CURRICULUM OF
ELECTRICAL ENGINEERING FOR
BACHELOR'S DEGREE
(POWER/COMMUNICATION)
PROGRAM

(Revised 2024)

DEPARMENT OF ELECTRICAL ENGINEERING

UNIVERSITY OF ENGINEERING & TECHNOLOGY, PESHAWAR

CONTENTS

PROGRAM MISSION

To produce competent electrical engineers who can efficiently fulfill professional responsibilities in industrial, academic and research organizations.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The graduates of the program of Bachelors of Electrical Engineering will be equipped with skills to demonstrate an understanding of key technologies applicable within the main areas of Electrical and Electronic Engineering. The main objectives of this program are to produce engineers with:

PEO-1	The graduates will serve competently in national and international industry or academia by showing requisite knowledge and skills in the field of Electrical Engineering.
PEO-2	The graduates will exhibit quest for learning and professional growth through inter personal and management skills.
PEO-3	The graduates will demonstrate commitment to ethical practices, community service and societal contribution.

PROGRAM LEARNING OUTCOMES (PLOs)

At the end of this program, the students are expected to have the ability to:

PLO-1	Engineering Knowledge	An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO-2	Problem Analysis	An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PLO-3	Design/Development of Solutions	An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
PLO-4	Investigation	An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
PLO-5	Modern Tool Usage	An ability to 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.
PLO-6	The Engineer and Society	An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
PLO-7	Environment & Sustainability	An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PLO-8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PLO-9	Individual and Team Work	An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.
PLO-10	Communication	An ability to communicate effectively, orally as well as in writing, 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.
PLO-11	Project Management	An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.
PLO-12	Lifelong Learning	An ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

MAPPING BETWEEN PROGRAM EDUCATIONAL OBJECTIVES AND LEARNING OUTCOMES

The following table demonstrates relationship and mapping between the defined Program Educational Outcomes (PEOs) and the Program Learning Outcomes (PLOs).

PLO/PEO	PEO:1	PEO:2	PEO:3
PLO:1	✔		
PLO:2	✔		
PLO:3	✔		
PLO:4	✔		
PLO:5	✔		
PLO:6			✔
PLO:7			✔
PLO:8			✔
PLO:9		✔	
PLO:10		✔	
PLO:11		✔	
PLO:12		✔	

Electrical Engineering Curriculum					
Code	Course Title	Th	Lab	Credit	**Knowledge Area**
NON ENGINEERING					
(i) **Humanities**					
BSI -142	English Composition & Comprehension	3	0	3	(English)
EE -286	Technical Report Writing	3	0	3	(English)
BSI -110	Pak Studies	2	0	2	(Culture)
BSI -101	Islamic Studies	2	0	2	(Culture)
BSI -120	Professional Ethics	2	0	2	(Social Science)
EE-243	Civics and Community Engagement	2	0	2	
EE-443	Entrepreneurship	2	0	2	
(ii) Management Sciences					
EE -287	Engineering Economics	2	0	2	
EE -388	Engineering Management	2	0	2	
(iii) Natural Sciences					
BSI -122	Calculus	3	0	3	(Math)
BSI -111	Linear Algebra	3	0	3	(Math)
BSI -231	Differential Equations	3	0	3	(Math)
BSI -362	Complex Variables	3	0	3	(Elective Math)
BSI -242	Numerical Analysis	3	0	3	(Elective Math)
BSI -151	Electricity & Magnetism	3	1	4	General Physics-I
ENGINEERING					
(i) **Computing**					
EE -121	Computer Fundamentals	2	1	3	
EE-170	Computer Programming	3	1	4	
EE- 271	Data Structure & Algorithms	2	1	3	
(ii) Electrical Engineering Foundation					
EE-156	Basic Electrical Engineering	3	1	4	
EE-200	Circuit Analysis-I	3	1	4	
EE-157	Workshop Technology	0	1	1	
EE-201	Circuit Analysis-II	3	1	4	
EE-345	Electronic Devices & Circuits	3	1	4	
EE-225	Digital Logic Design	3	1	4	

Electrical Engineering Curriculum					
Code	Course Title	Th	Lab	Credit	**Knowledge Area**
ME-100	Engineering Drawing	0	1	1	
EE- 202	Probability & Random Variables	3	0	3	
EE-312	Signals & Systems	3	1	4	
EE-363	Electromagnetic Field Theory	3	0	3	
(iii) EE Core (Breadth)					
EE-440	Electrical Machines	3	1	4	
EE-481	Control Systems	3	1	4	
EE-391	Communication Systems	3	1	4	
EE-326	Microprocessor Based System Design	3	1	4	
(iv) EE Specialization Based Electives (Depth)					
	Depth Elective-I				
	Depth Elective-II				
	Depth Elective-III				
	Depth Elective-IV				
	Depth Elective-V				
(v) IDEE					
ME-211	Applied Thermodynamics (Power)	3	0	3	IDEE-I for Power Stream
CE-230	Hydraulics & Hydraulics Machinery (Power)	3	0	3	IDEE-II for Power Stream
BSI -162	Engineering Mechanics (Comm)	3	0	3	IDEE-I for Comm. Stream
CSE-303	Data Communication (Comm)	3	1	4	IDEE-II for Comm. Stream
(vi) Senior Design Project					
EE-478A	Project-I	0	3	3	
EE-478B	Project-II	0	3	3	
	Industrial Training in Summer	0	0	0	
EE Power Engineering Based Electives (Depth)					
EE-432	Electrical Machine Design	3	1	4	
EE-336	Electrical Measurements & Instrumentation	3	1	4	(Breadth Core-I)
EE-403	Power Systems Engineering	3	1	4	

Electrical Engineering Curriculum					
Code	Course Title	Th	Lab	Credit	**Knowledge Area**
EE-394	Power Distribution & Utilization	3	0	3	(Breadth Core-II)
EE-401	Electrical Power Transmission	3	0	3	
EE-407	High Voltage Engineering	3	1	4	
EE-205	Power Generation	3	0	3	
EE-406	Power System Protection	3	0	3	
EE-305	Power Electronics	3	1	4	
	Advanced Electrical Machines	3	1	4	
	Power System Stability & Control	3	0	3	
	Renewable Energy Systems	3	0	3	
	Digital Signal Processing	3	1	4	
	Digital Control Systems	3	0	3	
	Analog & Digital Communication Systems	3	1	4	
	Integrated Electronic Circuits	3	1	4	
	PLC & Industrial Drives	3	0	3	
EE Communication Engineering Based Electives (Depth)					
EE-392	Digital Communication	3	1	4	
EE-413	Digital Signal Processing	3	1	4	
EE-482	Wave Propagation & Antennas	3	0	3	
EE-494	Wireless Communication	3	0	3	
EE-495	Mobile Networks	3	0	3	
EE-496	Computer Communication Networks	3	1	4	(Breadth Core-I)
EE-497	Electronics-II	3	1	4	(Breadth –Core II)
EE-430	Information Theory & Coding	3	0	3	
EE-336	Electrical Measurements & Instrumentation	3	1	4	
	Transmission & Switching System	3	0	3	
	Satellite Engineering	3	0	3	
EE-463	RF & Microwave Engineering	3	1	4	
	Digital Image Processing	3	1	4	
	Navigation & Radar Systems	3	0	3	
EE-485	Antenna Theory & Design	3	1	4	

Electrical Engineering Curriculum					
Code	Course Title	Th	Lab	Credit	**Knowledge Area**
EE-394	Power Distribution & Utilization	3	0	3	

SCHEME OF STUDIES FOR UNDERGRADUATE ELECTRICAL ENGINEERING

(Communication Group)

Semester 1

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-122	Calculus	3-0-3
BSI-151	Electricity and Magnetism	3-1-4
ME-100	Engineering Drawing	0-1-1
EE-121	Computer Fundamentals	2-1-3
BSI-101	Islamic Studies	2-0-2
BSI-120	Professional Ethics	2-0-2
BSI-142	English Composition and Comprehension	3-0-3
	Total	15-3-18

Semester 2

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-111	Linear Algebra	3-0-3
EE-156	Basic Electrical Engineering	3-1-4
EE-170	Computer Programming	3-1-4
BSI-162	Engineering Mechanics	3-0-3
EE-157	Workshop Technology	0-1-1
BSI-110	Pak Studies	2-0-2
	Total	14-3-17

Semester 3

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-231	Differential Equations	3-0-3
EE-225	Digital Logic Design	3-1-4
EE-200	Circuit Analysis-I	3-1-4
EE-287	Engineering Economics	2-0-2
EE-243	Civics and Community Engagement	2-0-2
	Total	13-2-15

Semester 4

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-202	Probability & Random Variables	3-0-3
EE-326	Microprocessor Based System Design	3-1-4
EE-201	Circuit Analysis –II	3-1-4
BSI-242	Numerical Analysis	3-0-3
EE-345	Electronic Devices & Circuits	3-1-4
	Total	15-3-18

Semester 5

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-336	Electrical Measurements & Instrumentation	3-1-4
EE-363	Electromagnetic Field Theory	3-0-3
EE-497	Electronic Circuit II	3-1-4
EE-271	Oops & Data Structures	2-1-3
BSI-362	Complex Variables and Transforms	3-0-3
	Total	14-3-17

Semester 6

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-312	Signal & Systems	3-1-4
EE-286	Technical Report Writing	3-0-3
CSE-303	Data Communication	3-1-4
EE-391	Communication System	3-1-4
	Total	12-3-15

Semester 7

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-496	Computer Communication Networks	3-1-4
EE-4XX	Elective-I	3-1-4
EE-440	Electrical Machines	3-1-4
EE-4XX	Elective-II	3-1-4
EE-443	Entrepreneurship	2-0-2
	Total	14-4-18

Semester 8

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-481	Control Systems	3-1-4
EE-388	Engineering Management	2-0-2
EE-4XX	Elective-III	3-0-3
EE-4XX	Elective-IV	3-0-3
EE-478	Project	0-6-6
	Total	11-7-18

Total Credit Hours: 136

Note: Code for the Laboratory part of a corresponding course will be followed by Letter L.

