration
- Industrial Visit
- Project

Student Assessment Strategy:

- Performance- 40%
- Report- 30%
- Final Presentation- 30%

4.4. Grading System and Calculation of GPA and CGPA

Letter grade and corresponding grade points will be awarded as follows:

Numerical Grade	Letter Grade	Grade Points
80% or above	A+ (A plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A- (A minus)	3.50
65% to less than 70%	B+ (B plus)	3.25
60% to less than 65%	B (B regular)	3.00
55% to less than 60%	B- (B minus)	2.75
50% to less than 55%	C+ (C plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00

Grade Point Average (GPA) of a Semester will be calculated as follows:

$$\text{GPA} = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

Where,

n is the number of courses enrolled by the student in a particular semester;

$\mathbf{C_i}$ is the number of credits assigned to a particular course i; And $\mathbf{G_i}$ is the grade point corresponding to the grade earned for i-th course.

Cumulative Grade Point Average (CGPA) will be calculated by dividing the total grade points accumulated up to the date by the total credits.

Both GPA and CGPA will be rounded off to the second place of decimal for reporting.

While enumerating credits the grades 'D' or above will be considered as credit earned for a course.

4.4-a) Degree Requirements

Completion of minimum 160 credit hours.
Passing of all courses individually and maintaining a CGPA of 2.25.
Completion of Project/Term paper with a minimum grade of "c".

5. INTENDED LEARNING BASED COURSE CURRICULUM:

For Learning Outcome Based Curriculum, we have designed Course Profile for Each subject offered in Department of Electrical & Electronic Engineering. Each course profile contains Course Outcome (CO) of the course mapped with Program Outcomes (PO). It also contain Bloom's taxonomy domain/level. At the end, we make a mapping table for whole program.

Domains and Levels of Bloom's Taxonomy:

Cognitive Domain (C):	Affective Domain (A):	Psychomotor Domain (P):
C1 - Recall data	A1 – Receive	P1 - Imitation
C2 - Understand	A2 - Respond	P2 - Manipulation
C3 - Apply	A3 - Value	P3 - Develop precision
C4 – Analysis	A4 - Organize personal value system	P4 -Articulation
C5 – Synthesize	A5 - Internalize value system	P5 - Naturalization
C6 – Evaluate		

From the next page all the course profiles are described

5.1 Language & Generals Education Courses.

Title of the course: Basic Accounting
Course Code: ACC 101
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/Two
Prerequisite: N/A
Type: Language & Generals Education Courses

Rationale: The aim of this course is to help students to get basic knowledge of accounting to enhance the financial managerial capability of engineers.

Objectives: -
The objectives of this course are-

- To provide the knowledge of accounting information.
- To accumulate basic ideas of journal, ledger, balance sheet & final account.
- To help students conceptualize basic theories on the preparation of financial statement.
- To facilitate with the basic knowledge of cost accounting.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Develop a journal.
CO-2: Develop a ledger.
CO-3: Produce a final account & balance sheet
CO-4: Discuss the basic cost accounting.

Course Description:
Introductory: Definition of Accounting and Financial Accounting, Users of Accounting Information, Branches of Accounting, Types of accounts, Determination of debit and credit, accounting concepts and Conventions, Definition of business transaction, Nature of business transaction, Accounting Principles, GAAP.
Accounting Cycle: Journal, Ledger, Trial Balance, Cash Book, adjusting entries, closing entries, classifying capital and revenue expenditure
Preparation of Financial Statement: Definition, Features of financial statement, Component/parts of financial statement, Multi-step Income Statement, Owners Equity Statement, Classified Balance Sheet, Cash Flow Statement, Bank Reconciliation Statement.
Depreciation: Definition of Depreciation, Objectives and methods for providing depreciation.
Cost Accounting: Introduction, Objectives and advantages of cost accounting, Elements of cost, Preparation of cost sheet, Inventory valuation (Store ledger), Overhead allocation.
Standard Costing: Calculation of material, labor and overhead variance, Break-even point, Margin of safety, Use of accounting information in project evaluation, Budget (cash budget and master budget)
Textbooks/Reference Books:

1. Accounting Principles. -by Weygandt, Kieso and Kimmel- Latest edition.
2. Cost Accounting- By Bhabatosh Banarjee

CO Delivery & Assessment:

Cos	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO11	C3, P4	Lecture	Final Exam, Class Test
CO2	PO11	C3, P4	Lecture	Final Exam, Assignment
CO3	PO11	C5, P2	Lecture	Final Exam, Mid Term
CO4	PO11	C3, P4	Lecture	Final Exam, Class Test

CO/PO Mapping												
Cos	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											√	
CO2											√	
CO3											√	
CO4											√	

Title of the course: Basic Economics
Course Code: ECO 201
Credit Hour: 3.00 credits
Contact Hours: 3 Hours /Week
Level/Term: Two/One
Prerequisite: N/A
Type: Language & Generals Education Courses

Rationale: This course aims to make the students oriented with the basic economics concepts.

Objectives:

The objectives of this course are-

- To help students conceptualize the basic theories of economics.
- To identify the economic variables and the factors determining them.
- To accustom them with initial demand, supply and equilibrium models.
- To introduce them with the basic macroeconomic ideas.
- To familiarize them with various macro problem-solving tools.
- To help them determine the process of multiplier theoretically and algebraically.
- To understand the roles of fiscal and monetary policy in demand management.

Course Outcomes (COs):

After successful completion of this course, students will be able to
CO-1: Analyze practical economic issues (inflation, unemployment, business cycle, stagflation etc.) by identifying relevant factual information.
CO-2: Distinguish between microeconomics and macroeconomics.
CO-3:Categorize concepts and theories related to the behavior of economic agents, markets, industry and firm structures, legal institutions, social norms, and government policies.
CO-4: Analyze the economic implications of alternative trade policies.

Course Description:

The Economic Problem: Want and Scarcity, opportunity cost.
The Language of economics: Economy, Production, Consumption, Exchange, Resources, What resources earn, Income and Wealth, Public and Private Sector in the Economy.
Economic System: Coping with scarcity, what how and for whom to produce, providing answers to what how and for whom, the market economy, the planned economy, the mixed economy, developed and less developed economy.
How the Economy works: The nature of economic problems and their sources, Economic goals of a society, Alternative economic systems, Circular flow of income, An Economy in Equilibrium.
Demand and Supply Theory: Supply, demand and market – elementary theory of supply and demand – relationship between goods and factor markets, adjustment to changes in demand and supply, Taxes and Subsidies.
Elasticity: Demand, Price, Income and Cross and supply elasticity - Measurement, importance and applications.
Consumer behavior and market demand: Utility approach vs. the indifference user approach – Individual and market demand curves - the consumer's surplus, application, Indifference curve, Budget Line.
Production and Costs Theory: What is production, The production function, the aims of firms, classification of inputs, production with one variable input – total, average and marginal product, law of diminishing returns, production with two variables input – Isoquants; constant, increasing and decreasing

return to scale; technical efficiency - short run and long run - choice of inputs in the short and the long run – total fixed and variable costs – average and managerial costs.

The perfectly competitive market and its characteristics: Conditions of profit maximization - A firms short run optimal output level – firm's short run supply curve - the short run industry supply – interaction of market demand and industry supply - the equilibrium price - The long run industry supply curve.

Imperfectly competitive markets: Monopoly - optimal price – output combination - inefficiency of monopoly-Price discrimination - natural monopoly - important features of monopolistic competitive and oligopoly – cartels in oligopoly.

Basic principles of factor pricing: Derived demand for an input – income distribution - factor price differentials – causes and implications - economic rents.

Resource allocation and the market: Concepts of equity and efficiency - strength and weakness of the market mechanism in terms of equity and efficiency - the need for government intervention – tools of intervention – regulation - public ownership and taxation, Perfect competition.

International trade: Gains from international specialization-free trade vs. protection – the World Trade Organization (WTO) and globalization - regional economic integration SAARC, EU.

Non – Renewable resources: Pricing and optimal rate of extraction.

Key macroeconomics phenomena: Output - employment- inflation - exchange rates- growth etc. – major macroeconomics ills – unemployment – inflation - slow growth. National output – concepts and measurements - interpretation of national income measures – inter temporal and international comparisons – the pitfall, Interest Rates, Balance of Payment, Exchange rate, Monetary and Fiscal Policy.

Income determination: Aggregate expenditure and equilibrium national income – a simple model, Changes in autonomous expenditures and national income – the multiplier, Government spending and taxes.

Balance of payments and the exchange rates: Policy changes to correct dis-equilibrium in the balance of payments.

Textbooks/Reference Books:

- *Modern Microeconomics* by A. Koutsoyiannis.
- *An introduction to positive economics* by R.G. Lipsey.
- *Economics* by P. A. Samuelson.

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO6	A5	Lecture	Final Exam, Mid Term
CO2	PO11	C2, P3	Lecture	Final Exam, Assignment
CO3	PO11	C2, P3	Lecture	Final Exam, Class Test
CO4	PO11	C4, P4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						√						
CO2											√	
CO3											√	
CO4											√	

Title of the course: General English
Course Code: ENG 101
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Language & Generals Education Courses

Rationale: The aim of this course is to enhance the students' basic understanding of English language.

Objectives:

The objectives of this course are-

- To develop student's grammatical knowledge.
- To improve the ability to recognize and fashion rhetorical and linguistic discourse and the manipulation of sound reasoning.
- To grow competence in textual analysis.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Outline common mistakes in English grammar.
CO-2: Write short & effective notes in English.
CO-3: Develop English vocabulary.
CO-4: Improve reading & writing skills.

Course Description:

English phonetics: The places and manners of articulation of the English sounds; Vocabulary; English grammar: construction of sentences, some grammatical problems; Comprehension; Paragraph writing; Précis writing; Amplification; Short stories written by some well-known classic writers.

Grammar: Tense, article, preposition, subject-verb agreement, clause, Main Verbs, Modals and Modal-related patterns, Causatives, Conditionals, Subjunctives, Infinitives, Have + Participle, Auxiliary Verbs, Pronouns, Relative Pronouns, Nouns and Adjectives, Nouns functioning as Adjectives and other Parts of Speech, Determiners, Comparatives, Prepositions and prepositional idioms, Point of View, Agreement of verbs, Introductory verbal Modifiers,

Vocabulary building: Correct and precise diction, affixes, level of appropriateness, Colloquial and standard, informal and formal. Word Choice – Vocabulary – Antonym, Synonym, Homonym, Homograph, Homophone, Wh. Questions, Punctuations: Full stop, comma, colon, semi colon, apostrophe, capital letter, hyphen, quotation marks, titles etc.

Developing reading skill: Strategies of reading – skimming, scanning, predicting, inferring, analyzing and interpreting variety of texts, practicing comprehension from literary and nonliterary texts.

Developing writing skill: Sentences and Clauses, sentence variety, generating sentences; clarity and correctness of sentences, linking sentences to form paragraphs, writing paragraphs, essays, and reports.

Textbooks/Reference Books:

1. English Grammar in Use by Raymond Murphy.
2. Build Up Your English (ELBS) by A. J. Glover.
3. Fluency in English by L.G. Alexander.
4. General English for Technical Students by E. Frank Candlin.
5. Words and Ideas by Hans P. Guth.
6. From Paragraph to Essay by Maurice Imhoof and Herman Hudson.
7. A Practical English Grammar, by A. J. Tomson, Oxford University Press.
8. Cliffs Test of English as Foreign Language by M. A. Pyle.

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C2	Lecture	Final Exam, Mid Term
CO2	PO1	C6	Lecture	Final Exam, Assignment
CO3	PO1	C3	Lecture	Final Exam, Class Test
CO4	PO10	A3, P5	Lecture	Final Exam, Class Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2										√		
CO3										√		
CO4										√		

Title of the course: Developing English Skills
Course Code: ENG 103
Credit Hour: 2.00 credits
Contact Hours: 2 Hours/Week
Level/Term: One/Two
Prerequisite: ENG 101
Type: Language & Generals Education Courses

Rationale: This course aims to develop writing, listening & speaking skills of students.

Objectives: -
The Objectives of this course are-

- To develop student's writing skill & listening skill in English.
- To improve the ability to note taking.
- To improve students spoken English skill.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Develop English speaking skills.
CO-2: Improve English writing skills.
CO-3: Develop the communication skill.

Course Description:

Developing Writing Skill: Letter Writing: formal and informal, Report writing; Business communication and tenders, business letters, letters of opinion, application and CV writing, fax, e-mail, memo, etc.

Listening Skill and Note Taking: Listening to recorded texts and class lectures and learning to take useful notes based on listening.

Developing Speaking Skill: Oral skills including communicative expressions for personal identification, life at home, giving advice and opinion, instruction and directions, requests, complaints, apologies, describing people and places, narrating events.

Discussion: A group of students to be brought on the dais at a time. Other students of the class will be interrogating and likewise every student should be brought in turn and questions should be asked from the fields of literature, science, current politics, international affairs, games and sports, etc. The Instructor will act as a conductor.

Textbooks/Reference Books:

1. English Grammar in Use by Raymond Murphy.
2. Build Up Your English (ELBS) by A. J. Glover.

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO10	P2, A2	Lecture	Final Exam, Mid Term
CO2	PO10	A5, P3	Lecture	Final Exam, Assignment
CO3	PO10	A5, P2	Lecture	Final Exam, Class Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2										√		
CO3										√		

Title of the course: Technical Writing & Presentation **Course Code:** EEE 401
Credit Hour: 2.00 credits **Contact Hours:** 2 Hours/Week
Level/Term: Four/One **Prerequisite:** ENG 101
Type: Language & Generals Education Courses

Rationale: This course aims to develop the skill to write a technical report and to improve presentation skills.

Objectives:
The objectives of this course are:

- To improve the technical writing skills.
- To learn about the basic elements of a report
- To gain skill on word choice, sentence structure and paragraph development
- To improve the presentation skills.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1 Write a technical report.
CO-2 Evaluate information effectively.
CO-3 Select proper words to make sentence and then paragraph, reports etc.
CO-4 Organize a work to present verbally.

Course Description:
Beginning to Write: a) Making sensible sentences. b) Joining and expanding sentences. c) Contracting sentences. d) Logical development of sentences in context using an idea. e) Clear and effective communication of information.
Reading for Writing: Students will be required to comprehend modern prose-passages drawn from different disciplines with attention to their (a) context, (b) vocabulary, and (c) syntax, and deliver feedback in the form of précis, summaries, and comprehension answers. They will also be required to present their writings before the class for discussion and reactions by the peers.
Expanding Writing: a) Writing paragraphs on technical aspects. b) Writing short, free and guided compositions. c) Developing essays on technical issues. d) Writing reports, memos and business letters. e) Editing compositions for clarity and effectiveness.

Textbooks/Reference Books:

1. Engineer's Guide to Technical Writing by Kenneth G. Budinski
2. Thinking on Paper by J.H. Barton and V.A. Howard

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO 10	P5, A2	Lecture	Final Exam, Mid Term
CO2	PO 1	C6	Lecture	Final Exam, Assignment
CO3	PO 10	A5, P3	Lecture	Final Exam, Class Test
CO4	PO 10	A4, P5	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										√		
CO2	√											
CO3										√		
CO4										√		

Title of the course: Industrial Business Management
Course Code: MGT 203
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: N/A
Type: Language & Generals Education Courses

Rationale: This course aims to build the managerial foundation for engineering management.

Objective:

The objectives of this course are-

- To help the students to gain understanding of the theory of management and organization
- To facilitate students with the knowledge to practice management in contemporary organizations from a conceptual, analytical and pragmatic perspective.
- To provide a framework of financial management at the introductory level.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Demonstrate the management functions.
CO-2: Categorize selected theories of management.
CO-3: Solve managerial challenges with teamwork.
CO-4: Apply modern tools of managerial calculation.
CO-5: Assess ethical issues in business situations.

Course Description:

Introduction: Scope of industrial management, functions of management, duties and responsibilities of a manager, Brief discussions about Tailor's scientific management, theory and contributions of Henry Fayol-Elton- Mayo and Gilbreth, Modern concepts of management.

Organization: Growth of organization authority, responsibility, relationships, span of control, principles of organization, administration-management and organization relationship, committee and task force, Manpower planning

Personnel management: Scope, Importance, Need hierarchy, Functions of personnel manager, wages and salary, wage-incentive plan, job evaluation and merit rating, Training, Performance appraisal, moral and motivation, leadership, industrial disputes, collective bargaining agent, health and safety measures, Informal groups, Organizational change and conflict.

Financial management: Elements of costs, break-even analysis, depreciation calculation, budgets, budgetary control, introduction to time value of money and benefit/cost ratio, Cost planning and control, Development planning process.

Marketing: Modern concept of marketing, marketing department, sales promotion, inventory and inventory control, CPM, plant layout and location, use of computer in management and office business, management information systems, Patent laws.

Technology Management: Management of innovation and changes; Technology life cycle; Case studies.

Textbooks/Reference Books:

- Productions and Operations Management by James B. Dilworth.
- Management by Ricky W. Griffin.
- Management by Heinz Weihrich & Harold Koontz.

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO11	C3, P4	Lecture	Final Exam, Mid Term
CO2	PO11	C2, P3	Lecture notes,	Final Exam, Assignment
CO3	PO9	A4, P2	Lectures, Notes,	Final Exam, Class Test
CO4	PO5	C3, P2	Lectures, Notes,	Final Exam, Class Test
CO5	PO8	A3	Lectures, Notes,	Final Exam, Class Test

CO/PO Mapping												
Cos	Program Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											√	
CO2											√	
CO3									√			
CO4					√							
CO5								√				

Title of the course: Organizational Behavior
Course Code: MGT 251
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: N/A
Type: Language & Generals Education Courses

Rationale: This course aims to develop organizational skills motivated by interpreting organizational interactions.

Objectives:
The objectives of this course are-

- To help the students to develop cognizance of the importance of human behavior.
- To enable students to describe how people behave under different conditions and understand why people behave as they do.
- To provide the students to analyze specific strategic human resources demands for future action.
- To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behavior and improve results.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Improve the performance of individual subordinates.
CO-2: Perform under a team.
CO-3: Develop a vision of the future.
CO-4: Develop ethical view while working.
CO-5: Design effective organizational framework to achieve superior performance.

Course Description:
Study of organizational behavior (OB): OB follows the principles of human behavior, organizations are social systems, and multiples factors shape OB, Structure and process effect OB and the emergent culture.
Model of managing Organizations: Behavior, Structure and Processes: Organization environment, behavior within organization, structure and design of the organization, the processes of organization;
The Individual: Biological characteristics, Ability, Learning, Values, Attitudes, Job Satisfaction, Personality, Emotion, Perception, Individual Decision Making, Motivation,
The Group: Definition and Classification, Stages of Group Development, Roles, Status and Norms, Composition, Cohesiveness, Group Decision Making, Team, Creating effective team, Leadership – the emerging concepts, Power and Politics, Conflict and Negotiation,
Contemporary Issues: Organizational Change, Stress Management. Organizational culture

Textbooks/Reference Books:

- Essentials of Organizational Behavior. 9th ed. New Jersey(2008): Pearson/Prentice Hall by Robbins, S. & Judge T.A
- Organizational Behavior: An Introductory Text, 6th ed., Harlow: FT/Prentice Hall(2007) by Huczynski, A. & Buchanan D
- Management and Organizational Behavior 8th ed. FT/Prentice Hall by Lauries J. Mullins (2007)
- Organizations: behavior, structure, processes. 12th ed. McGraw Hill(2006) by Gibson, J., Ivanchevich, J., Donnelly, J. &Konopaske R

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO9	A4, P3	Lecture	Final Exam, Mid Term
CO2	PO9	A4, P2	Lecture	Final Exam, Assignment
CO3	PO12	A3, P4	Lecture	Final Exam, Class Test
CO4	PO8	A3	Lecture	Final Exam, Class Test
CO5	PO12	A5, P3	Lecture	Final Exam

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									√			
CO2									√			
CO3												√
CO4								√				
CO5												√

5.2 Basic Science & Mathematics Courses.

Title of the course: Chemistry
Course Code: CHE 101
Credit Hour: 3.00
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Basic Science & Mathematics Courses

Rationale: This course aims to understand the chemistry of materials and the relationship between electricity and chemistry.

Objectives:
The objectives of this course are-

- To provide the basic knowledge of chemistry.
- To acquaint the student with the basic knowledge of materials (elements and compounds) that will require for electrical and electronics engineering.
- To help the students understand the relationship between electricity and chemistry.

Course Outcomes (COs):

After successful completion of this course, students will be able to
CO-1: Analyze the chemical bonding of atoms to characterize materials.
CO-2: Distinguish different types of chemical processes related to electrical & electronic engineering.
CO-3: Apply methodologies to produce electricity from a chemical reaction.

Course Description:

Structure of Atom: Atomic structure, quantum numbers, electronic configuration, periodic table. Properties and uses of noble gases, Wave nature and particle nature of electrons, Schrodinger's wave equation, Particle in one dimensional box, normalization and orthogonalization of wave functions, Mason theory of nuclear forces, Mass defect, Properties and uses of radioactive elements.
Chemical Bonding: Different types of chemical bonds, covalent and coordinate compounds, Valence bond theory.
Classification of Elements: Structure and properties of Boron, Silicon, Germanium, Gallium, Arsenic and Antimony, Preparation of pure silicon, Intrinsic and extrinsic semiconductors, p-n junction and Application of semiconductors.
Instrumental Analysis: Radiation and matter interaction, Electromagnetic radiation, UV- VIS and IR spectroscopy, Beer-Lambert's law, Basic components of a spectrometer, Radiation sources, Wavelength selectors, Different types of radiation detectors, Signal processor, Sensitivity and noise reduction.
Reaction Dynamics: Thermo Chemistry, Chemical kinetics, chemical equilibrium, Ionization of water and pH concept.
Electrochemistry: Types of conductors of electricity, Electrolytes and non-electrolytes, Phenomena of electrolysis, Faraday's law of electrolysis, Theories of electrolytic conduction, Electrical properties of solution.
Organic Chemistry: Aliphatic and aromatic hydrocarbons, Selective organic reactions.
Polymers: Synthetic and natural polymers, Thermosetting and thermoplastic polymers, natural and synthetic rubber, Insulation properties of PVC, rubber and plastics.

Water Treatment: Specification of water, Treatment of drinking water, Iron removing plant, Distillation of water, Contamination of water caused by As, Pd, Hg and other toxicants, Removal of toxicity from polluted water, Thermal and radioactive pollution of water.
Fuel: Types of fuel, Origin of fuel, Refining of crude fuels, Characteristics of different fuels, Calorific value, Octane number, Antiknock compounds, Cracking of fuels, Nuclear fuels and Aviation fuels

Textbooks/Reference Books:

1. Modern Inorganic Chemistry by S.Z. Haider
2. Selected topics of Inorganic Chemistry by Malik, Tuli and Madan (S. Chand and Co.)
3. Physical Chemistry by Haque and Nawab
4. Concise Engineering Chemistry by Neetu Goel and Sanjay Kumar (AITBS Publishers)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO 2	C4	Lecture	Final Exam, Class Test
CO2	PO 1	C2	Lecture	Final Exam, Mid term
CO3	PO 2	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2	√											
CO3		√										

Title of the course: Chemistry Laboratory
Course Code: CHE 102
Credit Hour: 0.75 credits
Contact Hours: 1.5 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Basic Science & Mathematics Courses

Rationale: This course aims to train the students in various types of chemical analysis.

Objectives:
The Objectives of this course are:

- To introduce students with safety regulations of chemistry laboratory.
- To facilitate students with foundation skills of preparing chemical solutions.
- To acquaint students with the knowledge of titration process.

Course Outcomes (COs):
After successful completion of this course, students will be able
CO-1: To demonstrate Laboratory Experiments related to chemical analysis as an individual or as a member of a team.
CO-2: To conclude the result from experimental data.
CO-3: To write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	**COURSE CONTENT (as Summary)**
1	Different chemical analysis on: HCl, NaOH, $KMnO_4$, Fe(II), $K_2Cr_2O_7$, Cu(II) etc.
2	Report writing based on laboratory work.
3	Oral Presentation on Mini Project Work (Design Project/Analytical Project/ Experimental Project/Industrial Tour)

Cos	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO 9, PO 10, PO 12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Engineering Mathematics I
Course Code: MAT 105
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Basic Science & Mathematics Courses

Rationale: This course aims to build up basics in differential calculus & co-ordinate geometry in the context of electrical engineering applications.

Objectives:
The objectives of this course are-

- To help students conceptualize basic theories in differential calculus.
- To develop the problem-solving skills related to changing quantities.
- To accumulate basics of co-ordinate geometry.

Course Outcomes (COs):
After successful completion of this course, students will be able to:
CO-1: Solve engineering problems using the knowledge of derivatives.
CO-2: Apply the optimization theories to solve extreme value problems.
CO-3: Apply the knowledge of Rolle's theorem, Mean-Value theorem and Leibnitz's theorem.
CO-4: Acquire the knowledge of geometric properties to solve the geometric problems.

Course Description:
Differential Calculus: Function and its domain, range and graphical representation. Limits, continuity and differentiability of functions, differential coefficients of various types of functions, successive differentiation and Leibnitz's theorem, Rolle's theorem, mean value theorem, Taylor's theorem in finite and infinite forms, expansion of functions, L'Hospital's rule, partial differentiation and Euler's theorem, tangent and normal, extreme curve plotting and optimization, Curvature, asymptotes, and curve tracing.
Co-ordinate Geometry: Transformation of co-ordinate axes, pair of straight lines, equations of conics and reduction to standard forms, circles, system of circles. Rectangular co-ordinates, Introduction of Vector Analysis.

Textbooks/Reference Books:

1. Calculus—A New Horizon: By Howard Anton
2. The Elements of Coordinate Geometry: by S. L. Loney
3. Calculus & Analytic Geometry: by George B Thomas, Jr.
4. The Analytical Geometry of the Conic Sections: by The Rev. E. H. Askwith

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C3	Lecture	Class Test, Final Exam
CO2	PO2	C3	Lecture	Mid Term, Final Exam
CO3	PO1	C3	Lecture	Final Exam, Assignment
CO4	PO1	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4	√											

Title of the course: Engineering Mathematics II
Course Code: MAT 107
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/Two
Prerequisite: MAT 105
Type: Basic Science & Mathematics Courses

Rationale: This course aims to build up basics in integral calculus & linear differential equations in the context of electrical engineering applications.

Objectives:
The objectives of this course are-

- To help the students to determine length, area & volumes using integration.
- To develop the ability to solve the differential equations in the context of electrical engineering.

Course Outcomes (COs):
After successful completion of this course, students will be able to:
CO-1: Solve indefinite and definite integral.
CO-2: Evaluate length, area and volume using integral calculus.
CO-3: Solve 1st order and higher order differential equation problems.

Course Description:

Integral Calculus: Integration of various types of functions, integration techniques, definite integrals and its properties, Wallis's formulae, Improper Integrals, Beta function and Gamma function, applications of integration, length of a curve, areas of surfaces, volume of solids/hollow solids of revolution, pedal equations.

Differential Equation: Formation of differential equations, Solution of first order and first-degree differential equation, first order but higher degree differential equations, solution of linear differential equations with constant coefficients, homogeneous linear differential equations, series solution of differential equations, Bessel functions.

Textbooks/ References Books:

1. Calculus—A New Horizon: by Howard Anton
2. Differential Equations: by Dr. S. M. Farid,
3. Calculus & Analytic Geometry: by George B Thomas, Jr.
4. Differential Equations: by Erinu Kresgige

CO Delivery & Assessment:

COs	**Corresponding POs**	**Bloom's taxonomy domain/level** *(C: Cognitive, P: Psychomotor A: Affective)*	**Delivery methods and activities**	**Assessment tools**
CO1	PO1	C3	Lecture	Class Test
CO2	PO2	C6	Lecture	Midterm, Assignment
CO3	PO2	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3		√										

Title of the course: Engineering Mathematics III
Course Code: MAT 201
Credit Hour: 3.0 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/One
Prerequisite: MAT 105, MAT 107
Type: Basic Science & Mathematics Courses

Rationale: This course aims to make students solve electrical engineering problems related to vector, complex function and statistical data.

Objectives:
The objectives of this course are:

- To develop a clear understanding of the fundamental concepts of complex analysis including analytic functions and complex integral.
- To develop skills on solving problems related to curves and surfaces.
- To help them conceptualize basic theories on statistics and probability.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Convert real function to complex function.
CO-2: Distinguish between real and complex integral using Cauchy's Integral formula and the Residual theory.
CO-3: Calculate gradient, divergence and curl of a vector field.
CO-4: Apply Green's theorem, Divergence theorem and Stokes theorem in electrical engineering.
CO-5: Analyze statistical data to characterize an engineering system.
CO-6: Solve real world problems using probability distribution.

Course Description:
Complex Variables: Complex number system, analytic functions, limit and continuity of functions of complex variables and related theorems, complex differentiation, Cauchy's integral theorem, Cauchy's integral formula, Liouville's theorem, Taylor's theorem, Laurent's theorem, singular points, Cauchy's residue theorem, contour integration, conformal mapping, etc.;

Vector Calculus: Differentiation and integration of vectors along with their elementary applications, definition of line, surface and volume integrals, del operator, gradient, divergence, curl, Laplacian operator, Gauss's theorem, Stoke's theorem, Green's theorem, etc.;

Statistics and Probability: Basic concepts of frequency distribution, measures of location and variation, permutation, combination, probability, binomial distribution, Poisson distribution, normal distribution, estimation, hypothesis testing, design of experiments, chi-square test, variance analysis, regression analysis, etc.

Textbooks/ Reference Books:

- An Introduction to Statistics and Probability: by M. Nurul Islam
- Theory and Problems of Complex Variables: by Murray R. Spiegel
- A Text Book on Vector Analysis: by Sardar Abdus Sattar

- A Text Book on Co-ordinate Geometry with Vector Analysis: by A. F. M. Abdur Rahman and P. K. Bhattacharjee
- Advanced Engineering Mathematics: by Peter V. O'Neil
- Basic Statistics & Probability: by S. K. Gupta

CO Delivery & Assessment:

COs	**Corresponding POs**	**Bloom's taxonomy domain/level** ***(C: Cognitive, P: Psychomotor A: Affective)***	**Delivery methods and activities**	**Assessment tools**
CO1	PO1	C2	Lecture	Final Exam, Mid Term
CO2	PO2	C2	Lecture	Final Exam, Assignment
CO3	PO1	C2	Lecture	Final Exam, Class Test
CO4	PO2	C3	Lecture	Final Exam, Class Test
CO5	PO2	C4	Lecture	Final Exam, Class Test
CO6	PO2	C3	Lecture	Final Exam, Class Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4		√										
CO5		√										
CO6		√										

Title of the course: Engineering Mathematics IV **Course Code:** MAT 203
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Two/Two **Prerequisite:** MAT 105; MAT 107; MAT 201
Type: Basic Science & Mathematics Courses

Rationale: This course aims to facilitate students to learn the mathematical tools which are being widely used in communication engineering and linear circuit.

Course Objectives:
The objectives of this course are:

- To help the students to find mathematical expressions that involves vectors, matrices and eigenvalue problems.
- To help them to solve periodic and non-periodic problems using Fourier and Laplace analysis.

Course Outcomes (COs):

After successful completion of this course, students will be able to:
CO-1: Formulate vector space.
CO-2: Solve the matrix and linear transformation.
CO-3: Apply Fourier and Laplace analysis to convert time domain signal to frequency domain signal and vice-versa.
CO-4: Solve differential and integral equations using Laplace transform

Course Description:
Matrix: algebra of matrices, adjoint and inverse of matrices, elementary transformation of matrices, Cayley-Hamilton theorem, normal and canonical forms, solution of linear equations, eigenvalues and eigenvectors, etc.;
Laplace Transform: definition of Laplace transform and related basic theorems, calculating Laplace transforms and inverse Laplace transforms, Laplace transform of first derivative and n^{th} derivatives, solution of initial value o. d. e. problem by using Laplace transform, Laplace transform of periodic functions, of shifting in the S-variable, of shifting the T-variable, of functions defined by integrals, partial fractions and inverse Laplace transforms, convolution theorem and inverse Laplace transforms, etc
Fourier Analysis: Real and Complex forms of Fourier series, Fourier integrals, Fourier transforms, etc.; *P. D. E.*: introduction, non-trivial solution of first order linear homogenous P. D. E., Derivation of wave and heat equations, Laplace's equation, Poisson's equation, Fourier series solution of wave equation and of heat equation, solution of boundary value problems, etc.
***Linear Algebra*:** Algebraic fields, linear spaces, subspaces, basis and dimension, linear transformation, functional and dual space, etc.

Textbooks/ Reference Books:

- Linear Algebra: by Howard Anton
- Mathematical Physics: by B.D.Gupta

- Linear Algebra: by Abdur Rahman
- Linear Algebra & Its Applications: by David C. Lay
- Advanced Engineering Mathematics: by Peter V. O'Neil
- Fourier Series and Boundary Value Problems: by Charchil
- Laplace Transform: by M. R. Spigel

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Class Test, Final Exam
CO2	PO1	C3	Lecture	Midterm, Final Exam
CO3	PO2	C3	Lecture	Final Exam, Assignment
CO4	PO1	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2	√											
CO3		√										
CO4	√											

Title of the course: Engineering Physics I
Course Code: PHY 101
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Basic Science & Mathematics Courses

Rationale: This course aims to provide necessary knowledge about classical physics in the context of electrical engineering.

Objectives:
The objectives of this course are-

1. To facilitate students with the knowledge of classical mechanics.
2. To help students to understand the basics of waves and oscillation.
3. To provide the necessary knowledge about thermodynamics.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Explain basic theories of classical physics related to engineering applications.
CO-2: Evaluate the parameters of a wave.
CO-3: Apply thermodynamics principles to solve related engineering problems.

Course Description:

Mechanics: Kinematics, Graphical representations of displacement-time, velocity-time and acceleration-time, Motion in two and three dimensions-projectile motion, Application of Newton's laws of motion, Free body diagrams, Analysis of frames of trusses, Friction, Equilibrium forces, Work-kinetic energy theorem.
Gravitation: Gravitational field. Kepler's laws.
Waves & Oscillations:
Oscillations: Simple Harmonic motion, damped simple harmonic oscillation, forced oscillations, Combination and Composition of simple harmonic motions, Lissajous figures, Transverse and Longitudinal nature of waves, traveling and standing waves, intensity of waves, energy calculation of progressive & stationary waves, Phase velocity, group velocity.
Sound waves: Velocity of Longitudinal wave in a gaseous medium, Doppler Effect.
Thermodynamics: 0^{th}, 1^{st} and 2^{nd}law of thermodynamics, Reversible and irreversible processes, Carnot cycle, Auto cycle, Diesel cycle and their efficiency; Clausius theorem, Entropy, Absolute scale of temperature. Clausius Clapeyron equation, Thermodynamic functions, Maxwell's thermodynamic relations, Problem involving thermodynamic relations and functions, Gibb's phase rule.

Textbooks/ Reference Books

1. Physics I by Halliday & Resnick
2. Waves and Oscillations by Brijlal.
3. Heat and Thermodynamics by Brijlal.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C2	Lecture	Final Exam, Mid Term
CO2	PO1	C6	Lecture	Final Exam, Assignment
CO3	PO1	C3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											

Title of the course: Engineering Physics II
Course Code: EEE 103
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/Two
Prerequisite: PHY 101
Type: Basic Science & Mathematics Courses

Rationale: This course aims to provide necessary knowledge about electromagnetism, optics and modern physics in the context of electrical engineering.

Objectives:
The objectives of this course are-

- To help students understand the basic concepts of electromagnetism.
- To acquaint students with the fundamentals of optics.
- To help them conceptualize basic knowledge about modern and nuclear physics.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Explain different laws of electromagnetism.
CO-2: Apply the knowledge of nuclear physics in the context of nuclear energy.
CO-3: Explain different behaviors of light in the context of optoelectronics.
CO-4: Understand the basic concepts of modern and atomic physics related to semiconductor devices.

Course Description:
Electricity and Magnetism
Electromagnetism: Magnetic fields, Maxwell's equations, Ampere's law, Faraday's law, Lenz's law. Inductance: Self mutual inductance. Magnetic properties of matter: Magnetomotive force, magnetic field intensity, permeability and susceptibility, classification of magnetic materials, magnetization curve of ferromagnetic materials, magnetic circuits, magnetostriction.
Optics: Theories of light; Huygen's principles and constructions.
Interference of light: young's double slit experiment, Fresnel bi-prism, Newton's ring, interferometers.
Diffraction and Polarization of light: Diffraction, Fresnel Fraunhoffer diffraction, Diffraction by single slit, Diffraction by double slit, Diffraction gratings, Polarization of electromagnetic waves, production and analysis of polarized light, optical activity, Optics of crystals.
Lasers and their Applications: Laser introduction, Stimulated and spontaneous radiation's coherence, Resonators Ruby, He, Ne, CO_2, N_2 and dye laser, Material processing with lasers, welding, material removal and material shaping.
Modern physics: Relativity, Michelson-Morley experiment, Lorenz-Einstein transformation, Mass energy relation, Quantum effect, Photoelectric effect, Compton Effect.
Atomic Physics: De-Broglie wave, correspondence principles, uncertainty principle, The Rutherford-Bohr model of the atom, Energy levels and spectra, atomic excitation, The Laser, Quantum theory of hydrogen atom, The Zeeman effect, Electron spin, Many electron atoms and the exclusion principle, vector atom model
Nuclear Physics: Introduction, Nuclear constituents, nuclear binding and nuclear structure, Radioactivity, Radioactive decay, Half-life, Law of successive disintegration, Radioactive

equilibrium, The nucleus, Properties of nucleus, Binding energy, nuclear reactions, nuclear fission and fusion, nuclear reactors.

Textbooks/ Reference Books:

- Physics volume II by Halliday & Resnick.
- Modern Physics by Beiser.
- Nuclear Physics by Kaplan.
- Engineering Physics by Theraja.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C2	Lecture	Final Exam, Mid Term
CO2	PO2	C3	Lecture	Final Exam, Assignment
CO3	PO1	C2	Lecture	Final Exam, Class Test
CO4	PO1	C2	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4	√											

Title of the course: Engineering Physics II Laboratory **Course Code:** PHY 104
Credit Hour: 0.75 **Contact Hours:** 1.5 Hours/Week
Level/Term: One/Two **Prerequisite:** N/A
Type: Basic Science & Mathematics Courses

Rationale: This course aims to build foundation skills of using modern engineering physics techniques, tools and laboratory instrumentation to solve engineering problems.

Objectives:
The objectives of this course are-

- To introduce students with safety regulations of physics laboratory.
- To facilitate students with foundation skills of using physics laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Determine values of different physical parameters by conducting various experiments as an individual or as a team member.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on: Wheat stone's network (meter bridge, post office box), measuring resistance of unknown wire, series/parallel combination of resistor, resistance of a galvanometer.
2	Report writing based on laboratory work.
3	Oral Presentation on Mini Project Work (Design Project/Analytical Project/ Experimental Project/Industrial Tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

5.3 Other Engineering Courses:

Title of the course: Civil Engineering Drawing Laboratory **Course Code:** CE 102
Credit Hour: 1.00 credits **Contact Hours:** 2 Hours/Week
Level/Term: Two/One **Prerequisite:** ME 102
Type: Other Engineering Courses

Rationale: This course aims to provide the foundation of building drawings, such as plan, elevation, section and 3D drawings.

Objectives:
The objectives of this course are-

- To make students understand about buildings plan and how to draw a plan with AutoCAD.
- To make them to learn how to draw elevation of buildings and basic need off elevation for building construction.
- To make students understand isometric and bird's eye view.
- To develop skills about electrical drawing and design for a two storied building with AutoCAD.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Sketch elevation of a building.
CO-2: Illustrate isometric and bird's eye view.
CO-3: Draw electrical design of building.
CO-4: Develop Engineering drawing using AutoCAD.