SCHEME OF STUDIES FOR UNDERGRADUATE ELECTRICAL ENGINEERING (Power Group)

Semester 1

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-122	Calculus	3-0-3
BSI-151	Electricity and Magnetism	3-1-4
ME-100	Engineering Drawing	0-1-1
EE-121	Computer Fundamentals	2-1-3
BSI-101	Islamic Studies	2-0-2
BSI-120	Professional Ethics	2-0-2
BSI-142	English Composition and Comprehension	3-0-3
	Total	15-3-18

Semester 2

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-111	Linear Algebra	3-0-3
EE-156	Basic Electrical Engineering	3-1-4
EE-170	Computer Programming	3-1-4
BSI-162	Engineering Mechanics	3-0-3
EE-157	Workshop Technology	0-1-1
BSI-110	Pak Studies	2-0-2
	Total	14-3-17

Semester 3

Code	Title	Credit Hours (Theory-Lab-Credits)
BSI-231	Differential Equations	3-0-3
EE-225	Digital Logic Design	3-1-4
EE-200	Circuit Analysis-I	3-1-4
EE-287	Engineering Economics	2-0-2
EE-243	Civics and Community Engagement	2-0-2
	Total	13-2-15

Semester 4

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-202	Probability & Random Variables	3-0-3
EE-326	Microprocessor Based System Design	3-1-4
EE-201	Circuit Analysis –II	3-1-4
BSI-242	Numerical Analysis	3-0-3
EE-345	Electronic Devices & Circuits	3-1-4
	Total	15-3-18

Semester 5

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-336	Electrical Measurements & instrumentations	3-1-4
EE-363	Electromagnetic Field Theory	3-0-3
EE-497	Electronic Circuits-II	3-1-4
ME-211	Applied Thermodynamics	3-0-3
BSI-362	Complex Variables & Transforms	3-0-3
	Total	15-2-17

Semester 6

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-312	Signals & Systems	3-1-4
EE-286	Technical Report Writing	3-0-3
EE-391	Communication System	3-1-4
EE-3XX	Elective-I	3-0-3
EE-4XX	Elective-II	3-1-4
	Total	15-3-18

Semester 7

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-4XX	Elective-III	3-1-4
EE-4XX	Elective-IV	3-1-4
EE-440	Electrical Machines	3-1-4
CE-230	Hydraulics & Hydraulics Machinery	3-0-3
EE-443	Entrepreneurship	2-0-2
	Total	14-3-17

Semester 8

Code	Title	Credit Hours (Theory-Lab-Credits)
EE-481	Control Systems	3-1-4
EE-401	Power Transmission & Distribution	3-0-3
EE-3XX	Elective-V	3-0-3
EE-388	Engineering Management	2-0-2
EE-478	Project	0-6-6
	Total	11-7-18

Total Credit Hours: 138

Note: Code for the Laboratory part of a corresponding course will be followed by Letter L.

1ST SEMESTER COURSES

Calculus (BSI-122)

Contact Hours:
Hours:
Theory =48

Credit

Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
01.	To know about different types of functions, their graphs, limits, continuities, derivatives and integrations and to describe the concepts of Differential Calculus	Cognitive	1	1
02.	To Apply calculus to the problems involving rate of change, optimization, area under and between the curves, volumes, arc length and area of surface of revolution etc	Cognitive	2	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

01.	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
02.	Problem Analysis:	☑	8	Ethics:	☐
03.	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
04.	Investigation:	☐	10	Communication:	☐
05.	Modern Tool Usage:	☐	11	Project Management:	☐
06.	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE:

S. No	Detailed Contents
01.	Mathematical and physical meaning of functions, graphs of various functions, Hyperbolic functions.
02.	Theorems of limits and their applications to functions: Some Useful limits, right hand and left hand limits
03.	Continuous and discontinuous functions and their applications
04.	Introduction to derivatives: Geometrical and physical meaning of derivatives.
05.	Product Rules, quotient Rules and different rules of derivative, and its applications, problems (rate of change, marginal analysis),
06.	Tangent and normal lines, approximation by Taylor and Maclarum serious.
07.	Maxima and minima, First and Second derivative test.
08.	Integral Calculus, some rules of integrations.
09.	Integration by parts, areas bounded by Curve, Volume of Solid of revolution
10.	Multivariable Calculus, Limit continuity of several variables local curve and local surfaces.
11.	Partial derivatives, Higher order partial derivatives, total

	differential, tangent plane, normal lines and its applications.
12.	Maxima and minima of two variables.
13.	Vector functions and its derivatives and its integrations, lines integrals, work done and its applications
14.	Gradient, Divergence, Curve and its applications.
15.	Directional derivatives, solenoidal field, equations of continuity, rotational and irrational fields, scalar potential and its applications and fluid dynamics
16.	Method of constraint optimization, Lagrange multiplier method and its applications.

Text book:

- Calculus by Thomas Finney, Addison-Wesley Publishing Company, Latest available Edition.
- Higher Engineering Mathematics by H.K. Dass and V. Sharma

Reference books:

[1]. Mathematics for Engineer 2nd Edition by Robert Davison, Latest available Edition.

- Multivariate Calculus 2nd Edition by Robert T. Smith ,Latest available Edition.

EE-121 Computer Fundamentals

Contact Hours: **Credit Hours:**

Theory =48 Theory = **2.0**

Practical = 48 Practical = **1.0**

Total = 96 Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Understand the working of computer hardware and software.	Cognitive	1	1
2.	Understand the working principles of arithmetic operations and binary logic.	Cognitive	1	1
3.	Understand the concepts of data communication and networks.	Cognitive	1	1
4.	Analyze problem solving skills and develop small scale computer programs.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Brief History of Computing, Key strengths and weaknesses of the modern computer, Computer Types According to Capability, Intro to Microprocessor & Binary logic, Number System used in Computers. Range of Numbers a computer can handle, Types of Software, System Software, Application Software, Types of Software License, Operating System, Application Software, and Computer Networks, introduction to the Internet, Databases, Cybercrime, and Introduction to Programming. Focus will be on HTML and ability to creating Web pages using HTML and off the shelf project, Web Hosting etc.

Practical:

Ser	LO	Domain	Taxonomy level	PLO
1.	Understand and recognize the working of hardware components of computer.	Psychomotor	1	1
2.	Practice typing speed and develop office application skills.	Psychomotor	3	1
3.	Computer programming execution for analysis of skills and knowledge.	Psychomotor	4	2

S.No	Descriptions
1.	Introduction to the very basics of the internet e.g. using search engines, using Wikipedia, checking your Email.
2.	Personal computer components, inside the CPU.
3.	Introduction to typing tutors, typing practice.
4.	*Introduction to MS word.*
5.	*Introduction to MS word (cont.).*
6.	Introduction to MS Power point.
7.	Introduction to MS Power point (cont.).
8.	Introduction to MS Excel.
9.	Introduction to MS Excel (cont.).
10.	Introduction to HTML
11.	Introduction to HTML codes.

12.	Writing small HTML codes.
13.	Introduction to web designing.
14.	Introduction to web designing (cont.).
15.	Introduction to programming languages.
16.	Introduction to programming languages (cont.).

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes

Assessment

Sessional (25%)

- Assignments 60%
- Quizzes 40%

Mid Term (25%)

Final Term (50%)

Text book:

Introduction to Computers by Peter Norton, 8th Edition.

BSI-151: Electricity and Magnetism

Contact Hours:
Hours:
Theory =48

Credit
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S. No	CLO	Domain	Taxonomy level	PLO
1.	Describe and explain the fundamental physical principles	Cognitive	2	1
2.	Apply these principles, together with logical and mathematical reasoning to situations of the physical world	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE:

S No.	Topics
01	Energy bands, electric charge and Coulomb's law
02	Electric field and its application
03	Flux of an electric field, Gauss's law
04	Electric potential and its application
05	Capacitors and dielectrics
06	Electric current and resistance
07	Ohm's law and resistance network
08	Magnetic field and its application
09	Magnetic force and torque on a current-loop
10	Biot–Savart law and its applications
11	Ampere's law and its applications
12	Inductance and inductors, inductors in series and parallel
13	Faraday's law of induction
14	Lenz's law
15	Magnets and magnetic materials

Text books:

- Physics vol.2, By Halliday David Halliday, et.al
- Fundamentals of Physics, 6th edition, by David Halliday, et. al

Reference books:

- University Physics By Young, Freedman, 9th Edition
- University Physics By Young, Sears and Zemanky

Electricity and Magnetism (BSI-151L)

Contact Hours:
Hours:
Lab =48

Credit
Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Show knowledge of constructing basic circuits	Psychomotor	2	1
2.	Employ classroom knowledge and laboratory techniques effectively for the demonstration of relevant theorems of electricity and magnetism	Psychomotor	3	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

PRACTICAL EXPERIMENTS:

S.No	Descriptions
01	Determine the resistance of a Galvanometer by Kelvin method
02	Convert a Galvanometer into an Ammeter
03	Convert the Galvanometer in to Voltmeter
04	Study the Capacitance and Dielectric of Parallel plate capacitor
05	Study Variation of Resistance in Metal & semiconductor
06	Calibrate the thermocouple by deflection method
07	Find the frequency of A.C Main by Sonometer
08	To determine the value of given high resistance by Leakage method
09	To study the variation of Photoelectric current with intensity of incident beam
10	To determine the angle of dip by earth inductor method
11	To determine the value of a given resistance by color coding
12	To Verify Ohm's law

ME-100: Engineering Drawing

Contact Hours:
Practical = 48

Credit Hours:
Practical = **1.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	To understand the basic technique and tools of engineering drawing and graphics as a language of communication.	Cognitive	1	1
2.	To understand the basic concepts & environment of AutoCAD.	Psychomotor	2	5
3.	Draw 2-D and 3D Drawings/Sketches using AutoCAD drawing and editing tools.	Psychomotor	3	5
4.	Drawing/projects related to Electrical Engineering applications by use **of DESIGN CENTER** tool in AutoCAD.	Psychomotor	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Computer Aided Drawing Introduction:

Drawing instruments and their uses, types of lines, lettering and planning of a drawing, planning of a drawing sheet, principle requirements of a working drawing. Preliminary consideration: An overview of AutoCAD, hardware requirement, installing and configuring AutoCAD.

Managing an AutoCAD drawing:

The drawing environment, Controlling and accelerating the drawing process, creating simple drawings, creating complex entities. Editing and plotting drawings: Editing drawing entities, changing the drawing display, printing and plotting the drawings, measuring different variables, designing shapes and text fonts. Autolisp: syntax and structure of Autolisp, Autolisp functions, manipulating block attributes, communication and merger with other software.

Lab:

S. No.	Descriptions
1.	Introduction to Engineering Drawing, Types of Engineering Drawing, Types of Measuring Systems
2.	Drawing instruments and their uses
3.	Basic geometrical constructions, lettering and planning of a drawing
4.	Projection Angles ,1st angle projection, 3rd angle projection
5.	Practice of orthographic projection, Missing lines in orthographic projection, drawing three views of different objects
6.	Introduction to AutoCAD & Its environment 2D commands: Line, Arc, and Circle by different methods. Coordinates system. Modify Commands: Erase, Explode, Reinserting etc.
7.	Ellipse, Spline, Polygon, Statusbar Options like Snap, Osnap, Lwt etc. List command, Point, Locating a point, Calculating Area, Measuring Distance, Units.
8.	Modify Commands like Move, Copy, Offset, Extend, Trim, Mirror, Rotate, Scale, Break, Stretch, Fillet, Chamfer, Array (Rectangular + Circular), Lengthen.

9.	Polyline command and its options. etcPedit, External Reference i.e. Xref command, Hatch command, Making Layers
10.	Dimensions and its Styles, , Block Making and its Insertion, User Coordinate System (UCS), Text and its options, Design Center.
11.	Printing and plotting the drawings, Autolisp: syntax and structure of Autolisp, Autolispfunctions, Communication and merger with other software
12.	3D Commands: Extrude, Taper extrude, Extrude along a path, Extrude Curves, Solid Composite like Union, Subtract, Intersect. 3D orbit commands, Visualizing The model.
13.	Conversion of Pictorial view into orthographic Projections. Dimensioning the views with complete Specifications. Viewports Layers.
14.	3D Editing like Align, Rotate, Mirror, Array (Rectangular + Circular). Revolve Command
15.	Solids like Cube, Sphere, Cylinder, Isolines, Facetres, Cone, Wedge, Torus, 3D View ports, Controlling View Ports, 3D surfaces.
16.	Solid Editing Commands like Extrude face, Shell, Rotate face, Taper face etc.

Teaching Methodology

- Lecturing
- Assignments
- Quizzes

Assessment

Sessional (25%)

- Assignments 10%
- Quizzes 15%

Mid Term (25%)

Final Term (50%)

Text book:

- Elementary Engineering Drawing, Revised and Enlarged Edition by N. D. Bhatt.
- First year engineering drawing by A.C. Parkinson.
- Introduction to AutoCAD 2009 2D and 3D Design by Alf Yarwood, First Edition.

BSI-142: English Composition & Comprehension

Contact Hours:
Hours:
Theory =48

Credit

Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Practice English correctly in speaking and writing.	Affective	2	10
2.	Apply sound vocabulary and skills to use English in professional life.	Cognitive	3	10

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE:

S. No	Detailed Contents
01	Words & expressions commonly misused
02	Vocabulary Building skills
03	Introduction to parts of speech in detail
04	Word formation
05	Conditional Sentences & types
06	Tense, voice and narration
07	Common Grammatical mistakes
08	Sentence, its structure, types and kinds
09	Paragraph, its structure and types
10	Process of writing
11	Elementary Principles of Composition and its types
12	Relative Pronouns & Clauses
13	**Getting the essential information** Finding the main idea, Defining vocabulary in context Practice
14	**Order of importance** Using order in the writing to determine what is most important to the author, Similarities & Differences; using comparisons to determine the author's attitude, Sentence structure, degree of detail, description & tone Practice
15	**Critical reading & thinking** Evaluating evidence and author credibility, rejecting faulty reasoning Reading across the curriculum; asking the right questions to get the most out of reading in the natural sciences, social sciences & Humanities
16	**Drawing Conclusions; putting it all together**

Text books:

[1]. Writing Effective paragraphs by Howard CJ. Cambridge: Winthrop Publishers, 1976
[2]. Practical English Usage by Michael Swan. ELBS
[3]. Michael swan practical English usage

Reference books:

[1]. The Little Brown Handbook
[2]. Exploring the world of English by Sadaat Ali Sh

BSI-101: Islamic Studies

Contact Hours: **Credit Hours:**

Theory =32 Theory = 2.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	Topic	Domain	Taxonomy level	PLO
1	To describe the basic concepts of believes and Arkan-e-Islam, the importance of Quran and Hadith and the concept of Dawah (Tabligh) in Islam.	Cognitive	C2	8,12
2	To explain the life of the Holy Prophet in Makkah and Madinah (including the basic concepts of jihad & philosophical thoughts of Misaq-e-Madinah, Fath-e-Makkah and Khutbah-e-Hujjatul Widah), and the importance of Honest character.	Cognitive	C2	6, 12
3	To discuss the Islamic civilization and culture, human rights in Islam, the lawful earning and status of family planning and population Dynamic of Pakistan	Cognitive	C2	6,8

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑

COURSE OUTLINE:

S. No	Detailed Contents
1.	Basic Concepts of Islam, Dawat and Seerat un Nabi, Concept of the Holy War in Islam (Jehad)
2.	Compilation of the Holy Quran, Basic Concepts of Hadith. Hadith as source of Islamic Law
3.	Tafseer Surah Hujuraat and Surah Noor
4.	Islam as a Complete Code of Life
5.	Human Rights in Islam, and comparative study with other religions and Human rights granted by UNO
6.	Quran, Science and Technology, Knowledge and Islam
7.	Islamic Civilization
8	Woman Rights
9	Lawful earning
Population Dynamics of Pakistan	
1	Family Planning in the light of Quran and Sunna.
2	Analytical Study of the growth of population of Pakistan in the light of Islamic Shariah.

Text book:

[1]. Islamiyat by Mukhtar Hassan
[2]. Family Planning in Islam by Khalid Saifullah Rehmani
[3]. Family Planning by Mufti Muhammad Shafi.

Reference books:

[1]. A guide book for Muslims by Syed Abul Hasan Ali Nadvi

[2]. An introduction to Islam by Dr. Muhammad Hameed Ullah

[3]. What is Islam by Maulana Manzoor Nomani.

[4]. Islamiat (A Standard Book for CSS), Prof. Dr. Arif Naseem.

[5]. Islamiat for Students O levels, Farkhanda Noor Muhammad

[6]. Deenyat by Syed Abul Aala Moudodi

BSI-120: Professional Ethics

Contact Hours:
Hours:
Theory =32

Credit

Theory = 2.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Examine the rational of the diverse definitions of Ethics i.e. theoretical, legal, professional, and personal; also discuss the relative advantages and disadvantages of ethical and unethical conduct	Affective	1	6, 8
2.	Identify any religious, National/cultural, International law/doctrine dealing with Engineering Ethics or code of conduct of a professional society	Affective	2	6, 8
3.	Identify and debate Ethical case studies dealing with ethical dilemmas ranging from documents to complex engineering projects. Formulate possible solutions and responses to a given ethical dilemma and evaluate the possible consequences of these actions	Affective	3	6, 8

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☑
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

COURSE OUTLINE:

S.No	Detailed Contents
01	Introduction to Ethics & Professional Ethics, Profession and Professionalism – Professional ideals and virtues
02	Social Cognition and Erickson's theory of Social Development, Moral Dilemma, Kohlberg's theory of Moral Development
03	Social Living/Society, Social Control and the value system.
04	Theories about right action – Self-interest – Customs and religion, Islamic Approach to Ethics – Use of Ethical Theories-Utilitarianism, Deontological Ethics
05	Presentation/Quiz/Activity
06	Engineering as experimentation – Engineers as responsible experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study.
07	Safety and risk – Assessment of safety and risk – Risk Benefit Analysis – Reducing risk – The Three Mile Island and Chernobyl Case Studies/Bhopal Disaster
08	Presentation/Quiz/Activity
09	Occupational Crime – Fundamental Human Rights, Principal of Natural justice, Professional Rights – Employee Rights – Discrimination.
10	Multinational Corporations- Engineers as Managers, Moral Leadership, Engineers as Expert Witnesses and Advisors
11	Contract Law. Ethical Implications of Contract
12	Environmental Ethics/Research Ethics/Computer Ethics +Class Activity =Quiz/Assignment
13	Sample code of conduct. Codes of Ethics of Pakistan Engineering Council
14	Code of Professional Engineering Ethics, World Federation of Engineering Organizations
15	National Accountability Code of Conduct and Ethics
16	Presentation-Activity-Quiz/Assignment

Text books:

[1]. Ethics and the Conduct of Business by J.R Boatright, Pearson, India, 2005

[2]. Introduction to Ethics by William liley

Reference Books:

[1]. Society, Ethics and Technology by Morton Winston & Ralph Edelbach
[2]. Social Psychology and Human values by Malhon Brewster Smith
[3]. Contract Ac 1872 by Kemeruddin bin Abbas
[4]. Towards a Theory of Human Rights: Religion, Law, Courts by Michael J. Perry
[5]. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996
[6]. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999
[7]. Laura Schlesinger, How Could You Do That: The Abdication of Character, Courage, and Conscience, Harper Collins, New York, 1996
[8]. Stephen Carter, Integrity, Basic Books, New York 1996.
[9]. Tom Rusk's The Power of Ethical Persuasion: From Conflict to Partnership at Work and in Private Life, Viking, New York, 1993

2ND SEMESTER COURSES

EE-156: Basic Electrical Engineering

Contact Hours:	**Credit Hours:**
Theory =48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Explain with Examples** the active circuit elements, passive circuit elements, their series and parallel combinations with time varying and DC excitation and various laws of Electrical Circuits.	Cognitive	2	1
2.	**SOLVE, ANALYZE** and **EVALUATE** the problems related to application of various laws of Electrical Circuits	Cognitive	3	2
3.	**Explain** AC fundamentals, phasors ,different mathematical operations of phasors, series and parallel circuits with AC excitation.	Cognitive	2	1
4.	**SOLVE, ANALYZE** and **EVALUATE** the problems related to application of phasor analysis and instantaneous expressions.	Cognitive	3	2
5.	**ACQUIRE** the basic knowledge of series and Parallel Magnetic Circuits and Single Phase transformers.	Cognitive	1	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐

4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

a. Laws of Electrical Circuits

Electrical elements and circuits, voltage and current sources, resistance, Ohm's law, sources in parallel and series, dependant and independent sources, Kirchoff's laws , power dissipation is resistors , power in electric circuits, ideal-vs-real sources, voltage and Current Source Conversion, Capacitors, inductors, charging and discharging of capacitors, Standard Loop equations and Standard Node Equations.

b. Phasors.

Phasor representation i.e rectangular, polar, exponential and trigonometric form.

c. Fundamentals of AC Voltage and Current

A.C Fundamental, generation of alternating emf , introduction to periodic functions, RMS, average, instantaneous and peak values for sinusoidal signal wave forms.

d. AC Series and Parallel AC Circuits

series circuits, R-L , R-C and RLC series Circuit, capacitive and inductive reactances, impedance of series circuits, power in AC circuits, active power, reactive power, apparent power and power factor, Phasor diagrams, Impedance and admittance Method of parallel circuits and their phasor diagrams.

e. Magnetic Circuits:

Magnetic circuit concepts, magnetization curves, magnetic circuits with DC excitation,magnetic circuits with AC excitation, hysteresis and eddy current losses, introduction to transformer, the ideal transformer e.m.f equation.