Course Description:
Plan: To give a basic understanding about plan of a two storied building and give an idea about scale and how to draw a plan of a building with scale and graph paper.
Elevations: How to draw elevations of a two storied building with graph paper.
Section: Give understanding about section and basic need of section for a building.
Electrical Drawing of Building: Give a basic idea about, how to draw electrical layout drawing for a two storied building on a graph paper.
AutoCAD: Drawing using AUTOCAD or contemporary packages instructed by the teachers.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C3, A2	Lecture	Quiz & Performance Test
CO2	PO3	C4, A2	Lecture	Quiz & Performance Test
CO3	PO3	C6, A2	Lecture	Quiz & Performance Test
CO4	PO5, PO12	C5, A5, P2	AutoCAD Drawing	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2			√									
CO3			√									
CO4					√							√

Title of the course: Introduction to Computer Science **Course Code:** CSE 110
Credit Hour: 2.00 credits **Contact Hours:** 4 Hours/Week
Level/Term: One/One **Prerequisite:** N/A
Type: Other Engineering Courses

Rationale: This course aims to provide the basic concepts of computer hardware, essential software's so that the learners can be able cope with the world of digitalization.

Course Objectives:
The objectives of this course are-

- To get an idea about the major components of a computer's hardware.
- To provide the knowledge of different types of the operating system.
- To accumulate basic ideas about computer networking
- To acquaint students with the basic tools of Microsoft Office.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO1: Identify the components of computer hardware like input, output devices, different parts of the central processing unit.
CO2: Assemble a desktop and a laptop computer
CO3: Discuss the function of a computer operating system.
CO4: Discuss different types of networks, network topologies, and communication media.
CO5: Construct document files, worksheets, and presentations using Microsoft Office.
CO 6: Solve mathematical Problems using modern programming techniques.

Course Description:

Introduction to computations: Early history of computing devices;
Computers: Major components of a computer;
Hardware: Processor, Memory, I/O devices, Hard Disk, Storage media, CD ROM, DVD, Printer, Scanner;
Software: Function of operating system, Discussion on different types of operating system;
Networking: Different types of networks, Network topologies, Communication media.
Language Concept: Different types of Computer Languages.
Program development stages: Flow charts; Basic programming concepts; Compiler and Interpreter, Executable and Object File.
Programming Constructs: Compilers and interpreters; Syntax and semantics; Data types and their representation; Strong typing. Static vs. dynamic typing; operators, arithmetic expressions and assignment statements; Loops and Nested Loops; Case statements; Arrays; Functions; Header files; Preprocessor; Multidimensional array; Strings; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, Files: file function for sequential and random I/O; Pointers: Pointers and structures; Pointer and function;

Operation and Pointer; Pointer and function; Pointer and array Pointer and memory address; Operations on Bits; Variable length argument list; Command line parameters; Error Handling; Linking; Library functions.

Textbooks:

Inside PC by Norton.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO-1	PO2	C1	Lecture Hardware Showcase class.	Quiz & Performance Test
CO-2	PO5	C3, P1	Lecture	Quiz & Performance Test
CO-3	PO1	C3	Lecture	Quiz & Performance Test
CO-4	PO1	C3	Lecture	Quiz & Performance Test
CO-5	PO1	C3	Lecture	Quiz & Performance Test
CO-6	PO2	C3	Lecture	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2					√							
CO3	√											
CO4	√											
CO5	√											
CO6		√										

Title of the course: Computational Methods for Engineering Problems
Course Code: CSE 301 **Credit Hour:** 3.00 credits
Contact Hours: 3Hours/Week **Level/Term:** Two/Two
Prerequisite: MAT 201 **Type:** Other Engineering Courses

Rationale: This course aims to provide necessary knowledge to solve numerical problems in electrical engineering.
Objectives:

The objectives of this course are-

- To apply the knowledge of numerical techniques to solve various engineering problems.
- To facilitate the students to analyze error of a computational system.

Course Outcomes (COs):

After successful completion of this course, students will be able
CO-1: To Construct numerical solutions for electrical engineering problems.
CO-2: To Evaluate the accuracy of common numerical methods.
CO-3: To Apply numerical methods to obtain approximate solutions of computational engineering problems.

Course Description:
Numerical Methods: Concepts of algorithm and flowchart, errors in numerical methods, interpolation, numerical methods for the solution of simultaneous linear/nonlinear algebraic and transcendental equations, numerical integration, solution of ordinary and partial differential equations.
Queuing Theory: Stochastic processes, Discrete-parameter Markov Chains and continuous-parameter Markov Chains, Queuing models, solution of network of queues.

Textbooks/ Reference Books:
1. Numerical Analysis by Vasistha
2. Numerical Analysis by Richard L. Burden
3. Numerical methods for scientific and engineering computation by Mahinder Kumar Jain, S. R. K. Iyengar, Rajendra K. Jain
4. Advanced Engineering Mathematics by H.K. Das

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C3, A4	Lecture	Class Test
CO2	PO1	C6	Lecture	Mid Term, Assignments.
CO3	PO1	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2	√											
CO3	√											

Title of the course: CMEP Laboratory
Course Code: CSE 302
Credit Hour: 1 credit
Contact Hours: 2 Hours/Week
Level/Term: Two/Two
Prerequisite: N/A
Type: Other Engineering Courses

Rationale: This course aims to explore basic algorithms in modern system on numerous uses of numerical methods in engineering.

Objectives:
The Objectives of this course are-
1. To help students to demonstrate aptitude in standard numerical techniques.
2. To learn error estimates for numerical derivative formulae.
3. To demonstrate implementation of numerical problems for engineering problems.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Determine values of different mathematical parameters by using various computer programming language.
CO-2: Write comprehensive reports on the work done in laboratory in a group and orally present the Findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on: Wheat stone's network (meter bridge, post office box), measuring resistance of unknown wire, series/parallel combination of resistor, resistance of a galvanometer.
2	Report writing based on laboratory work.
3	Oral Presentation on Mini Project Work (Design Project/Analytical Project/ Experimental Project/Industrial Tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				√								√
CO2									√	√		√

Title of the course: Mechanical Engineering Drawing & CAD
Course Code: ME 101
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Three/One **Prerequisite:** N/A
Type: Other Engineering Courses

Rationale: This course aims to lead students to an understanding of engineering drawing, an essential means of communication in engineering.

Objectives:
The objectives of this course are-

- To familiarize with drawing instruments and conventions in making engineering drawings.
- To introduce with freehand single view and multi-view sketching.
- To acquaint with Isometric sketching techniques and multi-view projections.
- To develop the knowledge of AutoCAD (Or Solid Works) in making engineering drawings with dimensions and taking sectional views.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Apply drawing instruments in making an engineering drawing.
CO-2: Describe different types of lines, drawing paper sizes, and grades of pencils.
CO-3: Draw freehand single view, multi-view sketches, and isometric sketches.
CO-4: Apply AutoCAD (Or SolidWorks) to draw plane drawing.
CO-5: Illustrate multiview projections using AutoCAD (Or SolidWorks).

Course Description:
This course contributes towards the engineering topics component of the mechanical engineering curriculum by familiarizing students with the state-of-the-art CAD and FEA software for modeling, analyzing and designing mechanical components. This course brings into focus the Introduction, Orthographic drawings, First and third angle projections, scale drawing, sectional view, isometric views, missing line, auxiliary view, detail and assembly drawing, project on engineering drawing and CAD using AutoCAD or contemporary packages instructed by the teachers. The students also understand the requirements for good engineering drawings, and are able to apply these to their work/projects.

Textbooks/ Reference Books:
AutoCAD – 2002 instant reference by Goerge Omura & B. Robert Colloria.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level (C: Cognitive, P: Psychomotor A: Affective)	Delivery methods and activities	Assessment tools
CO-1	PO5	C3, P2	Lecture	Class performance & Drawing
CO-2	PO1	C1	Lecture	Class performance & Drawing
CO-3	PO2	C6	Lecture	Class performance & Drawing
CO-4	PO5	C3, P2	Lecture	Quiz & Final Performance
CO-5	PO12	A4, P4	Lecture	Quiz & Final Performance

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2	√											
CO3		√										
CO4					√							
CO5												√

Title of the course: Basic Mechanical Engineering
Course Code: ME 201
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/Two
Prerequisite: N/A
Type: Other Engineering Courses

Rationale: This course aims to introduce students with the mechanical engineering that is interrelated and harmonizing part of electrical & electronic engineering.

Objectives:
The objectives of this course are-

- To introduce students with the various mechanical terminologies.
- To familiarize with the various thermodynamic law.
- To explain the operation of various mechanical system.
- To introduce with the basic of robotic design.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze various mechanical system based on thermodynamic laws.
CO-2: Design mechanical part of robotic system.
CO-3: Analyze various parts of boiler, heat engine & turbines.
CO-4: Categorize between the mechanical and electrical designing in power plant.

Course Description:

Introduction: Sources of Heat energy. Renewable and non-renewable sources and their potential; Introduction to steam generation, Steam generator: Boilers and their classification; Working principle of few common and modern boiler; Boiler mountings and accessories; Performance of boiler. Heat engines: Gas turbines, diesel engines, petrol engines, Fuel, lubrication and cooling systems of I.C engines.
Energy and First law: Systems and surroundings; Conservation of energy; Different thermodynamic processes; Energy transfer as heat for a control volume.
Entropy and Second law: Reversibility and irreversibility; Definition and corollaries of second law of thermodynamics. Entropy: its transfer and change.
Characteristics of some thermodynamic cycles: Analysis of different thermodynamic cycles, Vapor power cycles, Representation of various cycles on PV & TS planes.
Basic concepts of refrigeration systems: Vapor compression refrigeration, Absorption refrigeration, cop, Refrigerants and their classifications and properties.
Air conditioning: Introduction, Objectives and major components of air conditioning systems; Humidity; Dew point.
Robotics: Introduction to robotics, essential components of a robot & their kinematics, links, frames, spatial motions, programming robots, clocks, sensors, actuators and control.

Textbooks/Reference Books:

- Engineering Thermodynamics by P.K. Nag.
- Heat Engineering by V.P. Vasandani.
- A textbook of Thermal Engineering by RS Khurmi, J.K.Gupta.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Class Test
CO2	PO3	C6, A5	Lecture	Final Exam, Mid Term
CO3	PO2	C4	Lecture	Final Exam, Assignment
CO4	PO2	C4	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2			√									
CO3		√										
CO4		√										

5.4 Core Courses:

Title of the course: Electrical Circuit I
Course Code: EEE 101
Credit Hour.4: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to help the students to develop basic pillars of electrical engineering.

Objectives:
The objectives of the course are-

- To help students to understand the basic concept of electricity.
- To provide the knowledge of AC and DC circuits.
- To help the students to develop the analytical ability for solving AC and DC circuits.
- To develop the fundamentals of magnetic circuits.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze electrical circuits by using standard electrical circuit solving techniques.
CO-2: Develop phasor diagram of AC Circuit.
CO-3: Analyze simple magnetic circuit.
CO-4: Determine electrical parameters of DC & AC Circuit.

Course Description:

Circuit variables and elements: Voltage, current, power, energy, independent & dependent sources and 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.
Techniques of circuit analysis: Branch current method, Nodal and mesh analysis including super node and super mesh, Independent and dependent sources.
Network theorems: 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, RC and RLC circuits: Natural and step responses, Introduction to Alternating Current (AC), sinusoidal variation, frequency and wavelength, Instantaneous voltage, current and power, impedance of AC quantities, RMS value & average value, RLC series and parallel circuits. Phasor algebra and drawing of phasor diagram.

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. Magnetic circuits: series, parallel and series-parallel circuits.

Textbooks/References Books:

1. Introductory Circuit Analysis by Robert L. Boylestad, (Prentice Hall)
2. Electrical Engineering by Robert P. Ward
3. A text book of electrical technology by B. L. Thereja
4. Alternating Current Circuits by R.M. Kerchner and G.F. Corcoran (Wiley)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C3	Lecture	Final Exam, Assignment
CO3	PO2	C4	Lecture	Final Exam, Class Test
CO4	PO1	C6	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4	√											

Title of the course: Electrical Circuit I Laboratory
Course Code: EEE 102
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: One/One
Prerequisite: N/A
Type: Core Course

Rationale: This course aims to make the student proficient in using different basic measuring tools and to experimentally strengthen the basics of the "Electrical Circuit I" course.

Objectives:

The objectives of this course are:

- To introduce students with safety regulations of circuit laboratory.
- To facilitate students with foundation skills of using circuit laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

At the end of the course, the student will be able to-

CO-1: Demonstrate laboratory experiments related to verification of DC & AC circuit parameters as an individual or as a member of a team.

CO-2: Conclude the result from experimental data.

CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on Theory Course EEE 101: Ohms law. KCL, KVL, Thevenin theorem, superposition theorem, maximum power transfer theorem, basic RC circuit etc.)
2	Report writing based on laboratory work.
3	Oral Presentation on Mini Project Work (Design Project/Analytical Project/ Experimental Project/Industrial Tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping

COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electrical Circuit II
Course Code: EEE 103
Credit Hour: 3.0 credits
Contact Hours: 3 Hours/Week
Level/Term: One/Two
Prerequisite: EEE 101
Type: Core Course

Rationale: This course aims to provide foundation knowledge of AC circuit that will help students to understand electrical power network.

Course Objectives (COs):
The objectives of this course are:

- To help students to understand AC electric circuits, coupled circuit and systems with AC power concepts.
- To provide basic concepts of impedance, phasor, transient and resonance.
- To develop the ability of analysing ac filters circuit.
- To give proper knowledge of 3 phase balance and unbalance circuit.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Describe the foundational principles and components of AC electric circuits.
CO-2: Design a passive filter.
CO-3: Examine AC coupled circuit.
CO-4: Analyze transient analysis of electrical circuit.
CO-5: Solve complex engineering problems related to 3-phase balanced & unbalanced circuit.

Course Description:
AC Analysis: Effective values of AC current and voltage. Average power, phasors and complex quantities, impedance, real and reactive power, power factor with sinusoidal excitatory for RLC circuits. Analysis of non-sinusoidal waves, 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, passive filter.
Resonance in AC circuits: Series and parallel resonance.
Analysis of three phase circuits: Three phase supply, Analysis of balanced and unbalanced circuits, Power calculation, Phase sequence and its effects, Measurement of 3-phase power by 3-wattmeter method as well as two wattmeter method.
Miscellaneous: Magnetically coupled circuits, Application of Matrix in circuit analysis, Transient analysis for different types AC and DC circuits.

Textbooks/Reference Books:

1. Alternating Current Circuits by R.M. Kerchner and G.F. Corcoran (Wiley).
2. Fundamentals of Electric Circuits by Charles K. Alexander, Matthew N. O. Sadiku.
3. Introductory Circuit Analysis by Robert L Boylestad (Prentice Hall).
4. A text book of electrical technology by B. L. Thereja.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C1	Lecture	Final Exam, Mid Term
CO2	PO3	C6, A2	Lecture	Final Exam, Assignment
CO3	PO2	C1	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test
CO5	PO1	C3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2			√									
CO3		√										
CO4		√										
CO5	√											

Title of the course: Electrical Circuit II Laboratory
Course Code: EEE 104
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: One/ Two
Prerequisite: N/A
Type: Core Course

Rationale: This course aims to make student skilful at solving and investigating different AC circuits experimentally and fortify basics of "Electrical Circuit II" Course.

Objectives:

The objectives of this course are:

- To introduce students with safety regulations of circuit laboratory.
- To facilitate students with foundation skills of using circuit laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Demonstrate laboratory experiments related to verification of AC circuit parameters as an individual or as a member of a team.

CO-2: Conclude the result from experimental data.

CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory course EEE 103.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electrical Circuit Simulation Laboratory **Course Code:** EEE 106
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: One/Two **Prerequisite:** EEE 101
Type: Core Courses

Rationale: This course aims to introduce students with basic techniques and tools for electrical circuit simulation.

Objectives:
The objectives of this course are:

- To develop knowledge of using simulation tools for simulating electric circuit.
- To distinguish the difference between the simulation behavior and behavior of practical circuit.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Develop simulation models of various AC, DC, and electronic circuit to find the value of different circuit parameters.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work based on theory taught at "Electrical Circuit I", "Electrical Circuit II" and "Electronics I" using simulation software (Proteus, PSpice, MATLAB/Simulink etc.)
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping

COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							√
CO2				√								√
CO3									√	√		√

Title of the course: Signals & Systems
Course Code: EEE 201
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/Two
Prerequisite: MAT 107, MAT 203
Type: Core Courses

Rationale: This course aims to provide basic knowledge about various types of signals and systems along with different analysis techniques.

Course Objective:
The course objectives of this course are:

- To help students conceptualize the relation between signals & systems.
- To make the students understand classification of signals & properties of systems.
- To accumulate basic ideas about analogous system and differential equations.
- To facilitate students with necessary knowledge to conceptualize the properties of Fourier series.
- To acquaint students with the basic theory of fourier and laplace transformation.
- To develop skills to apply fourier and laplace transformation to solve real-time problems.
- To getting idea about Z transformation

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Identify different types of linear time invariant (LTI) systems and different types of signals.
CO-2: Analyze how signals transform from time domain to frequency domain & transform from frequency domain to time domain.
CO-3: Apply convolution on signals.
CO-4: Manipulate the analogy of mechanical system and electrical system.

Course Description:
Classification of signals and systems: Signals - classification, Basic operation on signals, Elementary signals, Representation of signals using impulse function; Systems – classification, Properties of Linear, analogous system and their solution.
Time Invariant (LTI) systems: Linearity, Causality, Time invariance, Memory, Stability, Inevitability, etc.
Time domain analysis of LTI systems: Analogous system 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, amplitude modulation and demodulation, sampling theorem time-division and frequency-division multiplexing.

Laplace transformation: properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application, poles and zeroes of a network. Distance signals and z-transform methods.
Introduction to Random signals: Stationery, Ergodicity, Noise models, Correlation and power spectrum, Distribution and density functions.

Textbooks/ Reference Books:

1.Signals and Systems by Haykin.
2. Linear System Analysis by D.K. Cheng.
3.Signal & Systems Analysis using Transform Methods and MATLAB by M.J. Roberts.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C1	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO1	C3	Lecture	Final Exam, Class Test
CO4	PO2	C3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3	√											
CO4		√										

Title of the course: Signal &Systems Laboratory **Course Code:** EEE 202
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Two/Two **Type:** Core Course

Rationale: This course aims to develop students' knowledge to implement different transform methods in MATLAB environment.

Objectives:
The objectives of this course are:

- To familiarize students with the MATLAB environment
- To introduce with plotting & sub-plotting concept.
- To learn simulation of fourier, laplace & z-transformation.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO1: Illustrate different types of Signals in Matlab or CAD tools.
CO2: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	**COURSE CONTENT (as Summary)**
1	Laboratory work based on theory taught at EEE 201 using simulation software (MATLAB/Simulink etc.)
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							√
CO2									√	√		√

Title of the course: Electronics I
Course Code: EEE 211
Credit Hour: 3.0 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/One
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to provide fundamental knowledge of basic electronic devices that are used in daily life.

Objectives:
The objectives of this course are

- To acquaint students with basic electronic devices, their characteristics and operation.
- To develop skills to analyze basic electronic circuits.
- To facilitate basic ideas about amplifier circuits.
- To accumulate basic ideas about current mirror and noise in electronic circuits.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Design clipping, clamping & rectifier circuits.
CO-2: Analyze electronics parameter of diode & transistor.
CO-3: Design single stage amplifier.
CO-4: Analyze active filters.