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Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Illustrate** knowledge of various laws of Electrical Circuits , series and parallel circuit.	Psychomotor	2	1
2.	**Show** knowledge of constructing basic electrical circuits and demonstration of relevant knowledge.	Cognitive	3	2

S. No.	Lab's Descriptions
1.	To get familiar with the usage of power supply, voltmeter, ammeter and multimeter.
2.	To measure the resistance, capacitance, frequency, AC and DC Voltage with the help of Multimeter.
3.	To demonstrate a series circuit to measure and calculate its equivalent resistance.
4.	To demonstrate a parallel circuit to measure and calculate its equivalent resistance.
5.	To verify KVL.
6.	To verify KCL.
7.	To find the Time period, frequency, peak value and RMS value of AC Voltage.
8.	To find capacitance of a simple RC series Circuit with AC excitation.
9.	To draw the Phasor diagram of RC series circuit.
10.	To find the turn ratio of a single phase step down transformer.
11.	To find the turn ratio of a single phase step up transformer..
12.	To study the different switching method.
13.	To perform open circuit and short circuit testing of a transformer
14.	To study the characteristics and working principle of DC motor.
15.	Review.

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs) 25%

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs) 50%

Sessional Marks (25%)

- Class attendance 5%
- Assignments 10%
- Quizzes 10%

Text books:

1) Electric Circuits, by Floyd
2) Basic Electrical Engineering by Fitzgerald.
3) Alternating circuits Theory by K Y Tang.

EE-170: Computer Programming

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Acquire the basic knowledge of C++ and to get the necessary proficiency in C++	Cognitive	1	1
2.	Apply the gained knowledge in C++ to analyze and solve problems in effective way	Cognitive	3	2
3.	Understand the difference between procedural and object oriented paradigms	Cognitive	1	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

1. Introduction to the course, C++ and the IDE
2. Data types and operators
3. Functions
4. Conditions (if, if-else, nested if-else)
5. Conditions (switch statement, conditional operator)
6. Recursion
7. Iteration (for loop, while, do-while)
8. Iteration (do-while)
9. Strings
10. File handling
11. Structures
12. Arrays
13. Sorting Array and passing arrays to functions
14. Pointers
15. Calling functions by reference
16. Introduction to classes and objects

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	Illustrate the use of Integrated Development Environment (IDE) specially Code Blocks for writing and compiling programs	Psychomotor	2	1
2.	Try to write and compile simple programs and remove errors using gained knowledge	Psychomotor	3	2

S. No.	**Descriptions**
01	Intro to C++
02	Arithmetic operations

03	Conditional statements (Part-1)
04	Conditional statements (Part-2)
05	Repetitive statements/loops (part 1)
06	Repetitive statements/loops (part 2)
07	Repetitive statements/loops (part 3)
08	Functions
09	Functions part 2
10	Recursion
11	Arrays- one dimensional
12	Sorting algorithms
13	Arrays – 2 dimensional
14	Strings
15	Pointers
16	Pointers – part2

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes
-

Assessment

Sessional (25%)

- Assignments 10%
- Quizzes 10%
- Attendance 5%

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs)

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs)

Recommended Resources:

- **Books**
  - "C++ How to Program" by Deitel & Deitel
  - "C++ programming in easy steps" by Mike McGrath

- "Thinking in C++" by Bruce Eckel available at http://mindview.net/Books/TICPP/ThinkingInCPP2e.html#Contents
- For the advanced programmer: "The C++ Programming Language" by Bjarne Stroustrup, published by Addison Wesley

- **Web resources**
  - http://www.cplusplus.com/
  - Stroustrup's website: http://www.research.att.com/~bs/C++.html

BSI-162: Engineering Mechanics

Contact Hours:
Hours:
Theory =48

Credit

Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No.	CLO	Domain	Taxonomy level	PLO
1.	Explain the basic concepts and principles of Mechanics including statics and dynamics	Cognitive	2	1
2.	Apply and solve the physical laws with logical and mathematical reasoning for different types of problems related to applications in mechanics	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE: (Electrical Eng)

S.No	Description
01	Int.to Engineering Mechanics : Basic concepts, System of unit, unit conversions, Scalar and Vectors, important vector quantities
02	Vector algebra, Force, Force system, Principle of transmissibility, Rectangular component
03	Law of triangle of forces, Law of parallelogram of forces, Polygon law of forces
04	Moment and principle of moment, Varignon's Theorem
05	Couple, Properties of couples, Resultant of forces
06	Law of equilibrium, Parallel force system
07	Free body diagram
08	Fundamentals of dynamics, Newton, s Laws, Dynamic of particles
09	Rectilinear motion, Equation of motion
10	Plane curvilinear motion, Rectangular coordinate, Projectile motion
11	Normal & Tangential coordinate
12	Polar coordinate
13	Newton's second Law Using different coordinate system
14	Work & Energy
15	Impulse & momentum, Conservation of linear momentum
16	Dynamics of Rigid body and its applications in engineering

COURSE OUTLINE: (Agriculture and Mining Eng)

S.No	Description
01	Int.to Engineering Mechanics : Basic concepts, System of unit, conversion of units, Scalar and Vectors, important vector quantities
02	Accuracy of results, General Principles of Static's, Vector algebra, Force, Force system, Principle of transmissibility, Rectangular component
03	Law of triangle of forces, Law of parallelogram of forces, Polygon law of forces
04	Moment and principle of moment, Varignon's Theorem
05	Couple, Properties of couples, Resultant of force systems
06	Law of equilibrium, Parallel force system
07	Types of beams, Supports and Loads, Simple cases of Axial forces, Shear forces and Bending Moment diagrams, Problem involving friction on Flat surfaces, Geometrical Properties of Plane Areas,
08	Fundamentals of dynamics, Newton, s Laws, Dynamic of particles
09	Rectilinear motion, Equation of motion
10	Plane curvilinear motion, Rectangular coordinate, Projectile motion
11	Normal & Tangential coordinate
12	Polar coordinate
13	Newton's second Law Using different coordinate system
14	Work, Energy & power
15	Impulse & momentum, Conservations laws
16	Simple Harmonic motion

Text books:

(1). Engineering Mechanics (Statics) Volume –1, by J.L. Merriam & L.G.Kraige

(2). Engineering Mechanics (Dynamics) Volume –2, by J.L. Merriam & L.G.Kraige

Reference books:

(1). Physics by David Holliday & Resnick

(2). Applied Mechanics for Engineers by J. Duncan.

(3). Engineering Mechanics, Statics by R.C. Hibbeler

(4). Engineering Mechanics, Dynamics by R.C. Hibbeler

(5). Engineering Mechanics, 4^{th} edition, Irving H. Shames, Prentice Hall

Engineering Mechanics Lab (BSI-162L)

Contact Hours:
Hours:
Lab =48

Credit

Lab = 1.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Show basic knowledge of experimental set up for problems in mechanics	Psychomotor	2	1
2.	Reproduce classroom knowledge and laboratory techniques for demonstration of relevant laws of mechanics in engineering problems	Psychomotor	3	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

PRACTICAL EXPERIMENTS:

S.No	Descriptions
01	To find various forces on Roof Truss
02	To find the various forces in various parts of wall crane
03	To Verify the Link Polygon on various forces
04	To Verify the various forces on hanging cord
05	To find coefficient of friction between various materials on inclined plane
06	To verify the Principle of moment in the Disc Apparatus
07	To verify the Principle of moment by bent lever
08	Helical block
09	To draw a Load efficiency curve for a Screw Jack
10	To draw a load efficiency curve for lifting crab
11	To draw a load efficiency curve for wheel and axle
12	To find the moment of inertia by fly wheel
13	To find the moment of inertia by inclined plane
14	To Find friction between Belt and pulley
15	To find the reaction forces on simple supported beam
16	To verify Hooks law

Linear Algebra (BSI-111)

Contact Hours:
Hours:
Theory =48

Credit
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	To describe different concepts of linear algebra and optimization	Cognitive	2	2
2.	To apply these concepts for solution of the problems in Sciences and Engineering	Cognitive	3	1,2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge and Application	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINES:

S. No	Detailed Contents
01	Solution of System of linear equations and applications. (Gauss Elimination, Gauss-Jordan, Pivoting methods, LU decomposition)
02	Matrix Algebra, Matrix Transformations, Determinants, Inverse of a matrix, Cramer's Rule
03	Vectors in R^n , Properties of vectors, application of vectors, vector algebra, inner product
04	Computer graphics by using different matrix transformations, that is, Reflection, rotation, dilation, contraction, shear in X- and Y-direction.
05	Applications of linear systems and matrices in electrical circuit, Markov process and then Markov process in Psychology, Business, Sociology, Genetics and Mass transit.
06	Introduction to linear transformations, their applications in coding and decoding the messages. Basis for range and kernel of a given transformation. Lines and planes in R^3
07	Introduction to vector spaces, Subspaces, linear combination, spanning sets and dependence Basis and dimension. Solution space, null space and rank of a matrix.
08	Eigenvalues and eigenvectors, similar matrices, diagonalization, Application of eigenvalues in dynamical systems
09	Introduction to linear programming, optimization, graphical method, simplex method, optimization problems in engineering and economics.

Text book:

[1]. Introductory Linear Algebra: By Bernard Kolman and David R. Hill, Latest Edition.

Reference Book:

[1]. Elementary Linear Algebra: By Howard Anton and Chris Rorrers, Latest Edition.

BSI-110: Pakistan Studies

Contact Hours:
Hours:
Theory =32

Credit
Theory = 2.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	know about Pakistan's historical perspective,geo-strategic location constitutional phases, contemporary affairs, and future challenges	Cognitive	C 2	6
2.	analyze major events and lives of prominent personalities related to Pakistan	Cognitive	C 4	6
3.	review the role of national institutions social issues including population growth in Pakistan, ethincity, foerign policy and future challenges	Cognitive	C 4	6

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

COURSE OUTLINE:

Week	Detailed Contents
1	Ideology, definition, importance some kinds ideology
2	Pakistan Ideology, Sayings of Quaid-E-Azam, Allam Iqbal about Pakistan Ideology, Aims and objectives of the creation of Pakistan
3	Reformist Movements, Shah Waliullah, Mujadid Alf Sani And Sayyed Ahmad Shaheed
4	Muslim Nationalism, Partition of Bengal, Simla Deputation
5	Muslim League, Lucknow Pact 1916, Khilafat Movement
6	Nehro Report, Quaid-e-Azam 14 points, Iqbal's Address 1930, Act of 1935, The Congress Ministries
7.	Lahore Resolution 1940, 3rd June and independence 1947
Midterm Examination	
8	Constitution in Law, method of making the constitution, the formation of the constituent Assembly 1947, Objective Resolution 1949
9	Dissolution of the Cabinet of Khwaja Nazimuddin, M.Ali Bogra Formula 1954 and dissolution of the Constituent Assembly 1954
10	Decision of Sindh High Court and Supreme Court regarding the dissolution of Assembly in 1955 (Doctrine of Necessity)
11	Features of 1956 and 1973 constitutions of Pakistan
12	Amendments in 1973 Constitution (17^{th} – 20^{th})
13	Foreign policy of Pakistan, goals and determinants of foreign policy.
14	Population Dynamics of Pakistan. • Growth and History of Population in Pakistan, Main factors driving population growth, • Life expectancy in Pakistan, Socio-Economic effects of High Birth rate
15	Strategy to control population growth in Pakistan. The role of society and State in controlling population, Socio-economic benefits of birth controlling

Text books:

[1]. Struggle for Pakistan by Ishtiaq Hussain Qureshi

[2]. Pakistan Studies by Ikram Rabbani

Reference books:

[1]. Pakistan Studies by Javed Iqbal

[2]. Constitutional Development in Pakistan by Safdar Mehmood.

[3]. Constitutional Development by KB Saeed

[4]. Social change by Alama Iqbal University, Islamabad

EE-157: Workshop Technology

Contact Hours:
Theory =16
Practical = 48
Total = 64

Credit Hours:
Theory = **1.0**
Practical = **1.0**
Total = **2.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**ACQUIRE** the basic knowledge of Electric circuit, its components. Electrical Power System, process of Electrical power Generation, Transmission and Distribution.	Cognitive	1	1
2.	**To Explain** Electrification System, how to get Electric supply both single and three phase from the Transformer, its protection.	Cognitive	2	2
3.	**ACQUIRE** the basic knowledge about Electric Shocks, types and its effects on the human body. First Aid procedures.	Cognitive	1	1
4.	**To Solve** simple electric wiring circuits for electrification of buildings, Selection of different components.	Cognitive	2	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

A. Basic Electric Circuits.

Electric Circuit, its components, conducting wires, battery sources, loads etc.

To know about various Electric circuit Devises and its Symbols.

B. System of Electricity.

Define Electrical power system?

Its main components, function of main components, and its proper representation. Types & its Comparison. Over view of Electrical Power Generation, Transmission & Distribution.

How to get Electricity form the Electric Pole, single phase, two phase, three phase. Basics about Distribution Transformer, its connections, protection against overload and voltage, cooling system.

C. Hazards Related to Electricity.

Why does human body conduct electricity? Defining Electrical Accidents, its types, factors intensifying electric shocks etc. Effects of Electrical shock on Human Body.

D. Safety and Grounding Systems

Factors effecting stability of System, Types of Grounding. Safety in Electrical System and Devises. Factors effecting the Safety of System and Devices.

E. Electrification System.

Electrifying an Area and building electrification. Various steps involved for Electrical Wiring system. Calculating Currents for single phase and three phases. Prediction of Electrical Load, Insulation. Receptacles Conduits and its types, Junction/Jointing

F. Protection Devices & Switch Gear System.

Circuit Breakers, Fuses, Relays, Bus Bars etc.

G. Health Safety, And First Aid.

Safety in workshop, precautions at the shop. First Aid for Electric shock victim.

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Illustrate** knowledge of various types of switches and there applications in practical circuits.	Psychomotor	1	1

S. No.	Descriptions
1.	To get familiar with the tools used in Electrical Workshop.
2.	To study about wires, cables there sizes, cages and types with different bases.
3.	To study the function of single pole switch, by controlling a lamp through it.
4.	To study and use two single pole switches to control a lamp and two pin wall Socket.
5.	To Study and demonstrate 3-lamps control by three single pole switches.
6.	To study function of two way switch and assembled a stair case wiring system.
7.	To study the Hotel wiring system and make a simple circuit with call bell, push button and lamps.
8.	To Study the properties of series and parallel connections, with lamps and switches.
9.	To Study the fluorescent tube circuit connection and function of various components.
10.	To Study the fluorescent tube circuit (Electronics) connection and function of various components
11.	To Study the connection diagram of single phase and three phase supply panel board.
12.	To study the connection diagram of a single phase and three phase motor to main panel.
13.	To study soldering techniques and to have, a hand on experience how to solder different components on circuit boards or PCB.
14.	To Design and Draw the connection diagram of home wiring system on a drawing Sheet.
15.	Troubleshooting and fixing some common problems in home Appliance.
16.	Measurement and Calculation of Energy, Power, Voltage and Current in a single phase Systems.

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Mid Term (40%)

- Written (Long Questions, Short Questions, MCQs) 50%
- Presentation 20%
- Assignments 20%
- Report Writing 10%

Final Term (60%)

- Written (Long Questions, Short Questions, MCQs) 50%
- Presentation 20%
- Assignments 20%
- Report Writing 10%

Text book:

- No Text book. Lecture Notes are sufficient.

3RD SEMESTER COURSES

ME-211: Applied Thermodynamics

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 0	Practical = **0**
Total = 48	Total = **3.0**

Course Outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Define and state basic thermodynamics laws and associated knowledge with it.	Cognitive	1	1
2.	Describe, discuss and explain the applications of thermodynamics.	Cognitive	1	1
3	Applying the knowledge of thermodynamics by solving the practical problems that would be faced by an Electrical Engineer speciality in power side.	Cognitive	2	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Outline:

- Basic Thermodynamics Concepts Applicable To Heat Engines: Brief review of gas laws; First and Second laws of thermodynamics and relevant heat engine cycles.
- Air Compressors: Fundamentals of reciprocating and rotary compressors with emphasis on construction and function.
- Boilers and Condensers: Important modern boilers, coal, oil and gas fired, their auxiliaries and fittings, with application to the steam turbines.
- I.C.Engines: Introduction to l.C. Engines and comparison of their performance;jet-propulsion, and gas-engines.
- Refrigeration And Air Conditioning: Basic concepts; Constructional details of components and arrangements of the system, House-hold refrigerator; and automatic controls.
- Steam and Gas Turbines: Basic cycles, use of gas turbines for power generation.

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Short & Long Questions) 100%

Final Term (50%)

- Written (Short & Long Questions) 100%

Sessionals (25%)

- Assignments 50%
- Quizzes 50%

Text & Reference Books:

1. Applied thermodynamics for Engineering Technologist by T.D.Eastop and A.Mc Conkey. 3rd Edition
2. Thermodynamics Applied to Heat Engines by E.H.

EE-200: Circuit Analysis-I

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Acquire** knowledge related to basic concepts, laws and theorems used for circuit analysis	Cognitive	2	1
2.	**Understand** the phenomenon of electrical resonance and operation of three phase circuits	Cognitive	2	1
3.	**Illustrate** the behavior of energy storing elements and **Solve** transient circuits	Cognitive	3	2
4.	**Design** of Electrical circuits for applications	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

The phase concept & phase relationship for an RLC elements
Impedance and admittance, Phasor diagram
Characteristic of sinusoids
Steady state response of a RLC circuits
Series and Parallel Resonance
Network theorems in A.C analysis
Kirchhoff's Laws-Mesh and node analysis
Superposition theorem, Thevenin's & Norton's theorems, Max power transfer theorem
AC bridge circuits. , A.C Steady state power analysis,
Instantaneous power, average power, apparent power, Reactive power, Power Triangle, power factor and P.F correction, Polyphse Circuits
Single phase system,3-phase system (3 wire & 4 wire systems , three phase Star–Star, Star-Delta, Delta_Star, Delta-Delta)
Balanced and Unbalanced three Phase load, 3-phase power calculations
Transient in RL, RC and RLC circuits

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Demonstrate** knowledge of constructing circuits using PSPICE.	Psychomotor	2	5
2.	**Perform** circuit simulation using PSPICE.	Psychomotor	3	5

S. No.	Descriptions
1.	Finding the potential drop across the resistor
2.	To determine unknown voltage and current in a DC circuit.
3.	To determine unknown loop currents in an AC circuit.
4.	To find out voltage and current in circuit having multiple sources.
5.	To verify balanced condition of a bridge circuit.
6.	To determine unknown nodal voltages in an AC Circuit.
7.	To plot voltage, current and power waveforms of a resistive circuit.
8.	To find voltage and current waveform of inductive and capacitive circuit.
9.	To plot voltage and current waveforms of an RLC circuit.

10.	To study series resonance curve.
11.	To study parallel resonance curve.
12.	To study RL transient circuit.
13.	To study RC transient circuit.
14.	To analyze RLC Transient Circuit.
15.	To study second order transient Circuit.
16.	To study RLC ringing circuit.

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Long Questions (Numericals)) 100%

Final Term (50%)

- Written (Long Questions(Numericals)) 100%

Sessionals (25%)

- Assignments 40%
- Quizzes 60%

Text book:

- Introductory Circuit Analysis, Boylestad, 8th, 9th or 10th Edition
- Basic Engineering Circuit Analysis, David Irwin, 8th or 9th Edition

Reference book:

- Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 6th Edition
- Electric Circuit by Nilsson and Riedel, 5th or 6th Edition

BSI-143: Communication and Presentation Skills

Contact Hours:
Theory = 48
Practical = 0
Total = 48

Credit Hours:
Theory = 3.0
Practical = 0
Total = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Understand** the basics of technical communication, the role of technology in communication and its impacts.	Cognitive	2	10
2.	**Discuss** different forms of oral communication like presentation, interview, meetings, conferences, group discussions and seminars.	Cognitive	2	10 & 12
3.	**Gain** the ability to use modern presentation skills. Have skill to avoid common errors usually made during interviews and Presentations	Affective	3	10

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:

Basics of technical Communication:
The process of communication, Language as a Tool of communication, Levels of communication, The flow communication, Communication Networks

Technology in Communication:
Impact of technology, Software for creating messages, Software for writing documents, Software for presenting documents, Effective use of technology

Active Listening:
Types of listening, Traits of good listener, Active versus passive listening, Implications of effective listening

Effective presentation strategies:
Introduction, Defining purpose, Analyzing Audience and Locale, Organizing contents, Preparing an outline, Visual Aids, Understanding Nuances of delivery, Kinesics, Proxemics, Paralinguistic, Chronemics

Interviews:
Introduction, Objectives, Types of Interviews, Job Interviews: Face to face, Telephone interviews