Course Description:
P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction, contact potential, current-voltage characteristics of a diode, simplified dc and ac diode models, 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: 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 and different type of biasing techniques. Voltage and current gain, input and output impedance of common base, common emitter and common collector amplifier circuits.
Metal-oxide-semiconductor field-effect-transistor (MOSFET): 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, Current Mirror: Simple CMOS current mirror, Source degenerated current mirror, high output impedance current mirror, Bipolar current mirror; Single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter**.**
Noise: Statistical Characteristics of Noise, Noise Spectrum, Amplitude Distribution, Correlated and Uncorrelated Noise, Types of Noise, Thermal Noise and Flicker noise, Noise in Single stage amplifiers, Common source stage, Common gate stage, Source follower, Cascade stage; Noise in Differential Pairs, Noise Bandwidth.
Junction field-effect-transistor (JFET): Structure and physical operation of JFET, transistor characteristics, pinch-off voltage. Differential and multistage amplifiers, Description of differential

amplifiers, small-signal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

Textbooks/ Reference Books:

1. Electronics Devices and Circuit Theory by Robert L. Boylestad& Louis Nashelsky.
2. Electronics Devices by Thomas L. Floyd.
3. Electronics Devices by Millmann & Halkias.
4. Design of Analog CMOS integrated circuits by Behzad Razavi.
5. Electronic Principles by Albert Paul Malvino.
6. Electronics Devices and Circuits by Tocci.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C6, A4	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO3	C6, A4	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2		√										
CO3			√									
CO4		√										

Title of the course: Electronics I Laboratory
Course Code: EEE 212
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/One
Prerequisite: N/A
Type: Core Courses

Rationale: This laboratory course aims to instruct students with various types of semiconductor devices, transistors based on course Electronics I.

Objectives:
The objectives of this course are:

- To introduce students with safety regulations of electronics laboratory.
- To facilitate students with foundation skills of using circuit laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to –
CO-1: Verify basic electronic circuits like rectification, clipping, clamping etc using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	**COURSE CONTENT (as Summary)**
1	Laboratory work using hardware based on theory courses EEE 211. It will cover Diode, MOSFET, different transistor biasing based experiments.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electronics-II
Course Code: EEE 213
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/Two
Prerequisite: EEE 211
Type: Core Courses

Rationale: This course aims to relate students with the design and analysis techniques of modern electronic devices.

Course Objectives: The objectives of the course are-

- To acquaint students with the op-amp and other electronics devices.
- To make the students understand the principle of various types of filter.
- To develop students' designing skills of various active filter using modern characteristics.
- To accumulate basic ideas about the theory, operation principle and mathematical model of power amplifier.
- To help the students conceptualize the application of frequency response of amplifier.
- To facilitate to get the introductory idea about noise model for op-amp circuit.
- To foster the analytical and designing prospect of differential amplifier.
- To acquaint students with the basic principle of multivibrator, signal generators.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Analyze op-amp based different types of circuit using principle and characteristics of op-amp, power amplifier, multi-vibrators, and signal generators.
CO-2: Analyze the single stage small signal amplifier and multistage small signal amplifier frequency response.
CO-3: Design various types of active filter.
CO-4: Classify and analyze classes of power amplifier (class A, class B, class AB, class C) circuit.

Course Description:
Operational amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, logic signal operation of Op-Amp, dc imperfections
General purpose Op-Amp: DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp. Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation.
Frequency response of amplifiers: Poles, zeros and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascade amplifiers, frequency response of differential amplifiers.
Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and band pass filters using Op-Amps.
Signal generators: Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, LC and crystal oscillators.

Power Amplifiers: Classification of output stages, class A, B and AB output stages, RF amplifiers, waveform generations using 555 and 8038 ICs, Schmitt trigger, pulse generator, VCO.
Multi vibrators: Bistable, Monostable, Astable, different types of bistable with their circuits & operating techniques.

Textbooks/Reference books:

1. Electronics Devices by Thomas L. Floyd.
2. Electronics Devices and Circuit Theory by Robert L. Boylestad& Louis Nashelsky.
3. Electronic Principles by Albert Paul Malvino,
4. Electronics Devices & Circuits by C. Halkias and Jacob Millman

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO3	C6, A4	Lecture	Final Exam, Class Test
CO4	PO1	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3			√									
CO4	√											

Title of the course: Electronics II Laboratory
Course Code: EEE 214
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/Two
Prerequisite: EEE 211
Type: Core Courses

Rational: This laboratory course aims to work students with various types of amplifiers & oscillators characteristics based on Electronics II course.
Objectives: The objectives of this course are:

- To introduce students with safety regulations of electronics laboratory.
- To facilitate students with foundation skills of using electronics laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Verify basic electronic circuits like amplifier, oscillator, integrator, differentiator, etc. using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory courses EEE 213. It will power amplifier, op-amp based experiments.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electrical Machines I
Course Code: EEE 221
Credit Hour: 3 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/One
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to make the students knowledgeable about common electrical machinery like DC generators, DC motors and transformers which have widespread applications in power industries.

Objectives: The objectives of this course are-

- To make the students understand the construction, principle of operation, application of DC electrical machineries and transformers.
- To help the students solve magnetic circuit problems using certain law.
- To enable the students to execute performance analysis of electrical machineries and transformers.
- To acquaint students with the vector group, parallel operation, testing of three phase transformers.
- To facilitate necessary knowledge of autotransformer and its various aspects.
- To provide knowledge of harmonics of poly phase transformers.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Determine performance parameters of DC machines and transformers.
CO-2: Distinguish DC machines and transformers for specific application.
CO-3: Calculate the voltage regulation of a DC generator and motor.
CO-4: Determine the losses and efficiency of DC machines.

Course Description:
DC generator: Construction, principle of operation classification, armature winding, voltage build up, armature reactions and commutation, performance evaluation and testing.
DC motor: Operation, types, speed-torque characteristics, starting, speed control, braking, Two and four quadrant operation of DC motor, Choice of DC motor for different application.
Single phase transformers: Construction and principle of operation, Equivalent circuit, PU systems, Phasor diagram, Efficiency, Regulation, Testing of short-circuit test and open circuit test, parallel operation, Determination of transformer constants and polarity.
Three-phase transformer: Vector group, parallel operation and testing, Autotransformer, Harmonics of poly phase transformers.
Textbooks/ Reference Books:

1. Electrical Machinery fundamental by Stephen J. Chapman.
2. Alternating Current Machines by A.F. Puchstein and T.E. Loyed.
3. Electric Machinery by A. Fitzgerald, Kingsley.
4. Electric Machines by Kothari, Nagrath.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C2	Lecture	Final Exam, Assignment
CO3	PO1	C2	Lecture	Final Exam, Class Test
CO4	PO1	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4	√											

Title of the course: Electrical Machines I Laboratory
Course Code: EEE 222
Credit Hour: 1.5 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/One
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to teach students about operation and application of various dc machines, single phase transformers and three phase transformers practically.

Objectives: The objectives of this course are-

- To get familiar with DC machines and transformer and give them experimental skills.
- To enhance the ability to conduct testing and experimental procedures on different types of electrical machines as well as on transformers.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze different characteristics & performance parameter of DC machines & transformers using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on course of EEE 221 (DC motor, DC generator, single phase transformer & 3 phase transformer).
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electrical Machine II
Course Code: EEE 223
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Two/Two
Prerequisite: EEE 221
Type: Core Courses

Rationale: This course aims to provide the knowledge on basic principles and characteristics of various ac machines used in domestic & industrial applications.

Objectives:
The objectives of this course are-

- To acquaint students with the principles of various types of AC machines and their characteristics.
- To develop student's analytical ability regarding electromechanical system.
- To provide the knowledge of parallel operation of alternator.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze the working of any ac machine using mathematical model under loaded and unloaded conditions.
CO-2: Determine various parameters of AC machines.
CO-3: Categorize single-phase motor for a given application.
CO-4: Analyze the response of synchronous machine under wide ranges of loads.

Course Description:

Three-phase induction motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, effect of changing rotor resistance and reactance on torque-speed curves, motor torque and developed rotor power, no-load test, blocked rotor test, V curves, starting, braking and speed control.
Single-phase induction motor: Theory of operation, equivalent circuit, starting techniques and generalized machines.
Special purpose motors: Two value capacitor motors, permanent split and split phase capacitor motors, Reluctance motors, Hysteresis motors, Universal motors, Stepper motors, servo motors, shaded pole motors.
Synchronous Generator: 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. Introduction to wind turbine generators.
Parallel operation of two or more generators: Necessary conditions, synchronization, circulating current and vector diagram.
Synchronous motor: Operation, effect of loading under different excitation condition, effect of changing excitation, V-curves and starting, Commutator motor.

Textbooks/Reference Books:

1. Electrical Machinery fundamental by Stephen J. Chapman.
2. Direct and Alternating Current Machinery by Jack Rosenblatt and M. Harold Friedman.
3. Alternating Current Machines by A.F. Puchstein and T.E. Loyed.
4. Fractional& sub-fractional HP Electric Motors by Martin.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO2	C2	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4		√										

Title of the course: Electrical Machine II Laboratory **Course Code:** EEE 224
Credit Hour: 1.5 credits **Contact Hours:** 3 Hours/Week
Level/Term: Two/Two **Prerequisite:** EEE 221
Type: Core Courses

Rationale: This course aims to teach students about operation and application of various AC machines practically.

Objectives: The objectives of this course are-

- To get familiar with AC machines and give them experimental skills.
- To enhance the ability to conduct testing and experimental procedures on different types of electrical machines as well as on transformers
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-
CO-1: Analyze different characteristics & performance parameter of AC machines using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on course of EEE 223 (3 phase induction motor, 3 phase AC synchronous machines).
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electromagnetic Fields and Waves **Course Code:** EEE 241
Credit Hour: 3.00 credits **Contact Hours:** 3Hours/Week
Level/Term: Two/One **Prerequisite:** N/A
Type: Core Courses

Rationale: This course aims to help students to construct the basic foundation of electromagnetic (EM) fields and waves for communication Engineering.

Objectives: The objectives of the course are-

- To facilitate students with necessary knowledge regarding wave guides and propagation of EM waves.
- To acquaint students with electromagnetic laws and principles for solving problems in propagation of EM waves.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Apply Coulomb's law for solving electrostatic problems.
CO-2: Apply Gauss' law for solving electric field density and intensity related problems.
CO-3: Calculate energy, forces and pressure due to static electric and magnetic fields.
CO-4: Analyze magnetic circuits.
CO-5: Apply Maxwell's equations for electromagnetics.

Course Description:
Electrostatics: Coulomb's law, force, electric field intensity, electrical flux density, Gauss's theorem with application, Electrostatic potential, boundary conditions, method of images, Laplace's and Poisson's equations, energy of an electrostatic system, conductors and dielectrics.
Magneto statics: Concept of magnetic field, Ampere's Law, Biot-Savart law, vector magnetic potential, energy of magneto static system, Mechanical forces and torque's in Electric and Magnetic fields, Curvilinear co-ordinates, rectangular, cylindrical and spherical co-ordinates, solutions to static field problems. Graphical field mapping with applications, solution to Laplace equations, rectangular, cylindrical and spherical harmonics with applications.
Maxwell's equations: Their derivations, continuity of charges, concepts of displacement current, Boundary conditions for time-varying system, Potentials used with varying charge and currents, Retarded potentials, Maxwell's equations in different coordinate systems.
Relation between circuit theory and field theory: Circuit concepts and the derivation from the field equations, High frequency circuit concepts, circuit radiation resistance, Skin effect and circuit impedance, Concept of good and perfect conductors and dielectrics, Current distribution in various types of conductors, depth of penetration, internal impedance, power loss, calculation of inductance and capacitance.
Propagation and reflection of electromagnetic waves in unbounded media: Plane wave propagation, polarization, power flow and Poynting's theorem. Transmission line analogy, Smith Chart; reflection from conducting and dielectric boundary display lines ion in dielectrics, liquids and solids, plane wave propagation through the ionosphere, Introduction to radiation.

Textbooks/Reference Books:

1. Field and Wave Electromagnetics by David K. Cheng.
2. Fields and Waves in Communication Electronics by Simon Ramo, John R. Whinnery, Theodore Van Duzer.
3. Engineering Electromagnetics by William H. Hayt. Jr.
4. Antenna & Wave Propagation by K.D. Prasad.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C3	Lecture	Final Exam, Mid Terms
CO2	PO1	C3	Lecture	Final Exam, Assignment
CO3	PO2	C2	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test
CO5	PO1	C3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3		√										
CO4		√										
CO5	√											

Title of the course: Electrical Appliance laboratory
Course Code: EEE 302
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: EEE 211
Type: Core Courses

Rationale: This course aims to introduce students with the hands-on troubleshooting experience on several domestic electrical appliances.

Course Objective:
The objectives of this course are-

- To introduce students with contemporary domestic electrical appliances.
- To acquaint students with the basic tools of troubleshooting domestic electrical appliances.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Analyze and troubleshoot of television.
CO-2: Adopt the techniques of soldering, de-soldering & PCB design.
CO-3: Troubleshoot different electronics appliances.

Course Description:
Study on Radio Transmitter & receivers: Basic principle of operation of an AM radio transmitter, FM Radio transmitter, transmitting antennas used in these cases.
Television & Display: Principles of black & white (B&W) and color TV, composite video & chrominance signals, formulation of the chrominance signal, I & Q signals, block, schematic & pictorial diagrams of TV and their characteristics, CRT, static & dynamic convergence, automatic degaussing circuits, pincushion cause & correction, raster & raster formation, different sections of B&W and color TV, VHF & UHF frequency allocations, control of all section, AFT & remote control circuits, basic troubleshooting procedures, isolating and replacing the defective stage & component, video signal & camera tubes.
Practical Circuit Analysis & Troubleshooting: Principle of operation of Electronic Appliances used in domestic places, commercial places and offices

- Calculator
- Fan regulator
- Telephone
- Scanner
- IPS & UPS
- Printer
- AM & FM Radio Receiver
- Mobile phone transmitter and receiver;
- VCD & DVD player
- Desktop computer & Laptop

Study of Practical circuit diagrams of the above mentioned

Textbooks/ Reference Books:

1. Monochrome and Colour Television by R.R.Gulati.
2. Home Satellite TV installation & troubleshooting manual by Frank Baylin (3rd edition).
3. Basic Television & Video Systems by Bernard Grob (5th ed International Student Edition).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5	C4, P2	Lecture	Quiz
CO2	PO5	C3, P2	Lecture	Performance Test
CO3	PO5	C4, P2	Lecture	Quiz & Presentation

CO-PO Mapping (Theory course):

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							
CO2					√							
CO3					√							

Title of the course: Communication Engineering
Course Code: EEE 309
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: N/A
Type: Core Course

Rationale: This course aims to introduce the basic principles and applications of analog and digital communication in our daily life.

Objectives: The objectives of this course are-

- To introduce students with the fundamental concepts of communication systems.
- To provide the knowledge of different analog modulation schemes and digital modulation schemes.
- To make the students understand the multiple access techniques and key aspects of noise.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze different types of analog modulation and digital modulation.
CO-2: Solve mathematical problems related to communication engineering.
CO-3: Analyze the various channels and noises of communication system.
CO-4: Analyze multiple access techniques.
CO-5: Categorize different types of communication system.

Course Description:
Introduction of communication systems: Basic principles, fundamental elements, system limitations.
Information Theory: Information and system capacity, Information transmission, Entropy, Continuous channel capacity, Transmission through electrical network.
Analog communication: AM, FM, PM, DSB, SSB, VSB, ISB.
Digital communication: Introduction, Nyquist sampling theorem, Quantization of analog system, Quantization noise, PAM, PWM, PPM, PCM, LOGPCM, and systems, Digital modulations, ASK, FSK, PSK, DPSK, MSK, M-array digital modulation, QAM, QPSK, Delta modulation, Multi carrier modulation, line coding, Frame construction, Error Probability. Introduction to Radar and Satellite Communication. ISDN, B-ISDN, SONET, SDH
Multiplexing: Space division multiplexing, frequency division multiplexing, time division multiplexing, and code division multiplexing.
Noise: Physical sources of noise, types of noise, calculation of noise, SNR & noise figure, and calculation of noise figure, noise temperature, equivalent noise resistance.
Textbooks/ Reference Books:

1. Electronic Communication System by George Kennedy.
2. Modern Digital & Analog Communication Systems by B.P. Lathi.
3. Communication System by Simon Haykin.
4. Principles of Communication Systems by Herbert Taub and Donald L. Schilling.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C3	Lecture	Final Exam, Assignment
CO3	PO1	C4	Lecture	Final Exam, Class Test
CO4	PO1	C4	Lecture	Final Exam, Class Test
CO5	PO2	C2	Lecture	Final Exam

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3	√											
CO4	√											
CO5		√										

Title of the course: Communication Engineering Laboratory
Course Code: EEE 310
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Three/One **Type:** Core
Prerequisite: N/A

Rationale: This course aims to make the student proficient in all types of modulation & demodulation techniques applicable in communication systems.

Objectives: The objectives of this course are-

- To facilitate students with foundation skills of using communication laboratory instruments.
- To make students understand about the operations and applications of various analog & digital modulation circuits.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Demonstrate different types of analog and digital modulation and demodulation techniques using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory course EEE 309. It will cover AM FM, ASK, FSK, PSK modulation and demodulation practical laboratory work.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Digital Electronics
Course Code: EEE 311
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to introduce the basic principles and applications of digital electronics in modern digital world.

Course Objectives (COs): The objectives of this course are:

- To help students to understand operations and applications of digital electronic circuits.
- To provide basic concepts of analysing digital combinational and sequential circuits.
- To develop the ability of designing digital electronic circuits.
- To provide knowledge on digital logic family.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Design digital electronic circuits for specified applications.
CO-2: Analyze digital combinational & sequential Circuit.
CO-3: Formulate digital electronic circuit using Boolean algebra.
CO-4: Categorize different types of digital logic family.

Course Description:
Number systems: Representation of numbers in different bases, Addition and subtraction in different bases, Complement: Subtraction using complements, Binary multiplication & division.
Binary codes: Different coding system, Boolean algebra, various gates, Sum of products and product of sums, Standard and canonical forms and other logical operations.
Simplification of Boolean functions: Karnaugh map method, Tabular method of simplification; Implementation of logic circuit using various gates, Universal gates.
Combinational logic circuit: Design procedure: Adder, Subtractor, Code converters, Parity bit checker and magnitude comparator, Analysis of different combinational circuits, Encoder, decoder, Multiplexer, Demultiplexer, ROM, PLA and their applications.
Flip-flops: SR, JK, Master slave, T and D type flip-flops and their characteristic tables & equations; Triggering of flip-flops, Flipflop, Excitation table.
Sequential circuits: Introduction to sequential circuits, Analysis and synthesis of synchronous and asynchronous sequential circuits.
Counters: Classifications, Synchronous and asynchronous counter design and analysis, Ring counter, Johnson counters, Ripple counter and counter with parallel load.
Registers: Classification, Shift registers, Circular registers and their applications and registers with parallel load, Basic Concept of Application Specific IC (ASIC) design.
Digital IC logic families: Brief description of TTL, DTL, RTL, ECL, I2L, MOS and CMOS logic and their characteristics, principles of operation and application.
Memory Units: Various memory devices and their interfacing.

Converters: Digital to Analog (D/A), Analog to Digital (A/D) converters, and their applications.

Textbooks/Reference Books:

1. Digital logic and Computer design by M. Moris Mano.
2. Modern Digital Electronics by R.P. Jain.
3. Digital Electronics by Tocci.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C6, A2	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO2	C6	Lecture	Final Exam, Class Test
CO4	PO2	C2	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2		√										
CO3		√										
CO4		√										

Title of the Course: Digital Electronics Laboratory
Course Code: EEE 312
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Type: Core Course
Prerequisite: N/A

Rationale: This course aims to provide laboratory experiments on designing combinational and sequential circuits and also provides the capability to program programmable logic devices.

Objectives:

The objectives of this course are -

- To make students Understand the operations and applications of various digital electronic circuits.
- To help students develop the analyzing skills of digital electronic circuits.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Demonstrate different logic gate circuits as well as the multiplexer/demultiplexer and counter operation as an individual and as a team member.

CO-2: Conclude the result from experimental data.

CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory course EEE 311: It will cover logic gates design, Boolean function implementation, half adder/full adder circuit design, multiplexer/demultiplexer, flip flops, counter design using TTL series IC.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Measurement and Instrumentation
Course Code: EEE 313
Credit Hour: 3.00 credits
Contact Hours:3 Hours/Week
Level/Term: Three/Two
Prerequisite: N/A
Type: Core Courses

Rationale: This course aims to make students knowledgeable about electrical measuring instruments and instrumentation process used in industrial automation system.

Objectives: The objectives of this course are:

- To facilitate necessary knowledge about fundamental of electrical measurement.
- To develop skills on measuring devices
- To help the students develop the ability in designing measuring circuit
- To make the students understands the basics of industrial instrumentation process.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Apply knowledge of measuring techniques to find various electrical parameters with accuracy, precision, and resolution.
CO-2: Determine unknown values balancing bridges.
CO-3: Distinguish among different types of signal analyzers.
CO-4: Design a system component or process to meet desired needs in electrical engineering.

Course Description:
Measurement:
Measurement of resistance, inductance and capacitance, balancing procedure for A.C bridges, cable faults and localization of cable faults, magnetic measurement, ballistic galvanometers, flux meter, separation of iron losses, high voltage measurement.
Measuring instruments:
Classification, operating principle of ammeters, voltmeters, wattmeter and watt-hour meters.
Introduction to instrumentation Error:
Classification of error, normal law of error, guarantee of error. Transducer: Resistive, strain gauges, thermal, magnetic, LVDT, capacitive, piezoelectric, optical, current and potential transformers.
Electronic measuring instruments:
Oscilloscope, DMM, VTVM, TVM.
Computer based instrumentation:
PC-based data acquisition, filtering by moving average, Instrumentation for process control, data conditioning.
Mechanical measurement:
Measurement of speed, frequency, pressure, temperature, flow force, weight level detector, shaft encoder.
Data Transmission and Telemetry:
Methods of data transmission, dc/ac telemetry system and digital data transmission. Recording and display devices. Data acquisition system and microprocessor applications in instrumentation. Mechanical, electrical and optical transducer, sample and hold circuits.

Textbooks/ Reference Books:

1. Electrical & Electronics Measurement and Measuring Instruments by A.K. Sawhney & Puneet Sawhney.
2. Electrical Measurements & Measuring Instruments by E.W. Golding & F.C. Widdis.
3. Electrical Measurements, Wiley Eastern by F.K. Harris.
4. Modern Electronic Instrumentation and Measurement Techniques, Prentice–Hall India by A.D. Helfrick & W.D. Cooper.
5. Transducers and Instrumentation, Prentice- Hall India by D V S Murty.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment, Mid Term
CO3	PO5	C4, P4	Lecture	Final Exam, Class Test
CO4	PO3	C6, A5	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3					√							
CO4			√									

Title of the course: Measurement & Instrumentation Laboratory
Course Code: EEE 314
Credit Hour: 1.50 credits **Contact Hours:** 3Hours/Week
Level/Term: Three/Two **Prerequisite:** N/A
Type: Core Course

Rationale: The laboratory course aims to familiarize students with various measurement and instrumentation techniques in the context of electrical engineering.

Objectives: -

The objectives of this course are-

- To help students getting the idea about various measuring techniques of electrical parameter.
- To be able to design and implement electrical automation system to control process variables.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Apply measuring techniques to find various electrical parameters with accuracy, precision, resolution by using experimental setup as an individual or as a team member.

CO-2: Conclude the result from experimental data.

CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on course of EEE 313: It will cover current transformer, thermostat, ADC, DAC, LRD based laboratory work.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO 4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Power System Analysis
Course Code: EEE 315
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Three/One
Prerequisite: EEE 223
Type: Core Courses

Rationale: This course aims to make the student skilful at the existing electrical power system operation.

Course Objectives (COs): The objectives of this course are:

- To model the various elements of power systems including generators, transformers & transmission lines.
- To form impedance & admittance matrix for the analysis of the large-scale power system.
- To develop & solve load flow problems in power network.
- To examine the network under both symmetric & unsymmetric fault conditions.
- To acquire the knowledge of power system ability involving two machine systems.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Analyze large scale power networks based on nodal admittance and impedance matrices.
CO-2: Develop model of generators, transformers, transmission lines and cables as the basis for the analysis of power system during steady and fault conditions.
CO-3: Formulate equations for load flow problems in power networks.
CO-4: Analyze the stability of power grid.

Course Content:
System modeling: Review of synchronous machine, the effect of synchronous machine excitation, per unit quantities, changing the base of per unit quantities, per unit impedance in single phase transformer and three phase transformer circuits, per unit impedance of three winding transformers, one-line diagram, impedance, and reactance diagram, per unit and percentage method of calculations, advantages and disadvantages of per unit computations.
Network calculations: Node equation, matrix partitioning, node elimination by matrix algebra, bus admittance and impedance matrices, modification of an existing bus impedance matrix, direct determination of a bus impedance matrix.
Load flow solution and control: Classification of buses, specification of bus voltage-power etc, Gauss-Seidel method and Newton-Raphson method of load flow solutions, some principles of load flow control.
Symmetrical three phase faults: Short circuit currents and the reactance of synchronous machines, internal voltages of loaded machines under transient conditions, bus impedance matrix in fault calculations, bus impedance matrix equivalent network, percentage reactance and short-circuit MVA, reactor control of short-circuit currents and location of reactors and their advantages and disadvantages.

Symmetrical components: Symmetrical components of unsymmetrical phasors, sequence impedance and sequence networks, sequence network of unloaded generators, positive and negative sequence networks, zero-sequence networks.

Unsymmetrical faults: Unsymmetrical short-circuits on an unloaded generator, single line-to-ground fault, line-to-line fault, double line-to-ground fault, unsymmetrical faults of power systems, faults through impedance, unsymmetrical open circuits and series impedances.

Power system stability: The stability problem of power system, swing equation, power-angle equation, equal area criterion of stability.

Multi-machine stability studies: Classical representation, step-by-step solution of the swing curve, factors affecting stability, techniques for improving stability

Textbooks/Reference Books:

1. Elements of Power System Analysis by William D Stevenson Jr.
2. Modern Power System Analysis by D P Kothari, I J Nagrath.
3. Principles of Power System by V.K Mehta.
4. Power System Analysis by Ashfaq Hussain.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO3	C6, A4	Lecture	Final Exam, Assignment
CO3	PO3	C3, A5	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2			√									
CO3			√									
CO4		√										

Title of the course: Power System Analysis Laboratory **Course Code:** EEE 316
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Three/Two **Prerequisite:** N/A
Type: Core Course

Rationale: This laboratory course aims to demonstrate students about the power system networks comprising of transmission lines with other equipment also the behavior of the components under various conditions.

Objectives: The objectives of this course are-

- To apprehend the operation and basic arrangement of transmission line model used in laboratory.
- To explain how different load works in power system.
- To understand the different condition of a power system and how to improve the system.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-
CO-1: Evaluate the performance of power system component in steady state and short circuit conditions using experimental setup as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory course EEE 315.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping

COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Electrical Machine Design
Course Code: EEE 332
Credit Hour: 1.50 credits
Contact Hours: 2 Hours/Week
Level/Term: Three/One
Prerequisite: N/A
Type: Core Course

Rationale: This laboratory course aims to develop knowledge on designing various electrical machines.

Course Objectives (COs): The objectives of this course are-

- To help students to understand fundamental concepts, principles of designing static and rotating machines.
- To provide proper knowledge about cooling systems.
- To develop the ability of designing an electrical machine.
- To provide basic knowledge to use modern tools for designing electrical machines.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Explain principles of electrical machines design.
CO-2: Design transformer & different types of rotating electrical machines.
CO-3: Estimate the losses & efficiency in designed machine.
CO-4: Use modern CAD tools for machine design.

Course Content:

Design principles of Electrical Machines, Equipment, Device involving electric and magnetic circuit, Design of Electric Power Transformers, Transformers for Electronics (AF & RF) circuits, Design of Electric Ceiling Fan, Pedestal Fan and table fan, Design of Electric motors for small pumps, Design of Electric Autotransformers, Design of Electric Welding Transformer.

Textbooks/Reference Books:

1. Electrical Machine Design by A.K. Sawhney.
2. Machine Design by M.G. Say.
3. Spotlight on Modern Transformer Design by Pavlos S. Georgilakis.
4. Design and Testing of Electrical Machines by M.V. Deshpande.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C2, A2	Lecture	Quiz & Performance Test
CO2	PO2	C6	Lecture	Quiz & Performance Test
CO3	PO2	C5	Lecture	Quiz & Performance Test
CO4	PO5, PO12	C3, A4, P2	Lecture	Quiz & Performance Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2		√										
CO3		√										
CO4					√							√

Title of the course: Switchgear & Protection
Course Code: EEE 333
Credit Hour: 3.00 credits
Contact Hours:3 Hours/Week
Level/Term: Three/Two
Prerequisite: N/A
Type: Core Course

Rationale: This course aims to make students knowledgeable about the safety & protection of equipment's in power system.

Objectives: The objectives of this course are:

- To make the students understand about protection issues of power system.
- To facilitate necessary knowledge about circuit breakers.
- To make the students understand the basics of relays.
- To facilitate necessary knowledge about safety equipment's.
- To make the students understand the power system protection.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Identify appropriate circuit interrupting device for different faulty situation.
CO-2: Calculate ratings of switchgear equipment (relay, fuse, circuit breaker, etc.) for different system configurations.
CO-3: Design different types of protection schemes.
CO-4: Apply knowledge of protection techniques in power system.

Course Description:
Protection issues: Purpose of power system protection, Introduction to circuit interruption and protection. Terminologies and general characteristics of relays and breakers.
Circuit breakers: control systems, arc extinction, recovery voltage. Air, oil, air blast, vacuum, SF6 and high voltage DC circuit breakers. Selection criteria, testing of circuit breakers.
Relays: Introduction to Analogue and Digital static relays. Static over-current, differential and distance protection. Microprocessor based relays, over-current, directional, sequence, pilot-wire and carrier current protection, power and impedance relays, balanced current relaying of parallel line, ground fault relaying.
Bus-bar arrangement, grounding, reactors, lightning arrestors, surge absorbers, ground wire, generators grounding.
Unit protection: generator, motor, transformer, bus and line protection.

Textbooks/Reference Books:

1. Principles of Power System by V.K Mehta.
2. Switchgear Protection & Power systems by Sunil S Rao.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C1	Lecture	Final Exam, Mid Term
CO2	PO2	C2	Lecture	Final Exam, Assignment
CO3	PO4	C6, P2	Lecture	Final Exam, Class Test
CO4	PO2	C3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3				√								
CO4		√										

Title of the course: Switchgear and Protection Laboratory **Course Code:** EEE 334
Credit Hour: 1.50 credits **Contact Hours:** 3Hours/Week
Level/Term: Three/Two **Prerequisite:** N/A
Type: Core Course

Rationale: This laboratory course aims to build foundation skills to select, install and operate appropriate diagnostic protective devices for electrical systems.

Objectives:
The objectives of this course are:

- To introduce the students with different switchgear and protection devices.
- To explain various methods of protection including primary and backup protection.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to –
CO-1: Operate different types of switchgear and protection equipment such as relay, fuse and circuit breaker in different system configurations practically as an individual or as a member of a team.
CO-2: Conclude the result from experimental data.
CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on the course of EEE 333.
2	Report writing based on laboratory work.

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Transmission & Distribution of Electrical Power
Course Code: EEE 351
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Three/One **Prerequisite:** N/A
Type: Core Courses

Rationale: This course aims to provide foundation knowledge on how electrical power transfer and distribute from one place to another.

Course Objectives:
The objectives of this course are-

- To make students understand the concepts of various methods of electrical power transmission.
- To facilitate students with necessary knowledge of passive elements in various power transmission systems.
- To make students understand the factors affecting Insulators and also in underground cables.
- To accumulate basic idea to calculate the various parameters in distribution system.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO 1: Determine various parameters of different transmission line models.
CO 2: Determine voltage regulation and efficiency of various transmission line.
CO 3: Analyze the performance of different types of insulators.
CO 4: Analyze the characteristics of different types of cables.
CO 5: Estimate the voltage drop in various types of distributors.

Course Description:
Inductance of transmission lines: Flux linkage, Inductance due to internal flux, Inductance of single-phase two wire lines, Flux linkage of one conductor in a group, Inductance of composite conductor lines.
GMD examples: Three-phase lines with equilateral spacing and unsymmetrical spacing, Parallel circuit 3 phase lines, Use of tables.
Electrical field: Potential difference between points due to a charge, Capacitance of a two-wire line, Group of charged conductors, Capacitances of 3 phase lines with equilateral and with unsymmetrical spacing, Effect of earth, parallel circuit lines.
Resistance and skin effect: Resistance and temperature, Skin effects, Influence on resistance, use of table, Current and voltage relation on a transmission line, T- and pi-representation, exact solution. Equivalent circuit of a long line.
Mechanical characteristics of transmission line: Sag and stress analysis; Wind and ice loading, supports at different elevation conditions at erection; effect of temperature changes.
Generalized line constant: General line equation in terms of A, B, C, D constants. Relation between constant, charts of line constants, constants of combined networks, measurement of line constants.
Circle diagrams: Receiving end and sending end power circle diagrams.

Voltage and power factor control in transmission systems: Tap changing Transformers; on load tap changing. Inductance regulators. Moving coil regulators, Boosting transformers, Power factor control; static condensers; synchronous condenser.

Cable: Insulators for overhead lines; types of insulators, their construction and performance. Potential distribution in a string of insulators, string efficiency, Methods of equalizing potential distribution; special types of insulators, testing of insulators, Insulated cables, cables versus overhead lines, insulating materials, electrostatic stress grading, three core cables; dielectric losses and heating. Modern development, oil filled and gas filled cables, Measurement of capacitance, Cable testing, Introduction to transmission line protection, over current relay and time grading, reverse power relays.

Protection: Differential protection Distant relays. Distribution: Distributor calculation, ring mains and interconnections.

Textbooks/reference Books:

1. Power System Analysis, by W.D. Stevenson JR, John J. Grainger
2. Elements of Power System Analysis, by W.D. Stevenson.
3. Principles of Power System by V.K. Mehta & Rohit Mehta.
4. Electrical Power system analysis by Ashfaq Husain.
5. The transmission and Distribution of Electrical Energy by H.W. Cotton and H. Barber

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO2	C4	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test
CO5	PO3	C5, A3	Lecture	Final Exam, Class Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4		√										
CO5			√									

Title of the course: Electrical & Electronic Engineering Services **Course Code:** EEE 356
Credit Hour:1.50 credits **Contact Hours:** 3Hours/Week
Level/Term: Three/Two
Prerequisite: CE 102 ; EEE 101
Type: Core Course

Rationale: This laboratory is intended to impart students with electrical wire, light, building, substation designing.

Course Objectives: The objectives of this course are:

- To help students develop their skills to do the electrical design of a building, industry and substation.
- To help students to model an electrical network using specified system components according to needs.
- To provide the knowledge of designing electrical scheme considering societal, safety and legal issues.
- To help students to integrate design scheme in electrical system considering environmental effect and sustainability.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO 1: Calculate cables size, circuit breaker rating, bus bar size etc.
CO 2: Design an LT electrical distribution system for low rise office buildings, industrial buildings & multipurpose buildings.
CO 3: Design electrical wiring for building & industries maintaining the IEE wiring regulation 16th (BS7671:2001).
CO 4: Develop electrical systems considering safety and legal issues.
CO 5: Adopt the basic installation of CCTV, fire detection and alarm system.
CO 6: Apply CAD tools for electrical engineering service design considering environmental safety and sustainability.
CO 7: Illustrate a single line diagram of a typical 11 kV/0.4 kV 500 kVA substation and 200 kVA pole mounted transformer.

Course Description:
Designing LT Electrical distribution buildings, for low rise office buildings, for industrial buildings, for multipurpose buildings, Selection of cable size, circuit breaker size, bus bar size, Typical lighting design inside a domestic building, office building and an industry, Choice of luminaries for various applications.
Introduction to modern Lifts and their installation, Installation of a PABX for domestic building, office building and industrial compound, Designing routing and layout of indoor and underground telephone and fiber optic cables, Designing routing and layout of UTP data cables and fiber optic cables for LAN.
Introduction to IEE Wiring Regulation 16th (BS7671:2001) incorporating Amendments 1&2, 2004. Safety regulations, various types of cables for indoor wiring and electrical distribution in buildings, Distribution boards, MCB, MCCB, Earthing requirements, various earthing systems, Conductors for outdoor distribution through poles. Single line diagram of a typical 11 KV/0.4 KV 500 KVA

Substation and 200 KVA pole mounted transformer. Bus-bar trunking system for various applications.
Introduction to CCTV, Fire Detection and Alarm system, Firefighting system, Burglar Alarm system.

Textbooks/ Reference books:

1. Electrical Wiring, Estimating & Costing by S.L Uppal.
2. Based on 2011 National Electrical code: Electrical Wiring: Residential by Ray C. Mullin & Phill Simmons.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C2	Lecture	Quiz & Performance Test
CO2	PO3	C6, A3	Lecture	Quiz & Performance Test
CO3	PO4	C6, P2	Lecture	Quiz & Performance Test
CO4	PO3	C5, A3	Lecture	Quiz & Performance Test
CO5	PO3	C3, A2	Lecture	Quiz & Performance Test
CO6	PO6, PO7	C3, A2	Lecture	Quiz & Performance Test
CO7	PO3	C4, A3	Lecture	Quiz & Performance Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2			√									
CO3				√								
CO4			√									
CO5			√									
CO6						√	√					
CO7			√									

Title of the course: Microprocessor & Microcontroller **Course Code:** EEE 371
Credit Hour: 3.00 credits **Contact Hours:**3 Hours/Week
Level/Term: Three/Two **Prerequisite:** EEE 311
Type: Core Course

Rationale: The aim of this course is to help students to develop basic concepts and solving techniques of problems with applications of microprocessors and microcontrollers.

Course Objectives: The objectives of this course are-

- To provide the knowledge of microprocessor architecture.
- To perform basic programing techniques using assembly language.
- To facilitate necessary knowledge about interfacing different peripheral devices.
- To get idea about microcontroller & development boards.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Write programs using assembly language.
CO-2: Distinguish among different types of processors.
CO-3: Design microprocessor peripheral interfacing circuits.
CO-4: Design microcontroller-based systems to solve real world problems.

Course Description:
Introduction to different type of microprocessors:
8 bit, 16 bit, 32 bit and their architectures; pin diagram & junction; Intel series microprocessor and Co-processor; RISK & CISK processor; Assembly Language: Basic Instruction Sets and Assembly language Programming based on 8086 microprocessor.
Microprocessor peripherals:
Introduction to some available microprocessor peripherals IC's and their application such as 8251, 8253, 8254, 8255, 8257, 8259, 8279, A/D and D/A converter interfacing, Timing Diagram, Interrupts, I/O systems, DMA-based data transfer, memory interfacing, MMX and SIMD technologies. The above peripheral is based on 8085 and 8086 processor.
Interfacing:
Introduction, interfacing to microprocessor to keyboards, alphanumeric displays, Introduction to microcomputers and interfacing to microcomputer ports to high power devices.
Basic Micro controller:
Introduction of microcontroller, embedded system design, microcontroller programming environment, Architecture of different microcontroller such as PIC, MSP, ARM etc. Real time application design based on microcontroller.
PIC Microcontroller:
Introduction To PIC Microcontroller, Internal Architecture, Components & Programming, Some PIC Based Project work.
Arduino & Raspberry Pi:
Introduction of Development boards

Textbooks/ Reference Books:

1. Architecture Programming and Application with the 8085 by Ramesh Gaonkar.
2. The Intel Microprocessors 8086/8088 : Architecture Programming and Interfacing by Barry B. Brey.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C2	Lecture	Final Exam, Mid Term
CO2	PO2	C2	Lecture	Final exam, Assignment, Mid Term
CO3	PO3	C6, A3	Lecture	Final Exam, Class Test
CO4	PO3	C6, A3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3			√									
CO4			√									

Title of the course: Microprocessor & Microcontroller Laboratory
Course Code: EEE 372
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Three/Two **Type:** Core Course
Prerequisite: N/A

Rationale: The course aims to develop basics on Microprocessor & Microcontroller based programming aimed to design embedded systems.

Objectives:
The objectives of this course are-

- To help students learn microcontroller programming.
- To design simple project based on microcontroller.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO 1: Solve complex engineering problems using programming as well as hardware tools as an individual and as a team member.
CO 2: Conclude the result from experimental data.
CO 3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware & simulation tools based on course of EEE371. It will cover ARDUINO & PIC based microcontroller system design & introduction to raspberry-pi.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

Cos	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Control System
Course Code: EEE 373
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/One
Prerequisite: EEE 201
Type: Core Course

Rationale: This course aims to provide basic knowledge of different control techniques used in industries to control electrical and mechanical devices.

Course Objectives:
The objectives of this course are:

- To acquaint students with the basic knowledge of modern control system.
- To help the students develop their ability in developing mathematical models of electrical system.
- To get idea about the principle of block diagram reduction and signal flow graphs.
- To provide the knowledge of the stability of electrical and mechanical systems.
- To help them conceptualize the basic theories of system analysis technique.
- To make the students understand the basic knowledge of different types of controllers to control the system.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Develop simplified mathematical models of physical systems.
CO-2: Apply various reduction methods to solve different real-world problems.
CO-3: Apply various analysis techniques for stability and designing systems.
CO-4: Categorize different types of controllers for industrial applications.
CO-5: Design PLC based automation system.

Course Description:

- **Introduction:** Introduction to the modern and basic control system.
- **Mathematical Model:** State space representation/transfer function/zero-pole of control system design, state space representation, solution of state equation.
- **Block diagram approach:** Signal flow graph, block diagram theory, block diagram reduction method.
- **Classical Control System:** Analysis methods such as Nyquist stability criterion, Root locus, Routh's criteria, classical design using frequency domain methods, phase lead and lag controllers, PID controllers, relay auto tuning, controllability and observability, Linear control system design using state feedback, LQR design, pole placement, use of observers.
- **Modern Control System:** Introduction to robotics, Transducers, actuators and the basic concept of the intelligent control system, application of eigen value, state variable analysis, canonical forms.
- **Controller Design:** P, I, PI and PID types.

- **PLC:** Introduction to PLC, PLC specification, a functional description of PLC, Different programming languages for PLC.

Textbooks/ Reference Books:

1. Linear Control System Analysis and Design by D' Azzo & C. H. Houpis.
2. Modern Control Engineering by K. Ogata.
3. Modern Control Systems by R. C. Dorf & R. H. Bishop.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C5	Lecture	Final Exam Mid Term
CO2	PO2	C3	Lecture	Final Exam, Assignment
CO3	PO2	C3	Lecture	Final Exam Class Test
CO4	PO2	C2	Lecture	Final Exam Class Test
CO5	PO3	C6, A2	Lecture	Final Exam Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4		√										
CO5			√									

Title of the course: Control System Engineering Laboratory **Course Code:** EEE 374
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/One **Prerequisite:** N/A
Type: Core Course

Rationale: This course aims to build foundation skills on designing and analyzing different industrial control systems using PLC and MATLAB.

Objectives: The objectives of this course are-

- To help students demonstrate the controlling of systems using PLC.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO 1: Design ladder diagram for PLC based automation system and design the best controller based on the systems requirement using CAD tool as an individual or as a member of a team.
CO 2: Conclude the result from experimental data.
CO 3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on theory course EEE 373. It will cover hardware-based work in PLC system.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Semiconductor Physics & Devices **Course Code:** EEE 441
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/One **Prerequisite:** EEE 211
Type: Core Course

Rationale: The aim of this course is to introduce students with the fundamental theories and applications associated with semiconductor materials and devices.

Objectives:
The objectives of this course are:

- To help students to develop the fundamentals of physics associated with semiconductor materials.
- To facilitate necessary knowledge about different semiconductor devices' structure and operation.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Apply the basic knowledge of semiconductor physics to design of semiconductor components.
CO-2: Identify specific type of devices considering the current requirements.
CO-3: Expand their gathered knowledge of semiconductor devices in the context of contemporary research.

Course Description:
Electron & Hole statistics in semiconductors, Transport properties, Charge carrier recombination, Diffusion of electron & hole, Equation of continuity, Carrier injection, p-n Junction, Types of p-n junction, Current-Voltage characteristics, Physical model of a p-n junction, Junction capacitance and Width, Breakdown phenomena, Bipolar junction transistors: Basic principle of PNP and NPN transistors, emitter efficiency, base transport factor and current gain, diffusion equation in the base, Ebers-Moll equations and circuit synthesis. Metal- Semiconductor Junction: Energy band diagram of metal semiconductor junctions, Rectification at metal-semiconductor Junction, MOS structure: MOS capacitor, energy band diagrams and flat band voltage and control of threshold voltage, Schottky-diffusion theory, Principle of operation of FET, qualitative theory of MOSFET operation, body effect and current–voltage relationship of a MOSFET, Junction field-effect-transistor. Photovoltaic effect, LED.

Textbooks/Reference books:

1. Physics of Semiconductor Devices by Michael Shur.
2. Physics of Semiconductor Devices 2nd edition, by S.M. Sze.
3. Solid State Electronic Devices by Ben Streetman & Sanjay Banerjee.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Final Exam, Mid Term
CO2	PO2	C1	Lecture	Final Exam, Assignment
CO3	PO4	C2, P2	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3				√								

Title of the course: Digital Signal Processing
Course Code: EEE 477
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: EEE 201
Type: Core Courses

Rationale: This course aims to provide students with the basics of digital signal processing and filter designing that are essential for digital systems.

Objectives:
The objectives of this courses are:
- To introduce the students with the basic knowledge of digital signal processing.
- To provide necessary knowledge for discrete and fast fourier transform.
- To familiarize the principles of convolution and correlation.
- To provide basic knowledge of z-transform.
- To provide fundamental knowledge for digital filters.
- To familiarize FIR and IIR filter design and their applications.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Perform analog to digital transformation of a signal and restore signal from the samples.
CO-2: Apply the knowledge of fourier and z-transform for signal analysis.
CO-3: Design different types of digital filter as per requirements.

Course Description:
Introduction to 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 of continuous-time signal from its samples (reconstruction), role of anti-aliasing 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.
Discrete Transformations: Discrete Fourier series, the Discrete-Time Fourier Transform, discrete Fourier transform (DFT) and fast Fourier transform (FFT): Forward and inverse transforms; coefficient ordering; time and frequency resolution; periodic extension, zero padding and modulo-M reduction; properties of the DFT, circular convolution; Cooley-Tukey decomposition, recursive application, radix-2 FFTs, time and frequency decimation, computational complexity.
Z-Transforms: Regions of convergence, convolution property and graphical interpretation of the convolution operation, z-transforms of cascaded systems, stability and causality.
Realization of Frequency Response: Frequency response (Magnitude and Phase), representation of LTI systems with rational polynomials, block-form implementations of a rational polynomial transfer function.
Digital Filters: FIR filters- linear phase filters, specifications, design using window, optimal and frequency sampling methods; IIR filters- specifications, design using impulse invariant, bi-linear z-transformation, least-square methods, linear phase, Butterworth, Chebychev, Inverse Chebychev, Bessel and elliptic filters, finite precision effects in implementing digital filters.

Implementing Digital Filters: Block-diagram representations, direct forms, cascade forms, first and second-order factors, parallel forms, feedback loops transposed forms, linear-phase FIR structures.
Wavelets: Short time Fourier transform, fundamentals of wavelets, wavelet transform (continuous and discrete), time – frequency density and orthogonal bases.

Textbooks/Reference Books:

1. Digital Signal Processing: Principles, Algorithms, and Applications by Dimitris G. Manolakis and John G Proakis.
2. Digital signal processing by Oppenheim.
3. Digital Signal Processing, A Computer-Based Approach by Sanjit K Mitra.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C2	Lecture	Final Exam, Class Test
CO2	PO2	C3	Lecture	Final Exam, Mid Term
CO3	PO3	C6, A2	Lecture	Final Exam, Assignment

s												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3			√									

Title of the course: Digital Signal Processing Laboratory **Course Code:** EEE 478
Credit Hour: 1.5 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** EEE 202
Type: Core Course

Rationale: This course aims to provide students practical knowledge, principles and applications of digital signal processing that are essential for modern engineering.

Objectives: The objectives of this course are-

- To introduce students with basic simulation techniques of digital signal processing.
- To familiarize with FIR and IIR filter design and their application.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Analyse different digital signals & digital filters with DTFT, FFT and z-transform using modern CAD tools.

CO-2: Conclude the result from experimental data.

CO-3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using CAD tools based on theory course EEE 451.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour).

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping

COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Project/Thesis
Credit Hour: 4.00 credits
Level/Term: Four/One
Type: Core Course

Course Code: EEE 400
Contact Hours: 4 Hours/Week
Prerequisite: N/A

Rationale: This course aims to enhance the knowledge in solving real word problem which makes students to capable to apply academic knowledge in the industrial field.

Objectives: The objectives of this course are-

- To prepare students solving real world problem related to the industry.
- To make students to practice research methodology.
- To facilitate students with the modern tools used in the industry.
- To make them learn ethical values in the research field.
- To practice the team work and communication in the industry.
- To enhance the knowledge of conducting a real time project.
- To make them understand the sustainable solution.
- To enhance the analytical ability of complex engineering problems.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: To identify a contemporary engineering problem whose solution can be designed, developed and verified.
CO-2: To formulate the complex engineering problems.
CO-3: To design circuit to solve engineering problem.
CO-4: To work effectively as an individual or as a team member.
CO-5: To assess the influence of a project in the context of environment, sustainability and ethics.
CO-6: To write professional technical reports regarding engineering project.
CO-7: To present outcome of any project or research work orally.

Course Content:
Two Students in a group will design a project from the following fields with the supervision of a faculty member. The design may be done by simulation or a hardware.

- Circuit and System.
- Communication System.
- Power system Analysis.
- Robotics.
- Industrial Automation System.
- Embedded System.
- IoT (Internet of Things) and Big Data.
- Measurement Equipment Design.
- Mathematical Analysis of Complex Engineering Problem.
- Renewable Energy.
- Signal Processing and Image Processing.

Thesis offering Procedure & Assessment Process:

a) To enroll the course, students need to pass the following courses: Electrical Circuits I (EEE 101), Electrical Circuits I Laboratory (EEE 102), Electrical Circuits II (EEE 103), Electrical Circuits II Laboratory (EEE 104), Electronics I (EEE 211), Electronics I Laboratory (EEE 212), Electronics – II (EEE 213), Electronics II Laboratory (EEE 214), Electrical Machines I (EEE 221), Electrical Machines I Laboratory (EEE 222), Electrical Machines II (EEE 223), Electrical Machines II Laboratory (EEE 224) Signals & Systems (EEE 201) and Transmission Distribution of Electrical Power (EEE 351).
b) Faculty members of DEEE provide project titles which will be under the domain of the curriculum of B.Sc. in Electrical and Electronic Engineering.
c) Thesis/project titles are rechecked by the specific project coordination committee to ensure the engineering standards and design constraints. This project coordination committee is formed by three members: Project coordinator (Faculty Member of the concerned department, at least assistant professor), Member (chair of the department, a faculty).
d) A project choice form is supplied to each student at the last week of 6^{th} semester. The thesis form contains specific project titles. Students have to set the priority marks against each title. The sample of the choice form has been given below as an enclosure. The project choice doesn't contain any name of the supervisor.
e) The specific committee members finalize the project allocation and announce the decision regarding proposal presentation.
f) Students have to present their proposal on the mentioned date and any correction or expansion of their works will be noted officially. The proposal presentation is generally held on the 2^{nd} week of 7^{th} semester.
g) Students have to meet with their supervisor regularly at least once in two weeks.
h) A mid-presentation is held on the first week of the 8^{th} semester and students have to present the progress of their project work.
i) Then they can submit their work at the final presentation. The final marks of this course are aligned as: performance (40), report (30) & presentation (30).

Textbooks/Reference Books:

- Field-Related Journal paper.
- Field-Related Conference paper.
- Tools related documentation/tutorial.

CO delivery and assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C5	Weekly meeting, student presentation	Report writing and presentation.
CO2	PO4, PO5	C3, P4	Weekly meeting, student presentation	Report writing and presentation.
CO3	PO3	C3, A3	Weekly meeting, student presentation	Report writing and presentation.
CO4	PO9, PO11	C4, A4, P4	Weekly meeting, student presentation	Report writing and presentation.
CO5	PO6, PO7, PO8	C6, A3	Weekly meeting, student presentation	Report writing and presentation.
CO6	PO10, PO11, PO12	C2, A3, P3	Weekly meeting, student presentation	Report writing and presentation.
CO7	PO10, PO11, PO12	C2, A3, P3	Weekly meeting, student presentation	Report writing and presentation.

CO/PO mapping												
Cos	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2				√	√							
CO3			√									
CO4									√		√	
CO5						√	√	√			√	√
CO6										√	√	√
CO7										√	√	√

5.5 Elective Courses:

Title of the course: Microwave and Antenna Engineering **Course Code:** EEE 403
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** EEE 241
Type: Elective Course

Rationale: This course aims to facilitate students to learn fundamental theories related to microwave engineering which are used in antenna design industry.

Objectives:

The objectives of the course are-

- To help the students conceptualize the basic concept related to radio frequency waves propagation in HF transmission line.
- To make the students understand the concepts of smith chart and impedance matching networks.
- To acquaint students with the knowledge of waveguides, cavity resonators and their applications.
- To help students understand the basic concepts of microwave signal generation and amplification.
- To facilitate the necessary knowledge about the basics of different types of antennas.

Course Outcomes (COs):

After successful completion of this course, students will be able to:
CO-1: Analyze high frequency transmission line.
CO-2: Determine characteristic parameters of different wave guide.
CO-3: Distinguish different types of antenna and their particular field of use.

Course Description:

Introduction to Microwave Engineering: Microwave engineering, Microwave device, Microwave system, Microwave units of measurement.

Details about HF Transmission Line: Transit time effect, Velocity modulation, Smith Chart, Impedance Matching Technique and Application, EM propagation, Reflection & Refraction, Microwave coaxial connectors.

Wave Guide Principles and Properties: Microwave cavities, Microwave hybrid circuits, Waveguide component, Rectangular and circular waveguide, Microwave cavity resonator.

Microwave Generation and Analysis: O-type & M-type, Klystrons, Multi-cavity klystron amplifier, Reflex klystron oscillator, Backward wave oscillator Magnetron, Traveling wave tube.

Antenna: The basic of Antenna Concepts, The origin of first antenna, Definition, Patterns, Beam area; Radiation intensity, Beam efficiency, Directivity- gainer solution Different types of aperture, Friis transmission formula; Duality of antenna; Antenna field zone, Radiation Patterns and Gain.

Point Source & Arrays: Phase scanning of Antennas Arrays; Array of Point Source: Introduction to point source; Power pattern; A power theorem and its application to an isotropic source; Radiation intensity; Source with hemispheric power pattern; Field pattern and phase pattern; Arrays of two isotropic point source.

Types of Antenna: Electric dipole antenna and thin layer antenna; Small current element antenna; Long straight antenna; Loop antenna; Helical antenna; Cylindrical antenna; Reflector antenna; Slot and horn antenna; Broadband and frequency independent antenna; Patch or micro-strip antenna; Log periodic antenna, Yagi-Uda antenna.

Textbooks/Reference Books:

1. Microwave Engineering, by David M. Pozar (2nd edition).
2. Antennas for All Applications by John D. Kraus & Ronald J. Marhefka.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Class Test
CO2	PO2	C4	Lecture	Final Exam, Mid Term
CO3	PO2	C2	Lecture	Final Exam, Assignment

CO/PO Mapping												
	Program Outcomes (POs)											
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										

Title of the course: Cellular Mobile and Satellite Communication System

Course Code: EEE 435
Credit Hour: 4.00 credits
Contact Hours: 4 Hours/Week
Level/Term: Four/Two
Prerequisite: EEE 309
Type: Elective Courses

Rationale: This course aims to make students knowledgeable about cellular mobile communication, satellite communication & RADAR system

Objectives: The objectives of this course are:

- To make the students understand the basics of 2G,3G & 4G communication systems.
- To facilitate necessary knowledge about cellular and channel concept.
- To make the students understand the basics of mobile radio propagation.
- To facilitate necessary knowledge about GSM.
- To make the students understand the basics of satellite communication and RADAR.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Develop detailed calculations of cell planning for cellular communication.

CO-2: Solve various problems related to cellular communication like, call drop, channel interference etc.

CO-3: Distinguish different types of multiple access techniques and particular field of application.

CO-4: Adopt the knowledge of RADAR & satellite communication system.

Course Description:

Cellular Communication: Introduction, Concept, Evolution and Fundamentals; Cellular traffic,

Cell Planning: Introduction of cells; Cell planning process; Frequency reuse; Co-channel interference; Adjacent channel interference; Clusters; Cell splitting and components.

Channel Concept: Introduction to physical and logical channel, Classification of channels, Mathematical modeling of fading channels, Control channel; Logical channel, Different types of bursts, Relationship between bursts and frames; Mapping of logical channels onto physical channels; Sample traffic case (Call to an MS); Co-channel and adjacent channel interference

Diversity Techniques: Concept of diversity branch and signal paths; Carrier interference ration performance; Diversity schemes and combining techniques, 3G & 4G Communication, EDGE, GPRS

GSM: Introduction of GSM; GSM system networks; Base station system (BSS), Switching systems (SS), Operation and support system (OSS), General packet radio service (GPRS), Mobile intelligent network (MIN), Service center (SC), Billing gateway (BG), Service order gateway (SOG).

GSM identities: Mobile station ISDN number (MSISDN), International mobile subscriber identity (IMSI), Temporary mobile subscriber identity (TMSI), Mobile station roaming number (MSRN),

International mobile equipment identity (IMEI) and Software version number (IMEISV), Location area identity (LAI), Cell global identity (CGI);
GSM system architecture: SS implementation, BSS implementation, OMC and NMC implementation.
Base Station: Introduction of Base station, Transcoder controller (TRC), Base station controller (BSC), Radio base station (RBS).
Mobile Stations: Introduction to Mobile station; Mobile station functions; Mobile station classes; Subscriber identity module (SIM); Subscriber data stored in the mobile equipment; Features and evolution of mobile stations;
Multiple Access Techniques: Brief discussion of CDMA, FDMA systems, TDMA systems, Spread Spectrum Technique.
Radio Propagation: Propagation Characteristics; Models for radio Propagation;
Hand off and Dropped calls: Reason and types; Forced hand-off; Mobile assisted hand-off and dropped call rate;
Satellite Communication: The brief history of satellite communication, types of satellite, basic satellite operation, orbit consideration, frequency issues, aspects of propagation and antennas, multiple access in satellite communication, link budget overview, broadcast satellite service, fixed satellite service, mobile satellite service; communication satellite subsystems, earth station, regenerative satellite systems, broadcasting by satellites and satellite link analysis.
RADAR: Introduction to radar system, principal, RADAR equation, TR, ATR tubes duplexer and application of radar.

Textbooks/Reference Books:

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport .
2. GSM System Survey by Ericsson publishers.
3. Satellite Communication by D.C. Agarwal.
4. Radar Engineering and Fundamentals of Navigational Aids by G.S.N. Raju.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Final Exam, Class Test
CO2	PO2	C3	Lecture	Final Exam, Mid Term
CO3	PO2	C2	Lecture	sFinal Exam, Assignment
CO4	PO1	C3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										
CO4	√											

Title of the course: Wireless Communication
Course Code: EEE 437
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to make students knowledgeable about related aspects of wireless communication systems.