Group communication:
Introduction, Group discussion, Organizational discussions, Group Discussions, Brain storming, Nominal group & Delphi techniques, Group discussion as part of a selection process, Meetings, Conferences

Job application & Resume:
Résumé and Curriculum Vitae, Differences, Do's and don'ts

Teaching Methodology

- **Lecturing**
- **Home Assignments**
- **Class Activities**
  Listening Activities, Class Presentations, Mock Interviews, Quiz, Group Activities

Assessment

Mid Term (25%)
- Written (Long Questions, Short Questions, MCQs) 100%

Final Term (50%)
- Written (Long Questions, Short Questions, MCQs) 100%

Sessionals (25%)
- Class Presentations 75%
- Assignments 25%

Text book:

- Technical Communication: Principles and Communication
  Author: Meenakshi Raman and Sangeeta Sharma

Reference book:

- Basic communication skills for Technology by Andrea J. Rutherford.
  ISBN 978-8177584073

Differential Equations (BSI- 231)

Contact Hours:
Hours:
Theory =48

Credit

Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	To solve different types of differential equations by understanding fundamental methods and techniques	Cognitive	3	2
2.	To develop force balancing models based on differential equations for different engineering problems	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINES:

S. No	Detailed Contents
01	PDE, Linear Differential equations, Non-Linear, Differential equations, Solutions of differential equations, General solutions, Particular solutions, Initial and boundary value problems
02	Separable equations, Homogeneous equations, Differential equations reducible to homogeneous form and related examples
03	Exact equations, Integrating factors, Linear equations and related examples.
04	Bernoulli's equations, orthogonal trajectories, Equations solvable for p, Equations solvable for y, Equations solvable for x and related examples
05	Homogeneous linear equations, Differential operators, Non-homogeneous linear equations, Undetermined coefficients, Cauchy-Euler equations and related examples
06	Variation of parameters, exact linear equations, linear system of Differential Equations and related examples
07	Power series solutions of first order Differential Equations, Second order linear equations and related examples
08	Applications of Ordinary differential equations in Electrical Engineering
09	Partial Differential Equations: Method of Separation of variables and related examples
10	Applications of partial differential equations in Engineering

Text Book:

[1]. Advanced Engineering Mathematics by Erwin Kreyzig, John Wiley & Sons Inc. Latest Edition.

Reference Book:

- Differential Equation with Boundary Value problems by D. G. Zill, M. R Cullen Latest Edition, Brook/Cole Publishers.
- Mathematical Methods by Dr. S.M Yousuf, Ilmi Kitab Khana, Latest Edition.

EE-225: Digital Logic Design

Contact Hours:	**Credit Hours:**
Theory =48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Identify** and **Explain** fundamental concepts of digital logic design including basic and universal gates, number systems, binary coded systems, basic components of combinational and sequential circuits	Cognitive	2	1
2.	**Demonstrate** the acquired knowledge to apply techniques related to the design and analysis of digital electronic circuits including Boolean algebra and multi-variable Karnaugh map methods	Cognitive	3	1
3.	**Illustrate** small-scale combinational and sequential digital Circuits includes Flipflops, registers, counters using Boolean algebra and K-maps.	Cognitive	3	2
4.	**Analyze** Simple as possible (SAP) computer an its functioning using programming.	Cognitive	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐

3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- Binary Systems
  Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic
- Boolean Algebra & Logic Gates
  Boolean Postulates & Theorems
  Boolean Functions and their Complements
- Sum of Min-Terms & Product of Max-Terms
  Standard forms & Canonical Forms
  Digital logic gates
- Karnaugh maps
  Multi-variable (2,3,4) K-maps
  Don't care conditions
  Digital Circuits using Basic and Universal Gates
- Combinational Logic
  Analysis and Design of circuits
  Code Converters, Adders & its types
  Subtractors and its types
- Magnitude Comparator,
  Decoders and Encoders
- Multiplexers, its designing with examples and design
- Sequential Circuits
  Latches (SR Latch, D Latch)
  Flip Flops (D Flip Flop, JK Flip Flop, T Flip Flop)
- Flip-flops Characteristic Tables, Characteristic Equations.
  Design and Analysis of Clocked Sequential Circuits (State Equations, State Tables, State Diagrams)
- Counters
  Asynchronous and Synchronous Counters
  Ripple, Binary, BCD, & Johnson Counters
- Registers
  Simple registers, Shift registers
  Registers with parallel Load
- Shift Registers/Serial to parallel Convertors
  Universal Shift Register
- SAP 01
- SAP 02
- SAP 03

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Acquire** knowledge related to the concepts, tools and techniques for the design of digital electronic circuits	Psychomotor	2	1
2.	**Understand** and **Apply** the acquired knowledge to implement small-scale digital combinational circuits	Psychomotor	2	2 & 4
3.	**Analyze** and **practice** the small-scale sequential circuits on experimental boards.	Psychomotor	3	4

S. No	**Descriptions**
1.	To familiarize with the logic trainer EES-220, IC & Datasheet and Verification of truth tables for Universal Gates
2.	To test the Versatility of Universal gates
3.	Design and Implementation of XOR (Exclusive-OR) gate using Universal gates
4.	*Design and Implementation of Half Adder using Universal Gates*
5.	*Design and Implementation of Half Subtractor using Universal Gates*
6.	Design and Implementation of Full Adder using Two Half Adders
7.	Design and Implementation of Full Subtractor using Universal Gates
8.	Design and Implementation of Full Adder using function of simplifying techniques
9.	Design and Implementation of 3 × 8 Decoder using Universal Gates
10.	Design and Implementation of 4 × 1 MUX using Universal Gates
11.	To study and Implement SR Flip-flop
12.	To study and Implement JK Flip-flop
13.	Design and implementation of Master-Slave JK Flip-flop

14.	Design and Implement Shift Right Registers
15.	Design and Implement 4-bit Ripple Counter
16.	Design and Implement of Mod-10 Counter
17.	Design and Implement Binary Memory Cell

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Mid Term (25%)

Written (Long Questions, Short Questions, MCQs) 100%

Final Term (50%)

Written (Long Questions, Short Questions, MCQs) 100%

Sessional (25%)

Quizzes 40%
Assignments 40%
Class Participation 20%

Text book:

- Digital Design, 4th Edition by Morris Mano and Michael D. Ciletti. ISBN: 0131989243
- Digital Computer Electronics 3rd Edition by Alberto P. Malvino and Jerald A Brown ISBN-13: 978-0028005942

Reference book:

- Digital Fundamentals 10th Edition by Thomas Floyd, ISBN: 978-0132359238

EE-271: OOP & Data Structures

Contact Hours:
Theory = 32
Practical = 48
Total = 80

Credit Hours:
Theory = **2.0**
Practical = **1.0**
Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Describe** and **identify** fundamental concepts of object-oriented programming, and basic and advanced data structures	Cognitive	2	1
2.	**Explain, interpret, compare** and apply algorithms and principles of object-oriented programming and advanced data structures to a particular situation	Cognitive	3	1
3.	**Implement** small-to-moderate level programs to manipulate and manage data elements while exhibiting the object-oriented programming skills	Cognitive	5	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction to OOP, abstract data types, encapsulation, inheritance, polymorphism Classes and objects, member methods and attributes, constructors, destructors, pointers, reference pointers, operator overloading, method overloading, method overriding Virtual functions, pure virtual functions, friend functions, class interface object oriented design and implementation of vector, linked-lists, stacks, queues, trees and binary trees, map data structures Templates, Hash tables and graphs

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Describe** fundamental concepts of object-oriented programming	Psychomotor	2	1
2.	**Implement** basic and advanced data structures	Psychomotor	2	1
3.	**Implement** small-to-moderate level object oriented programs	Psychomotor	3	2

S. No.	Practical
1	Introduction to the course and the Integrated Development Environment (IDE)
2	Refresh the concepts of structured programming and Basics of Object-Oriented Language
3	Introduce the concepts of object-oriented programming and its implementation
4	To implement global scope resolution operator, passing and returning objects to & from member functions
5	To implement the concepts of operator overloading and overloading different operators
6	To implement the concepts of inheritance
7	To Use dynamic memory allocation, Copy Constructor, Static data

	members, member functions, and objects
8	Introduce the concepts of friend functions and classes
9	Introduce the concepts of polymorphism and its implementation
10	Implement linear data structures such as linear list (Part I)
11	Implement linear data structures such as stack, linear and circular queue (Part II)
12	To implement Sorting and searching algorithms
13	To implement stack applications
14	Implement double linked list
15	Implement circular linked list
16	Implement trees and introduce the concepts of operations on trees

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions) 100%

Final Term (50%)

- Written (Long Questions, Short Questions) 100%

Sessionals (25%)

- Assignments 40%
- Quizzes 60%

Text book:

- Object Oriented Programming in C++ by Robert Lafore
- Data Structures and Algorithms in C++ by Adam Drozdek

Reference book:

- Data Structures Using C and C++, by Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum

4TH SEMESTER COURSES

EE-345: Electronics Devices & Circuits

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Describe** and **explain** the basic construction, operation and characteristics of semiconductor devices	Cognitive	2	1
2.	**Apply** the acquired knowledge to solve small scale circuits consisting of semiconductor devices	Cognitive	3	1
3.	**Analyze** dc and ac response of small signal amplifier circuits using device models	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

- **Chapter No. 01: Semiconductor Devices**
  Semiconductor Diode Introduction, Semiconductors, Energy Levels, n-type and p-type materials, Semiconductor Diode, Characteristics of Diode, Diode Equivalent Circuits Transitions, Recovery, Specification, Notations, Testing of Diode, Zener Diode, Light Emitting Diodes, Numerical Problems.

- **Chapter No. 02: Diode Applications**
  Introduction, Load Line Analysis, Parallel and Series Configurations, Gates, Sinusoidals, Half Wave/Full Wave Rectifiers, Clipper and Clamper Circuits, Zener Diodes, Voltage-Multiplier Circuits and Applications, Numerical Problems.

- **Chapter No. 03: Bipolar Junction Transistors**
  Bipolar Junction Transistors Introduction, Bipolar Junction Transistors, Construction and Operation, and Amplification analysis, Common-Emitter, Common-Base and Common Collector Configurations of BJT, Limits of Operation, Specification, Testing, Casing and Terminal Identification of BJTs, Numerical Problems.

- **Chapter No. 04: DC Biasing-BJTs**
  Introduction, Operating Point, Fixed-Bias, Emitter Bias, Voltage Divider Bias Configurations, Collector Feedback , Emitter-Follower, Common-base and Miscellaneous Configurations, Design Operations, Current Mirror and Current Source Circuits, PNP Transistors, transistor Switching Networks, Bias Stabilization, Numerical Problems.