Objectives:
The objectives of this course are:

1. To make the students understand the basics of radio wave propagation
2. To facilitate necessary knowledge about several statistical channel Models
3. To make the students understand the capacity of channel
4. To facilitate necessary knowledge about applications of diversity technique
5. To make the students understands the space time and broadband communication system.

Course Outcomes (COs):
Upon successful completion of this course, students will be able to
CO-1: Discuss about the foundation of wireless communication system.
CO-2: Apply knowledge of radio wave propagation on wireless communication system.
CO-3: Distinguish among different channel models.
CO-4: Calculate the channel capacity for wireless communication system.
CO-5: Identify several aspects of space time and broadband communication system.

Course Description:
Introduction: Wireless communication systems, regulatory bodies. Radio wave propagation: Free space and multi-path propagation, ray tracing models, empirical path loss models, large-scale and small-scale fading, power delay profile, Doppler and delay spread, coherence time and bandwidth.
Statistical Channel Models: Time-varying channel models, narrowband and wideband fading models, baseband equivalent model, discrete-time model, space-time model, auto- and cross correlation, PSD, envelope and power distributions, scattering function.
Channel Capacity: Flat fading channels - CSI, capacity with known/partially known/unknown CSI. Frequency-selective fading channels - time-invariant channels, time-varying channels.
Performance of digital modulations: Error and outage probability, inter-symbol interference, MPSK, MPAM, MQAM, CPFSK.
Diversity Techniques: Time diversity - repetition coding, beyond repetition coding. Antenna diversity - SC, MRC, EGC, space-time coding. Frequency diversity - fundamentals, single-carrier with ISI equalization, DSSS, OFDM.
Space-time Communications: Multi-antenna techniques, MIMO channel capacity and diversity gain, STBC, OSTBC, QOSTBC, SM, BLAST, smart antennas, frequency-selective MIMO channels.

Broadband Communications: DSSS, FHSS, spreading codes, RAKE receivers, MC-CDMA, OFDM, OFDMA, multiuser detection, LTE, WiMAX.

Textbooks/Reference Books:

1. Wireless Communications: Principles and Practice by Theodore S. Rappaport.
2. GSM System Survey by Ericsson publishers.
3. Satellite Communication by D.C. Agarwal.
4. Radar Engineering and Fundamentals of Navigational Aids by G.S.N. Raju.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C3	Lecture	Final Exam, Class Test
CO2	PO2	C4	Lecture	Final Exam, Mid Term
CO3	PO2	C2	Lecture	Final Exam, Assignment
CO4	PO3	C2, A3	Lecture	Final Exam, Assignment
CO5	PO2	C1	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3		√										
CO4			√									
CO5		√										

Title of the course: Industrial Power Electronics **Course Code:** EEE 441
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/One
Prerequisite: EEE 211, EEE221
Type: Elective Course

Rationale: The aim of the course is to introduce the key aspects of power electronics device, design and their applications in the context of power conversion applications.

Objectives:
The objectives of this course are

1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
2. To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
3. To facilitate necessary knowledge about electrical drive.

Course Outcomes (COs):
After the completion of this course, a student will be able to
CO-1: Analyze different power electronics circuits and characteristics of basic static semiconductor devices and their applications.
CO-2: Design AC-DC converter circuit.
CO-3: Design DC-DC and DC-AC converter for various industrial application.
CO-4: Classify the required machine drives for industrial purposes.

Course Description:
Power Diode: SCRs, TRIACS, Power MOSFET, IGBT, UJT, DIAC.
AC-DC converter: Thyristor converter, characteristics, commutation, dc motor speed control, harmonics, power factor and cycloconverter, Dual converter.
DC-DC converter: Characteristics and operation, dc motor speed control, switching converter and power supplies.
DC-AC Converter: Three phase and single-phase voltage source and current source inverters, voltage, frequency and harmonic control, PWM inverters and SVM inverters.
Introduction to power electronic control of motor: Scalar and vector control of poly phase induction motors, rotor power control, synchronous motor and PMSM motor control, DC motor braking and plugging circuits, transistor dynamic braking circuit; emergency stop plugging circuit, switch mode power supply.
Textbooks/ Reference Books:

1. Power Electronics Handbook by Muhammad Harunur Rashid.
2. Modern Power Electronics and AC Drives by Bose.
3. Power Electronics, Tata McGraw-Hill Publishing Company Ltd, NEW DELHI by M D Singh.
4. Industrial Electronics and Robotics, Tata McGraw-Hill, Singapore by Schuler & McNamee.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Mid Term
CO2	PO3	C6, A3	Lecture	Final Exam, Assignment
CO3	PO3	C6, A3	Lecture	Final Exam, Class Test
CO4	PO2	C4	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2			√									
CO3			√									
CO4		√										

Title of the course: Industrial Power Electronics Laboratory **Course Code:** EEE 442
Credit Hour: 1.50 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/One **Prerequisite: N/A**
Type: Elective Course

Rationale: The aim of this course is to develop laboratory works to experimentally reinforce the fundamental concepts presented in the industrial power electronics course.

Objectives:

The objectives of this course are-

- To introduce students with safety regulations of Power Electronics laboratory.
- To facilitate students with foundation skills of using Circuit laboratory instruments.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After the completion of this course, a student will be able to-

CO1: Verify and simulate various semiconductor switching devices characteristics as well as basic phase control circuit and energy conversion of the machines using experimental setup as an individual or as a member of a team.

CO2: Conclude the result from experimental data.

CO3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on Theory Course EEE 441: It Will Cover SCR, TRIAC Characteristics, half wave/full wave triggering circuit, speed control of induction motor, buck boost converter etc.
2	Report writing based on laboratory work.
3	Oral Presentation on Mini Project Work (Design Project/Analytical Project/ Experimental Project/Industrial Tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: VLSI Design
Course Code: EEE 443
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/One
Prerequisite: EEE 211
Type: Elective Course

Rationale: This course aims to introduce the basic theories and fundamental procedures of integrated circuit (IC) design and analysis.

Objectives:
The objectives of this course are:

- To make students understand MOSFET operation.
- To help students conceptualize MOSFET dc and ac analysis.
- To facilitate necessary knowledge about CMOS characteristics and operation.
- To enhance the skills of designing different logic gates using CMOS.
- To accumulate basic ideas about sequential circuits.
- To foster the analytical and critical knowledge of digital circuits' delay calculations.
- To acquaint students with various real-world circuits.
- To get idea about CMOS fabrication process.
- To help students develop basic VHDL skills.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Design analog integrated circuit.
CO-2: Analyze performance issues, fabrication procedures and conditions governing the procedures.
CO-3: Design digital logic gates and digital electronic circuit.

Course Description:
VLSI design methodology: Top-down design approach, Introduction to microelectronics and MOS technology; basic electrical properties and circuit design processes of MOS and Bi-CMOS circuits; scaling of MOS circuits; sub-system design processes.
Brief overview fabrication process: NMOS, CMOS, Bi-CMOS process, layout, Analog and digital layout, Stick diagram.
CMOS design: Behavioral description; structural description; physical description and design verification; Complex CMOS gates,
CMOS building block: multiplexer, barrel shifter, adder, counter, Data Path and memory structures it also give concept of GaAs technology & Ultrafast , VLSI circuits and systems.
Computational elements: Design of ALU subsystem, adder, multipliers, memory, registers and aspects of system timing, practical aspects of design tools and test-ability.
Introduction to HDL: FPGA and PLD design; Introduction to HDL; Basic digital design using VHDL.

Textbooks/Reference Books:

1. Design of Analog CMOS Integrated Circuits by Behzad Razavi.
2. Fundamentals of Semiconductors Fabrication by Gary S. May & Simon M. Sze
3. Design of VLSI System by Linda E.M. Brackendury.
4. CMOS VLSI Design: A Circuits and Systems Perspective by Neil Weste & David Harris.
5. The Art of Analog Layout by Alan Hastings.
6. MOS Device by Yannis Tsividis.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C6, A2	Lecture	Final Exam, Mid Term
CO2	PO2	C4	Lecture	Final Exam, Assignment
CO3	PO5	C6, P3	Lecture	Final Exam, Class Test

CO/PO mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2		√										
CO3					√							

Title of the course: VLSI Design Laboratory
Course Code: EEE 444
Credit Hour: 1.50 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/One
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to introduce the fundamentals of VLSI circuit simulation to design efficient electronic circuits.

Objectives:

The objectives of this course are-

- To introduce students about the fundamentals of VLSI (Very Large-Scale Integration) simulation.
- To help students to design different VLSI circuits and define efficient design procedure.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to –
CO1: Apply the general concept of VLSI Design methodologies to design different electronic circuits using modern CAD tools.
CO2: Conclude the result from experimental data.
CO3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using hardware based on Theory Course EEE 443: In This course student will design NMOS, CMOS, transmission gate, adder, complex gate, multiplexer, counter in CAD tools.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Introduction to Robotics Engineering **Course Code:** EEE 445
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** N/A
Type: Elective Course

Rational: This course aims to provide foundation knowledge of designing and implementation of robots.

Objectives:
The objectives of this course are:

- To familiarize students with various robotic components and sensors.
- To provide knowledge about industrial application of robot.
- To develop knowledge of students on robot controlling.
- To facilitate students with basic foundation on robotic language.

Course Outcomes (COs):
Upon successful completion of this course, students will be able to
CO-1: Describe basic robot working principles and robot configurations.
CO-2: Describe the operations of robot components and uses of sensors for robots.
CO-3: Select a suitable driving system for a robot.
CO-4: Select a control strategy for proper navigation and motion.
CO-5: Estimate the use of robots in industries to lift as Industry 4.0 and other related applications.
CO-6: Develop programming of robots for different operations.

Course Description:
Introduction to Robotics: Definition of Robot, History of Robotics, Laws of robotics, Robot's characteristics, robot's configurations and Work envelop, Types of Robots
Robot's components and sensors: Manipulators: Direct kinematics, Inverse Kinematics, Coordinates transformation, robot dynamics, end-effectors, grippers, Robot/end-effort interface, selection criteria of sensors for robotic uses, Range sensing, proximity sensing, Touch sensing, force and torque sensing, sensor interfaces to computer systems, Organization of sensor suits, machine vision sensing, digitizing image processing, Image analysis.
Robot drives and robot Programming: Types of robot drives, selection criteria of drives, programing methods and Languages, Capabilities and limitation, Artificial intelligence, Knowledge representation, Search techniques -A1 and robotics.
Robot Controls: Basic robot motions, Point to point (PTP) Control, Continuous path control Feedback control, PID controller, Robot Odometry, Differential drive and navigation, Basic of Robot Operating System (ROS), Simulating different robot structure with a suitable simulator tool.
Industrial Application: Applications of robots in industrial applications (machining, welding, assembly work, Material handling task, Loading and unloading), roles of robot in Industry 4.0, CIM, Hostile and remote environment, Agricultural industries, Medical uses, Collaborative Tasks.

Textbooks/Reference Books:

1. Industrial robotics Technology, programming and applications by Groover M.P, McGraw-Hill Book Co., 2005.
2. Introduction to Robotics Mechanics and Control by John J. Craig, Second Edition, Addison Wesly Longman Inc. International Student edition, 1999.
3. Introduction to Robotics by Subir Kumar Saha, McGraw Hill Education (India) Private Limited, 2014.
4. Learning Robotics using Python by Lentin Joseph (Second Edition).

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C1	Lecture	Final Exam, Class Test
CO2	PO1	C1	Lecture	Final Exam, Mid Term
CO3	PO1	C1	Lecture	Final Exam, Assignment
CO4	PO1	C1	Lecture	Final Exam, Assignment
CO5	PO2, PO12	A2, P2	Lecture	Final Exam, Assignment
CO6	PO3, PO12	A3, P3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											
CO5		√										√
CO6			√									√

Title of the course: Introduction to Digital Image Processing
Course Code: EEE 447
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** N/A
Type: Elective Course

Rationale: This course aims to provide students all the fundamentals in digital image processing in the context of electrical engineering.

Objectives:
The objectives of this course are-

1. To provide detailed knowledge about digital image processing technology for describing features of image.
2. To help students understand digital image representation.
3. To help students adopt different fundamental steps in image processing.

Course Outcomes (COs):
After successful completion, the students will be able to
CO-1: Understand of the principals the Digital Image Processing terminology used to describe features of images.
CO-2: Analyze an image enhancement in the spatial domain and frequency domain.
CO-3: Understand the image restoration, compression, segmentation, recognition, representation and description.
CO-4: Solve complex engineering problems using digital image processing algorithms.
CO-5: Design digital image processing applications using modern CAD tools.

Course Description:
Introduction and Digital Image Fundamentals: The origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems, Image Sampling and Quantization, Some basic relationships like Neighbors, Connectivity, Distance, Measures between pixels, Translation, Scaling, Rotation and Perspective Projection of image, Linear and Non-Linear Operations
Digital image Representation: Reading, Displaying, Writing Images, Data Classes, Image Types, Converting Between data classes and Image Types,
Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Combining Spatial Enhancement Methods, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Digital Image Processing Application
Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Computing and Visualizing the 2D DFT, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

Image Restoration: A model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Processing Application, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Geometric Mean Filter, Geometric Transformation

Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Compression standards

Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding

Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods

Textbooks/Reference Books:

1. Fundamentals of Digital Image Processing by A.K. Jain, Prentice-Hall, Addison-Wesley, 1989.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C2	Lecture	Final Exam, Class Test
CO2	PO1	C4	Lecture	Final Exam, Mid Term
CO3	PO1	C2	Lecture	Final Exam, Assignment
CO4	PO2	C3	Lecture	Final Exam, Mid Term
CO5	PO3	C6, A3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4		√										
CO5			√									

Title of the course: Introduction to Image Processing Laboratory
Course Code: EEE 448
Credit Hour:1.5 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** N/A
Type: Elective Course

Rationale:
This course aims to provide students with practical knowledge, principles and applications of digital image processing that are essential for modern engineering.

Objectives:
The objectives of this course are-

- To introduce students with basic simulation techniques of digital image processing.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):
At the end of the course, the student will be able to-
CO 1: Analyze different types of image processing algorithms using modern CAD tools.
CO 2: Conclude the result from experimental data.
CO 3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using CAD tools based on theory course EEE 447.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√							√
CO2				√								√
CO3									√	√		√

Title of the course: Power Plant Engineering
Course Code: EEE 451
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to provide the students foundation knowledge of power plant engineering that is used in modern day power plants.

Objectives:

The objectives of this course are-

1. To make the students understand the construction, principle of operation, application of various conventional power plant.
2. To enable the students to execute station performance analysis of power plants.
3. To acquaint students with power economics.
4. To facilitate necessary knowledge on power plant planning.
5. To provide knowledge on various non-conventional power plants.
6. To make the students understand reliability concepts.

Course Outcomes (COs):

After successful completion of this course, students will be able to

CO-1: Categorize the most suitable power plant for a certain location considering the available fuel, demand, and other reasonable criterion.
CO-2: Evaluate power plant performance to determine best possible generation schedule.
CO-3: Design the estimation of power plant reliability.

Course Description:

Power Plant Planning: Generating capacity and selection of plants, types of load and their effects.
Plant Location: Site selection for different plants, plant performance.
Station Performance: Efficiency, heat rate and incremental rate, load division between generating units for economy.
Generation Scheduling: Deterministic and probabilistic
Conventional Power Plant: Hydro and thermal power plant, generating cost.
Nuclear Power Plant: Nuclear fission and fusion; energy release; moderation, control, cooling and shielding aspects; Nuclear power station of different types.
Non-Conventional Power Generation: Micro-hydro power plant, Wind, magneto hydrodynamic and photovoltaic power generation**.**
Reliability Concepts: Failure rate, outage, mean time of failure, series and parallel systems and redundancy, Reliability evaluation techniques of single area system.

Textbooks/Reference Books:

1. Power Station Engineering and Economy by William A. Vopat.
2. Power Plant Engineering by P.K Nag.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C4	Lecture	Final Exam, Class Test
CO2	PO2	C6	Lecture	Final Exam, Mid Term
CO3	PO3	C6, P3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3			√									

Title of the course: Power System Reliability
Course Code: EEE 453
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to teach students how to analyze the reliability of power systems.

Objectives:

The objectives of this course are –

1. To facilitate the students with the knowledge of reliability concepts.
2. To familiarize students with the concept of reliability indices.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO-1: Apply the basics of probability to analyze system reliability.

CO-2: Recognize the reliability concepts.

CO-3: Analyze the reliability of a single-area system.

Course Description:

Review of probability concepts. Probability distribution: Binomial, Poisson, and Normal. Reliability concepts: Failure rate, outage, mean time to failure, series and parallel systems and redundancy, Markov process, Probabilistic generation and load models.

Reliability indices: Loss of load probability and loss of energy probability. Frequency and duration, Reliability evaluation techniques of single area system, Interconnected system: tie line and evaluation of reliability indices.

Textbooks/Reference Books:

1. Power Generation, Operation, and Control, 3rd Edition by Allen J. Wood, Bruce F. Ollenberg, Gerald B. Sheblé.
2. Operation of Restructured Power Systems by Kankar Bhattacharya, Math H.J. Bollen, Jaap E. Daalder.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Final Exam, Class Test
CO2	PO2	C1	Lecture	Final Exam, Mid Term
CO3	PO2	C4	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3		√										

Title of the course: VHDL
Course Code: EEE 463
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to build foundation knowledge of synthesizing digital systems using VHDL programming that will map readily to hardware.

Objectives:
The objectives of this course are-

- To facilitate students with foundational knowledge of synthesizing digital system modeling.
- To help students learn VHDL.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Apply fundamental concepts of digital system modelling.
CO-2: Apply hardware description language.
CO-3: Design digital logic circuit using VHDL.

Course Description:
Fundamental Concepts: Modelling digital system, Domains and level of modelling, Modelling concepts.
Scalar data types and operation: Types of classification.
Sequential Statement: Different type of sequential statement, Composite data type and operation, Basic modelling construction, Packages, Aliases, resolved signals, Generic Constants, Generate Statements, Components and Configuration, Guards and blocks, Access types, Files and I/O, status, Components and configuration, VHDL Synthesis, High level design flow and top level system design, RTL simulation.

Textbooks/Reference Books:

1. The Designer's guide to VHDL by Peter J. Ashenden.
2. VHDL Programming by Example by Douglas L. Perry.
3. Fundamentals of Digital logic with VHDL Design by Stephen Brown & Zvonko Vranesic.

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO2	C3	Lecture	Final Exam, Class Test
CO2	PO2	C3	Lecture	Final Exam, Mid Term
CO3	PO3	C6, A3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		√										
CO2		√										
CO3			√									

Title of the course: VHDL Laboratory
Course Code: EEE 464
Credit Hour: 1.5 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale:

This course aims to provide students with practical knowledge on synthesizing digital electronics circuit on FPGA.

Objectives:

The objectives of this course are-

- To enhance the skills on designing digital circuit based on hardware description language.
- To facilitate necessary knowledge about synthesizing digital electronics circuit on FPGA.
- To demonstrate the ability to present the results of investigations orally and in writing.

Course Outcomes (COs):

After successful completion of this course, students will be able to-

CO 1: Design modern day digital electronics circuit using VHDL.
CO 2: Synthesize digital circuit on FPGA.
CO 3: Write comprehensive reports on the work done in laboratory in a group and orally present the findings.

Course Description:

Sl NO	COURSE CONTENT (as Summary)
1	Laboratory work using CAD tools based on theory course EEE 463.
2	Report writing based on laboratory work.
3	Oral presentation on mini project work (design project/analytical project/ experimental project/industrial tour)

CO Delivery & Assessment:

COs	Corresponding POs	Bloom's taxonomy domain/level: *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO5, PO9, PO12	C3, P2, A2	Lecture & Laboratory Experiments	Quiz & Performance Test
CO2	PO4, PO12	A3, P4, C6	Lecture & Laboratory Experiments	Quiz & Performance Test
CO3	PO9, PO10, PO12	A2, P2	Lecture & Laboratory Experiments	Quiz & Performance Test

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					√				√			√
CO2				√								√
CO3									√	√		√

Title of the course: Renewable Energy
Course Code: EEE 471
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: EEE 211
Type: Elective Course

Rationale: This course aims to provide the students with the foundation knowledge on various renewable sources that are being widely used nowadays**.**

Objectives:
The objectives of this courses are-

1. To make the students understand the challenges and problems associated with conventional energy sources.
2. To acquaint students with various renewable sources.
3. To provide students with the knowledge of various characteristics, construction, principle of operation, performance parameters, applications of solar cell.
4. To facilitate students with the necessary ideas about wind turbine generators, types, operational characteristics, cut-in and cut-out speed control, grid interfacings and AC-DC-AC link.