- **Chapter No. 05: BJT AC Analysis**
  Introduction, AC Domain, BJT Modeling, re-Model, CE-Fixed Configuration, Voltage Divider Bias, CE Emitter-Bias, Emitter-Follower, Common-Base, Collector Feedback and Collector Feedback Configurations, Current Gain, RL and RS, Two Port Systems, Cascaded Systems, Darlington and Feedback Pair, Hybrid Equivalent Model, Hybrid π Model, Variations of Transistor Parameter, Numerical Problems.

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Observe** and **practice** the knowledge of primary electronic lab instruments including Oscilloscope, Power Supply, experimental board, and Electronic trainer to power up and evaluate Diode and BJTs based electronic circuits	Psychomotor	2	4
2.	**Analyze** the use of transistor and different passive electronic components in development of certain electronic solutions with possible variations to fine tune the output	Psychomotor	3	5

S.No	Descriptions
1.	1) Measure ac waveform with Oscilloscope 2) Measure dc voltage with the Oscilloscope 3) Measure the frequency of ac signal using the calibrated time base of the Oscilloscope.
2.	To construct a Half-wave rectifier and demonstrate its operation by displaying and measuring dc average and peak output voltage and ripple factor
3.	To construct a Full-wave (Bridge) rectifier and demonstrate its operation by displaying and measuring dc average and peak output voltage and ripple factor
4.	*Measure and plot the forward and reverse characteristics of a typical Zener diode using a voltmeter*
5.	*To construct a voltage regulator and plot the voltage regulation properties of a typical shunt-type Zener diode voltage regulator*
6.	To construct a biased limiter circuit (positive and negative)
7.	To construct a Clamping circuit and demonstrate its operation
8.	To construct a voltage doubler and demonstrate its operation
9.	To construct a Common-Base circuit, and measure the dc operating voltages found in typical common-base circuit, also voltage gain and phase relationship between input and output
10.	To construct a Common-Emitter circuit, and measure the dc operating voltages found in typical common-emitter circuit, also voltage gain and phase relationship between input and output
11.	To construct a Common-Collector circuit, and measure the dc operating voltages found in typical common-collector circuit, also voltage gain and phase relationship between input and output
12.	To construct a transformer coupled push-pull power amplifier and measure the dc operating voltages and voltage gain
13.	TO construct a two-stages RC coupled amplifier circuit and measure dc operating voltages and demonstrate the operation and measure the ac voltage gain of a typical RC-coupled amplifier with and without emitter by-passing
14.	Gate characteristics of an SCR a) Demonstrate the effect of negative gate current in an SCR b) Demonstrate the effect of excess capacitance in the gate of an SCR
15.	SCR AC Power Control Demonstrate with operation of half-wave variable resistor phase control circuit

Teaching Methodology

- Lecturing
- Written Assignments
- Bi-weekly evaluation quizzes

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs) 65%
- Quizzes 10%
- Assignments 10%
- Attendance 05%
- Class Performance 10%

Final Term (75%)

- Written (Long Questions, Short Questions, MCQs) 65%
- Quizzes 10%
- Assignments 10%
- Attendance 05%
- Class Performance 10%

Text book:

- Electronic Devices and Circuit Theory 10th Edition, By H. Boylestad and L. Nashelsky, ISBN-10: 0135026490

Reference book:

- Electronic Devices 10th Edition by Thomas L. Floyd, ISBN-10: 0132359235
- Electronics Principles 8th Edition by Alberto P Malvino ISBN: 978-0073373881

EE 202: Probability and Random Variables

Contact Hours:
Theory =48
Practical = 0
Total = 48

Credit Hours:
Theory = **3.0**
Practical = **0.0**
Total = **3.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLOs	Domain	Taxonomy level	PLO
1.	**Define** basic concepts of probability, conditional probability, independent events and Baye's formula	Cognitive	1	1
2.	**Explain** discrete and continuous random variables, distributions and density functions, probability distributions (Binomial, Poisson, Hyper geometric, Normal, Uniform and Exponential).	Cognitive	2	1
3.	**Illustration** of Mean, variance, standard deviations, moments and moment generating functions, linear regression and curve fitting, limits theorems, stochastic processes, first and second order characteristics and basic concept of Monte Carlo Simulations. Apply knowledge of probability to solve real life problems	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐

6 The Engineer and Society: ☐ 12 Lifelong Learning: ☐

Course outline:

Basic concepts of probability, conditional probability, independent events, Baye's formula, discrete and continuous random variables, distributions and density functions, probability distributions (Binomial, Poisson, Hyper geometric, Normal, Uniform and Exponential) Mean, variance, standard deviations, moments and moment generating functions, linear regression and curve fitting. limits theorems, stochastic processes, first and second order characteristics, applications to real life, basic concept of Monte Carlo Simulations.

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs) 75%
- Quizzes 10%
- Assignments 10%
- Attendance 05%

Final Term (75%)

- Written (Long Questions, Short Questions, MCQs) 75%
- Quizzes 10%
- Assignments 10%
- Attendance 05%

Text book:

- Schaum's Outline of Theory And Problems of Probability, Random Variables, and Random Processes by Hwei P. Hsu,. ISBN-13: 978-0070306448

Reference book:

- Probability, Statistics, and Random Processes For Electrical Engineering, 3rd Edition by Alberto Leon-Garcia ISBN-13: 978-0131471221

EE-201: Circuit Analysis-II

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Acquire** knowledge related to mutual inductance and magnetically coupled circuits.	Cognitive	2	1
2.	**Acquire** knowledge related to two port networks	Cognitive	2	1
3.	**Analyze** circuits in s-domain	Cognitive	4	2
4.	**Analyze** and **Understand** filters and their frequency response	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Dependent Sources:
Thevenin's and Norton's Equivalent of Circuits with Dependent Sources

Mutual Inductance:
Analysis of Circuits with Mutual Inductance, Transformer Circuits, Impedance Matching

Two Port Networks:
T and Pi Equivalent Circuits, Circuit Analysis using Z, Y, h and ABCD Parameters

Circuit Analysis in s-domain:
Standard Inputs, Laplace Transform, Transfer Function, Poles and Zeros, System Response

Operational Amplifier:
Ideal and Non Ideal Amplifier, Inverting and Non Inverting Configurations, Operational Amplifier as a Summer, Differentiator and Integrator

Fourier Analysis:
Non-sinusoidal inputs, Fourier Series of periodic waveforms, Frequency Response of Filters and their Transfer Function, Passive and Active Filters, Basic Filters (Low pass and High pass), Advanced Filters (Band pass and Band stop)

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Demonstrate** knowledge of constructing circuits using Circuit Simulation Software	Psychomotor	2	2
2.	**Perform** circuit simulation using Circuit Simulation Software	Psychomotor	3	2

S. No.	Descriptions
1.	To learn the basics of Circuit Simulation Software
2.	To study the Transient Response of RL Series Circuit
3.	To Study the Transient Response of RC Series Circuit
4.	To study the Transient Response of RLC Series Circuit
5.	To study the Transient Response of RLC Parallel Circuit
6.	To study the Frequency Response of Low Pass Filter
7.	To study the Frequency Response of High Pass Filter

8.	To Study the Frequency Response of Band Pass Filter
9.	To Study the Frequency Response of Band Stop Filter
10.	To Study the Fourier Analysis of Non Sinusoidal Wave
11.	To Study the Frequency Response of First Order Low Pass Active Filter
12.	To Study the Frequency Response of 2nd Order Low Pass Active Filter
13.	To Study the Frequency Response of First Order High Pass Active Filter
14.	To Study the Frequency Response of 2nd Order High Pass Active Filter
15.	To Study the Frequency Response of 5th Order Low Pass Butterworth Filter

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Long Questions)

Final Term (50%)

- Written (Long Questions)

Sessional (25%)

- Assignments 10%
- Quizzes 15%

Text book:

- Electric Circuits by James W. Nilsson & Susan A. Riedel, 6th Edition, Addison Wesley
- Basic Engineering Circuit Analysis by David Irwin, 9th Edition, John Wiley & Sons

Reference book:

- Engineering Circuit Analysis by William H. Hayt, Kemmerly and Durbin, 6th Edition
- Fundamentals of Electric Circuits by Charles K. Alexander & Matthew, 4th Edition

EE-326: Microprocessor & Microcontroller

Based System Design

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Introduction to the course:

This course is designed to make the student understand fundamental architecture of microprocessors and Microcontrollers, its interfacing with memory and input/output ports, its operation, and assembly language programming. The course take a student from micro-level programming where they get to know the internal processes inside microprocessors with their unique hex codes and identities to high level programming in C, where the system is independent of internal operations. It explains how microprocessors and microcontrollers play an important role in day-to-day life of modern digital industry in the form of embedded systems. At the end of the course, the students are in position to understand and able to develop prototypes of cell phones, ATM machines, CNC Machines, and general automation industry prototyping. The students understand the process of transforming manual processes in the physical world to an automated one through sensors and actuators.

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Explain the basic and fundamental concepts about the architectures of microprocessors and microcontrollers including CPU, memory, I/O devices	Cognitive	2	1
2.	Discuss the instruction set of 8085in assembly languages and of both assembly and C language in case of 8051 Microcontroller.	Cognitive	2	1
3.	Design serial and parallel interfaces and interfacing of peripheral devices like external memory mapping, key boards, LCDs, 8255 interfacing to 8051, ADC, DAC & sensors interfacing.	Cognitive	3	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Week	Topic
1	**Introduction to Microprocessors, overview of 8085**
2	**Jump , Loop ,Call & I/O port programming in 8085**
3	**Decision making using arithmetic & logical instructions**
4	**Counters & Delays**
5	**Stacks & Subroutines**
6	**Interfacing I/O ports to 8085**
7	**Interfacing External memory to 8085**
8	**Interfacing 8255 with 8085**
9	Midterm Examination
10	**Difference between Microcontrollers & embedded systems & overview of 8051**
11	**I/O port programming & Addressing modes in 8051**
12	**Timer programming & Serial port programming**
13	**Interrupts programming & LCD interfacing**
14	**Keyboard Interfacing**
15	**External memory interfacing**
16	**8255 interfacing to 8051**
17	**ADC,DAC & Sensors interfacing**
	Final term examination

Lab:

S. No	LO	Domain	Taxonomy level	PLO
1.	Illustrate knowledge of Microcontroller based system design encompassing a variety of microcontrollers	Psychomotor	2	1
2.	Designing of microcontroller based systems (prototype and simulation based)	Psychomotor	4	3

S. No.	Descriptions
1.	Introduction to Simulator for Intel's 8085 Microprocessor and executing a simple program to add two numbers.
2.	To get data from an Input Port and to send data to an Output Port.
3.	To get familiar with ARITHMETIC Instructions and see their effects on Flags Status.
4.	To get familiar with LOGIC Instructions and learn about Data Masking.
5.	To get familiar with BRANCH Operations and learn about Conditional and Unconditional Jumps.
6.	To introduce LOOPS in an assembly language program and hence, design a counter.
7.	To get familiar with 16-bit DATA TRANSFER and ARITHMETIC Operation.
8.	To get familiar with STACK, STACK POINTER and SUBROUTINES.