Course Outcomes (COs):
After successful completion of this course, students will be able to
CO-1: Design appropriate PV module considering cost, application, and other requirements.
CO-2: Categorize energy systems based on economic and environmental considerations.
CO-3: Determine environmental impact and safety of renewable energy sources.

Course Description:
Introduction to Renewable Sources: Importance of renewable energy sources, Statistics regarding solar radiation and wind speed, geographical distribution, atmospheric factors, measurements, economic issues, and selection criterion of appropriate energy system.
Solar cell: Principle of operation, spectral response, factors effecting conversion efficiency, I-V characteristics, maximum power output. PV modules and arrays: stationery and tracking. PV systems: stand alone, battery storage, inverter interfaces with grid.
Wind Energy: Wind turbine generators: types, operational characteristics, cut-in and cut-out speed control, grid interfacings, AC-DC-AC link.
Various Traditional Renewable Energy Sources (Biogas, Tidal and Geothermal): Types, working principle, problems and prospects of various traditional renewable energy sources.

Textbooks/Reference Books:

1. Renewable Energy by Godfrey Boyle.
2. Introduction to Renewable Energy by Vaughn C. Nelson.
3. Renewable Energy: Its Physics, Engineering, Use, Environmental Impacts by Bent Sorensen.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C6, A3	Lecture	Final Exam, Class Test
CO2	PO2, PO7	C4, A4	Lecture	Final Exam, Mid Term
CO3	PO7	C4, A3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2		√					√					
CO3							√					

Title of the course: Analog Integrated Circuit
Course Code: EEE 485
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: EEE 213
Type: Elective Course

Rationale: This subject aims to design integrated circuits using the properties of advanced analog circuit.

Course objectives:
The objectives of this course are

- To analyze modern analog circuits using integrated field effect transistor technologies.
- To Introduce the principles of analog circuits and apply the techniques for the design of analog integrated circuit (Analog IC's).
- To design an op-amp given a constraining set of specifications.

Course Outcome (COs):
After successful completion of this course, students will be able to
CO-1: Familiarize with the aspects of research and development in the area of analog and mixed signal IC design.
CO-2: Analyze MOS fundamentals, small signal models and MOSFET based circuits.
CO-3: Design analog circuits such as differential amplifier, OP-AMP, current mirrors.

Course Description:
Analog IC Design: Bipolar, MOS and Bi-CMOS 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 Bi-CMOS, Amplifiers with passive and active loads, cascade stages. Multiple current sources/sinks using Bipolar and FET technologies.
Current mirrors: Basic, cascade and active current mirrors; influence of channel modulation, mismatched transistors and error in aspect ratios, Wilson current mirror.
Constant current or voltage references: Supply voltage and temperature independent biasing, band-gap references; constant-Gm biasing, Widlar band-gap voltage reference.
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, and frequency response of differential pairs.
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.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C1	Lecture	Final Exam, Class Test
CO2	PO2	C4	Lecture	Final Exam, Mid Term
CO3	PO3	C6, A3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2		√										
CO3			√									

Title of the course: Embedded System Design
Course Code: EEE 493
Credit Hour: 3.00 credits
Contact Hours: 3 Hours/Week
Level/Term: Four/Two
Prerequisite: N/A
Type: Elective Course

Rationale: This course aims to enhance the ability of the students to design an embedded system for the particular requirement.

Objectives:
The objectives of this course are-

- To develop the designing skill of microprocessor/ microcontroller-based system.
- To apply the knowledge of the embedded system to design real time operation system (RTOS).
- To facilitate the necessary knowledge about FPGA to design FPGA based design system.

Course Outcomes (COs):
After successful completion of this course, students will be able to-
CO-1: Apply the techniques of interfacing various microprocessors with external input/output devices for real life application.
CO-2: Design a microprocessor/ microcontroller-based system that meet specified needs.
CO-3: Design real time operating system (RTOS) for embedded system.
CO-4: Design FPGA based embedded system.

Course Description:
Introduction to Embedded System: Embedded computing, characteristics of embedded computing applications, embedded-system design challenges, constraint-driven design, IP based design, hardware and software co-design.
Development Environment: Execution environment, memory organization, system space, code space, data space, unpopulated memory space, I/O space, system start-up, interrupt response cycle, function calls and stack frames, runtime environment, object placement.
Embedded Computing Platform: Sensors and actuators, embedded processors (CPUs), bus, memory devices, I/O devices, component interfacing. Real time embedded systems, real time operating systems, embedded systems programming, mapping between languages and hardware, embedded communication systems, and embedded computer security.
Designing with Microprocessors and Microcontrollers: Development and debugging, design examples, design patterns, data-flow graphs, assembly and linking, basic compilation techniques, analysis and optimization.
Distributed Embedded-system Design: Inter-process Communication, shared memory communication, accelerated design, design for video accelerators, networks for embedded systems, network-based design, internet-enabled systems.

FPGA Based Embedded System Design: Design methodologies and tools, design flows, designing hardware and software components, requirement analysis and specification, system analysis and architecture design, system integration, Introduction to Verilog HDL, structural and behavioral description.

Textbooks/Reference Books:

1. Structured Computer Organization by Andrew Tanenbaum, Prentice Hall.
2. Embedded system: From Hardware to Application by P. Raghavan, Auerbach.
3. Computer Organization & Design by David A. Patterson and John L. Hennessy, Morgan Kaufmann.
4. Microprocessors and Interfacing: Programming and Hardware by D. V. Hall.
5. Microcomputer Systems: The 8086/8088 Family Architecture, Programming Design by Y. Liu and G. A. Gibson.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO3	C3, A2	Lecture	Final Exam, Class Test
CO2	PO3	C6, A3	Lecture	Final Exam, Mid Term
CO3	PO3	C6, A3	Lecture	Final Exam, Assignment
CO4	PO3	C6, A3	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			√									
CO2			√									
CO3			√									
CO4			√									

Title of the course: Cyber Security and Internet of Things **Course Code:** EEE 487
Credit Hour: 3.00 credits **Contact Hours:** 3 Hours/Week
Level/Term: Four/Two **Prerequisite:** N/A
Type: Elective Course

Rational: This course aims to make students knowledgeable about the protection of computer networks, programs and data from unauthorized attacks.

Objectives:

The objectives of this course are-

- To provide students with the knowledge of cyber security.
- To make the students understand various types of malware and their prevention.
- To acquaint students with the basic concepts of firewalls.
- To accumulate basic ideas about Internet of Things(IoT).

Course Outcomes (COs):

After successful completion of this course, students will be able to-
CO-1: Restate basic cyber security terminologies.
CO-2: Identify main malware types, awareness of different malware propagation methods and skills for preventing malware infections.
CO-3: State firewalls, types of various virtual private networks and network intrusion detection and prevention technologies.
CO-4: Identify risk management details and framework.
CO-5: Design an outline about physical security, perimeter security and modern cyber security architecture.
CO-6: Design architecture of IoT systems.
CO-7: Identify appropriate security/privacy solutions for IoT.

Course Description:

Cyber Security Fundamentals: Cyberspace, Definition of Cybersecurity, Importance of Cybersecurity, CIA triad, Asset, Asset valuation, Hackers, types of hackers, Hackers vs Crackers. Malware, types of malware, breaches in cyber security, Hacking Techniques and Attacks

Prevention techniques for different attacks: Firewall details, Virtual Private Network, Intrusion Prevention/Detection System Asset Register, Importance of its, Asset Register to Risk Register, Risk Treatment plan. Perimeter Security, End to End security, Défense in Depth (DiD), Security Awareness, Training.

The Internet of Things: Definitions, implications, perspectives, IoT architecture, component and technology (Device, networking, cloud computing, and big data analysis), a simplified model, Sensors and actuators in IoT, Industry Markets and Applications, Issues and Challenges. Internet layers, protocols, packets, services, performance parameters of a packet network, Local Area Networks, Mobile Networking, Real-time networking, Data Storage in Cloud. IoT challenges (computation and communication constraints, power constraints, maintenance cost, reliability, data

trustworthiness, security, and privacy). Discussion on specific IoT applications and their design considerations Cybersecurity overview in IoT.

Textbooks/Reference Books:

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything by Francis da Costa.
2. Architecting the Internet of Things by Dieter Uckelmann, Mark Harrison and Florian Michahelles.
3. Introduction to computer security by Michael Godrich and Robert Tamassia.
4. An Introduction to information security by Umesh Hodeghatta Rao and Umesha Nayak.
5. An introduction to computer security: The NIST Handbook by Barbara Guttman.

CO Delivery & Assessment:

COs	Corresponding Pos	Bloom's taxonomy domain/level *(C: Cognitive, P: Psychomotor A: Affective)*	Delivery methods and activities	Assessment tools
CO1	PO1	C2	Lecture	Final Exam, Class Test
CO2	PO1	C1	Lecture	Final Exam, Mid Term
CO3	PO1	C2	Lecture	Final Exam, Assignment
CO4	PO1	C1	Lecture	Final Exam, Assignment
CO5	PO2	C6	Lecture	Final Exam, Assignment
CO6	PO2	C6	Lecture	Final Exam, Assignment
CO7	PO1	C1	Lecture	Final Exam, Assignment

CO/PO Mapping												
COs	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	√											
CO2	√											
CO3	√											
CO4	√											
CO5		√										
CO6		√										
CO7	√											

6. CO-PO Mapping:

Course Title & Course Code	COs	Program Outcomes (POs)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Basic Accounting (ACC 101)	CO1											√	
	CO2											√	
	CO3											√	
	CO4											√	
Basic Economics (ECO 201)	CO1						√						
	CO2											√	
	CO3											√	
	CO4											√	
General English (ENG 101)	CO1	√											
	CO2										√		
	CO3										√		
	CO4										√		
Developing English Skills (ENG 103)	CO1										√		
	CO2										√		
	CO3										√		
Technical Writing & Presentation (EEE 401)	CO1										√		
	CO2	√											
	CO3										√		
	CO4										√		
Industrial Business Management (MGT 203)	CO1											√	
	CO2											√	
	CO3									√			
	CO4					√							
	CO5								√				
Organizational Behavior (MGT 251)	CO1									√			
	CO2									√			
	CO3												√
	CO4								√				
	CO5												√
Chemistry (CHE 101)	CO1		√										
	CO2	√											
	CO3		√										
Chemistry Laboratory (CHE 102)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Engineering Mathematics I (MAT 105)	CO1	√											
	CO2		√										
	CO3	√											
	CO4	√											
Engineering Mathematics II (MAT 105)	CO1	√											
	CO2		√										
	CO3		√										
Engineering	CO1	√											

Mathematics III (MAT 201)	CO2		√										
	CO3	√											
	CO4		√										
	CO5		√										
	CO6		√										
Engineering Mathematics IV (MAT 203)	CO1		√										
	CO2	√											
	CO3		√										
	CO4	√											
Engineering Physics I (PHY 101)	CO1	√											
	CO2	√											
	CO3	√											
Engineering Physics II (PHY 103)	CO1	√											
	CO2		√										
	CO3	√											
	CO4	√											
Engineering Physics II Laboratory (PHY 104)	CO1						√				√			√
	CO2					√								√
	CO3										√	√		√
Civil Engineering Drawing Laboratory (CE 102)	CO1				√									
	CO2				√									
	CO3				√									
	CO4						√							√
Introduction to Computer Science (CSE 101)	CO1		√											
	CO2						√							
	CO3	√												
	CO4	√												
	CO5	√												
	CO6		√											
Computational Methods for Engineering Problems (CSE 301)	CO1				√									
	CO2	√												
	CO3	√												
CMEP Laboratory (CSE 302)	CO1					√								√
	CO2										√	√		√
Mechanical Engineering Drawing & CAD (ME 101)	CO1						√							
	CO2	√												
	CO3		√											
	CO4						√							
	CO5													√
Basic Mechanical Engineering (ME 201)	CO1		√											
	CO2				√									
	CO3		√											
	CO4		√											

Electrical Circuit I (EEE 101)	CO1		√										
	CO2		√										
	CO3		√										
	CO4	√											
Electrical Circuit I Laboratory (EEE 102)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electrical Circuit II (EEE 103)	CO1	√											
	CO2			√									
	CO3		√										
	CO4		√										
	CO5	√											
Electrical Circuit II Laboratory (EEE 104)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electrical Circuit Simulation Laboratory (EEE 106)	CO1					√							√
	CO2				√								√
	CO3									√	√		√
Signals & Systems (EEE 201)	CO1		√										
	CO2		√										
	CO3	√											
	CO4		√										
Signal &Systems Laboratory (EEE 202)	CO1				√								√
	CO2									√	√		√
Electronics I (EEE 211)	CO1			√									
	CO2		√										
	CO3			√									
	CO4		√										
Electronics I Laboratory (EEE 212)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electronics-II (EEE 213)	CO1		√										
	CO2		√										
	CO3			√									
	CO4	√											
Electronics II Laboratory (EEE 214)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electrical Machines I (EEE 221)	CO1	√											
	CO2		√										
	CO3	√											
	CO4	√											

Electrical Machines I Laboratory (EEE 222)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electrical Machines II (EEE 223)	CO1		√										
	CO2		√										
	CO3		√										
	CO4		√										
Electrical Machines II Laboratory (EEE 224)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electromagnetic Fields and Waves (EEE 241)	CO1	√											
	CO2	√											
	CO3		√										
	CO4		√										
	CO5	√											
Electrical Appliance Laboratory (EEE 302)	CO1					√							
	CO2					√							
	CO3					√							
Communication Engineering (EEE 309)	CO1	√											
	CO2		√										
	CO3	√											
	CO4	√											
	CO5		√										
Communication Engineering Laboratory (EEE 310)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Digital Electronics (EEE 311)	CO1			√									
	CO2		√										
	CO3		√										
	CO4		√										
Digital Electronics Laboratory (EEE 312)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Measurement and Instrumentation (EEE 313)	CO1		√										
	CO2		√										
	CO3					√							
	CO4			√									
MI Laboratory (EEE 314)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√

Power System Analysis (EEE 315)	CO1		√										
	CO2			√									
	CO3			√									
	CO4		√										
Power System Analysis Laboratory (EEE 316)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Electrical Machine Design (EEE 332)	CO1			√									
	CO2		√										
	CO3		√										
	CO4					√							√
Switchgear & Protection (EEE 333)	CO1		√										
	CO2		√										
	CO3				√								
	CO4		√										
Switchgear & Protection Laboratory (EEE 334)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Transmission & Distribution of Electrical Power (EEE 351)	CO1		√										
	CO2		√										
	CO3		√										
	CO4		√										
	CO5			√									
Electrical & Electronic Engineering Services (EEE 356)	CO1		√										
	CO2			√									
	CO3				√								
	CO4			√									
	CO5			√									
	CO6						√	√					
	CO7			√									
Microprocessor & Microcontroller (EEE 371)	CO1		√										
	CO2		√										
	CO3			√									
	CO4			√									
Microprocessor & Microcontroller Laboratory (EEE 372)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Control System	CO1		√										

(EEE 373)	CO2		√										
	CO3		√										
	CO4		√										
	CO5			√									
Control System Laboratory (EEE 374)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
Semiconductor Physics & Devices (EEE 411)	CO1		√										
	CO2		√										
	CO3				√								
Digital Signal Processing (EEE 477)	CO1		√										
	CO2		√										
	CO3			√									
Digital Signal Processing Laboratory (EEE 478)	CO1					√							√
	CO2				√								√
	CO3									√	√		√
Microwave and Antenna Engineering (EEE 403)	CO1		√										
	CO2		√										
	CO3		√										
Cellular Mobile and Satellite Communication System (EEE 435)	CO1		√										
	CO2		√										
	CO3		√										
	CO4	√											
Wireless Communication (EEE 437)	CO1	√											
	CO2		√										
	CO3		√										
	CO4			√									
	CO5		√										
Industrial Power Electronics (EEE 441)	CO1		√										
	CO2			√									
	CO3			√									
	CO4		√										
Industrial Power Electronics Laboratory (EEE 442)	CO1					√				√			√
	CO2				√								√
	CO3									√	√		√
VLSI Design (EEE 443)	CO1			√									
	CO2		√										
	CO3					√							
VLSI Design	CO1					√				√			√

Laboratory (EEE 444)	CO2				√								√
	CO3									√	√		√
Introduction to Robotics Engineering (EEE 445)	CO1	√											
	CO2	√											
	CO3	√											
	CO4	√											
	CO5		√										√
Introduction to Digital Image Processing (EEE 447)	CO1	√											
	CO2	√											
	CO3	√											
	CO4		√										
	CO5			√									
Introduction to Digital Image Processing Laboratory (EEE 448)	CO1					√							√
	CO2				√								√
	CO3									√	√		√
Power Plant Engineering (EEE 451)	CO1		√										
	CO2		√										
	CO3			√									
Power System Reliability (EEE 453)	CO1		√										
	CO2		√										
	CO3		√										
VHDL (EEE 463)	CO1		√										
	CO2		√										
	CO3			√									
VHDL Laboratory (EEE 464)	CO1					√							√
	CO2				√								√
	CO3									√	√		√
Renewable Energy (EEE 471)	CO1			√									
	CO2		√					√					
	CO3							√					
Analog Integrated Circuit (EEE 485)	CO1	√											
	CO2		√										
	CO3			√									
Embedded System Design (EEE 493)	CO1			√									
	CO2			√									
	CO3			√									
	CO4			√									
Cyber Security and Internet of Things (EEE 487)	CO1	√											
	CO2	√											
	CO3	√											
	CO4	√											
	CO5		√										
	CO6		√										
	CO7	√											

Thesis/Project (EEE 400)	CO1	√	√										
	CO2				√	√							
	CO3			√									
	CO4									√		√	
	CO5						√	√	√			√	
	CO6										√	√	√
	CO7										√	√	

7.Tamplet for Question Moderation:

Premier University, Chittagong.

Department of Electrical & Electronic Engineering

Course Name:	**Course Code:**
Session:	**Semester:**
Course Teacher	

Section 1: To be completed by Course Teacher				**Section 2:** To be completed by Moderator (s)	
No.	**Course Learning Outcome**	**Exam question Addressing to CLO (s)**	**Level of Bloom's Taxonomy**	**Question (s) Addressing the CLO satisfactorily (Yes/No/NA)**	**Comments**

Domains and Levels of Bloom's Taxonomy:

 "Cognitive" Domain (C): C1 - Recall data, C2 - Understand, C3 - Apply, C4 - Analysis, C5 - Synthesize, and C6 - Evaluate.
 "Affective" Domain (A): A1 - Receive, A2 - Respond, A3 - Value, A4 - Organize personal value system, and A5 - Internalize value system.
 "Psychomotor" Domain (P): P1 - Imitation, P2 - Manipulation, P3 - Develop precision, P4 - Articulation, and P5 - Naturalization.)

Checked by:	**Date:**	Confirmed BY:
Chairman, EEE ---- Exam Committee		Department of EEE Premier University

8. Sample Lesson Plan

Premier University
Department of EEE

Academic session:
Department:
Course Code:
Course Title:
Name of the Course Teacher:

COURSE LESSON PLAN

Lesson Plans (3hours = 1.5*2=26 classes)

Lesson	Topic	Teaching strategy	Course Outcome (CO)	Assessment Strategy
1				
2				
3				
.				
.				
.				
.				
24				
25				
26				
** More than one class test should be taken. Any one of three-class test can be pop test or instant test. Not more than three class should be taken.				