Microcontroller

S.No.	Descriptions
1.	To get familiar with Intel's 8051 Microcontroller and learn Data Input and Output using INPUT/OUTPUT Ports.
2.	To get familiar with Intel's 8051 Microcontroller and learn Data Input and Output using INPUT/OUTPUT Ports.
3.	Interfacing an LCD to the 8051 Microcontroller.
4.	To Interface ADC with 8051 Microcontroller.
5.	To Interface a HEX KEYBOARD with the 8051 Microcontroller.
6.	To Interface DAC with 8051 Microcontroller.
7.	To Interface MAX233 with 8051 Microcontroller (Serial Communication).

8.	To Interface STEPPER MOTOR with 8051 Microcontroller.

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Sessional (20%)

- Quizzes 50%
- Assignments 50%

Mid Term (20%)

- Written (Long Questions, Short Questions, MCQs) 100%

Final Term (60%)

- Written (Long Questions, Short Questions, MCQs) 100%

Text book:

- 8085 Microprocessor by Goanker
- Embedded System Design using 8051 micro controller in Assembly and C. By Ali Mazidi

Reference book:

- Microprocessors and Interfacing: Programming and Hardware
  by Douglas V. Hall

BSI-242 Numerical Analysis

Contact Hours:
Hours:
Theory =48

Credit

Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S. No	CLO	Domain	Taxonomy level	PLO
1.	To describe different numerical techniques in interpolation, differentiation, integration, eigenvalues and solution of algebraic and differential equations	Cognitive	2	1
2.	To apply these techniques for the solution of engineering problems	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE:

S.No	Detailed Contents
01	Error analysis, types of error, condition number
02	Interpolation: Newton forward and backward difference formula for interpolation, central difference based interpolation formulae, Lagrange's interpolation polynomial.
03	Numerical differentiation of first order and higher order and its application in engineering.
04	Numerical integration (Trapezoidal, Simpson's rules, Boole's rule, Weddle's rule, Romberg integration), Application of integration in Engineering (Area, Volume, Surface area, length of arc etc)
05	Numerical method for solution of ODE, Picard's method, Taylor's method, Euler method and its variations. Runge Kutta method, Multi step methods.
06	Solution of initial and boundary value problem using numerical methods
07	Solution of nonlinear equations: graphical method, bracketing methods, iterative methods
08	Solution of system equation by numerical methods, Jacobi method, Gauss Seidel method.
09	Eigenvalues and Eigenvectors: power method, Inverse power method, Shifted inverse power method.

Text book:

[1]. Numerical Analysis: By Richard L. Burden, J. Douglas Faires, Latest Edition

Reference Book:

[1]. Numerical methods for scientist and engineers by R.W. Hamming (Latest Edition)

5TH SEMESTER COURSES

BSI-362: Complex Variables & Transforms

Contact Hours:
Theory =48

Credit Hours:
Theory = 3.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	To know about basic concepts of complex analysis and Fourier transforms	Cognitive	1	1
2.	To apply these concepts in engineering problems	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

COURSE OUTLINE:

S. No	Detailed Contents
01	Complex numbers, addition and multiplication of complex numbers
02	Complex plane, complex conjugate numbers, numerical and related examples
03	Curve and region in the complex plane polar form, Demoiver's theorem, numerical and related examples
04	Complex functions, limit continuity and derivatives of complex functions
05	Complex integrations, contour integrations, Cauchy integral theorem, Cauchy integral formula
06	Derivatives of analytical functions, Morera's theorem, Liouvill's theorem
07	Power series, Taylor series, Laurent series
08	Singularities and zeros, Pole and essential singularities
09	Residue integration method, Residue theorem, Conformal mapping
10	Gamma and Beta functions, periodic functions and applications
11	Fourier series, Fourier sine and cosine series, Fourier integrals and applications

Text book:

[1]. Advanced Engineering Mathematics, by Erwin Kreyszing, Latest Edition

Reference book:

[1]. Complex Variables and Applications by Churchill, latest Edition

EE-336: Electrical Measurement & Instrumentation

Contact Hours:	**Credit Hours**
Theory =48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand standards of measurement, units of measurement, Error and types of error in measurement.	Cognitive	1	1
2.	Analyze the design of different electromechanical indicating instruments.	Cognitive	4	2
3.	Demonstrate the use of bridges and Transducers.	Cognitive	2	1
4.	Explain the construction and working of Oscilloscopes and digital multimeters.	Cognitive	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Definitions and classification of errors, instrument errors, environmental errors, temperature effect, Method of avoiding and correction errors. Engineering units and Standards, Principle, Operation, working and Construction of Different Analog and Digital Meters, Oscilloscope and its Measurements, Recording Instruments and signal generators. Transducers,

Different types of Bridges for Measurements of Resistance, Inductance, Capacitance. High Voltage Measurements,

Precision Measurements Terminologies Including Resolution, Sensitivity, Accuracy, Uncertainty. Mechanical Measurements: Length, Force, Displacement, Stress and Strain. Thermodynamic Measurements temp and pressure, Measurements in fluid Flows: velocity, Flow rate,

Data Manipulation and presentation Basic data Manipulation skills using personal Computers. Spread sheets and graphs, Static and Dynamic Measurements: Time Series and Sampling Requirements.

Data Acquisition System. Software Simulation.

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	Illustrate the use of different measuring instruments/systems for the measurement of different Electrical quantities.	Psychomotor	2	1
2.	Demonstrate use of sensors, transducers, electronic measuring instruments and mismatch losses.	Psychomotor	2	2

S. No.	Descriptions
1.	To find the inductance of the unknown inductor by three voltmeter method
2.	To find the unknown capacitance by three voltmeter method
3.	Measurement of power factor by voltmeter ammeter and wattmeter
4.	To find the single phase power by three voltmeter method
5.	To measurement the single phase power of load by three ammeter method

6.	To measure the intensity of light by lux meter
7.	To study the speed test for an energy meter
8.	To measure the current in circuit using tungtester
9.	To measure the unknown resistance using megger
10.	To measure the resistance of the grounding using megger
11.	To calculate q factor of a circuit
12.	To measure unknown resistance using Wheatstone bridge
13.	To measure unknown inductance using Maxwell inductance bridge
14.	To measure unknown inductance using Maxwell Wien bridge
15.	To measure unknown capacitance using Schering bridge

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes
- Written exams

Assessment

Sessional (25%)

- Assignments 10%
- Quizzes 10%
- Attendance 5%

Mid Term (25%)

- Written (Long Questions, Short Questions)

Final Term (50%)

- Written (Long Questions, Short Questions)

Text book:

- Modern Electronic Instrumentation and Measurements Techniques by A.D.Helfrick, W.D. Cooper

Reference book:

- Electrical Instrumentation and Measurement techniques ,By A.K.Sawhney

EE-363: Electromagnetic Field Theory

Contact Hours:
Theory =48
Practical = 0
Total = 48

Credit Hours:
Theory = **3.0**
Practical = **0**
Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Describe the fundamentals of Electrostatics and magnetostatic.	Cognitive	1	1
2.	Identify the characteristics of materials and relate them to electric and magnetic fields.	Cognitive	2	1
3.	Demonstrate the theoretical background of Maxwell's equations and electromagnetic wave concepts, regarding propagation characteristics, polarization and reflection.	Cognitive	3	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Scalar and Vector Quantities, Vector operations like addition ,Vector subtraction, Multiplication of Vector by a scalar, Product of two vectors, the coordinate systems, Differential elements of length, surface and volume, the gradient of a scalar function.

coulomb's law, Application of superposition theorem in coulomb's law, Electric field intensity due to point charge. Different Charge configurations i.e. Line charge Density, surface charge density, Volume Charge Density. Electric field intensity due to a Line Charge, Electric Field Intensity by due to a sheet of Charge, Electric Field Intensity due to Volume Charge. Electric flux and Electric Flux Density, Gauss's Law, Applications of Gauss's Law, the Divergence theorem, Maxwell's first Equation.

Energy in moving a charge in an electric field. The electric potential, the line integral, Definition of Potential Difference and potential, the potential field of a point charge, the potential field of a system of charges (superposition), Potential gradient. Electric dipole, Boundary conditions i.e. the normal components and the tangential components of the electric fields..

Biot- Savart Law, the Field due to infinitely long straight conductor, the Magnetic Field Intensity due to a Finite Length current Filament. Ampere's circuital Law. The Field due to an infinitely long coaxial cable. Applications of Amper's circuital Law, Field due to a sheet of current, curl, stokes' Theorem, Magnetic Flux and Magnetic Flux Density, Maxwell's Second Equation, Force on a Moving Charge, Force on a Differential current Element, force Between Differential current Elements, Force and torque on a closed loop, Magnetic Boundary Conditions.

Farday's Law, Motional e.m.f, Displacement current Density, Equation of Continuity, Maxwell's Third and fourth Equations, Maxwell's Equations in integral Form, Maxwell's Equations in Phasor Form.General wave equations, plane wave in a Loss less dielectric medium, plane wave in free space, plane wave in lossy medium, skin depth, plane wave in a Good conductor, plane wave in a good Dielectric, Normal incidence of uniform lane waves i.e conductor, conductor interface, dielectric- dielectric interface, dielectric-perfect conductor interface, oblique incidence of uniform plane waves.

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes
- Written exams

Assessment

Sessional (25%)

- Assignments 10%
- Quizzes 10%
- Attendance 5%

Mid Term (25%)

- Written (Long Questions, Short Questions)

Final Term (50%)

- Written (Long Questions, Short Questions)

Text book:

- Engineering Electromagnetics, 5th Edition by William H Hayt, Jr.

Reference book:

- Electromagnetic Field Theory, By Hozorgu and Guru.

EE-497: Electronics Circuit-II

Contact Hours: **Credit Hours:**

Theory =48 Theory = **3.0**

Practical = 48 Practical = **1.0**

Total = 96 Total = **4.**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Describe and explain the construction, characteristics and operation of FET devices.	Cognitive	2	1
2.	AC and DC analysis of FET Amplifiers for various configurations	Cognitive	4	2
3.	Investigation of different feedback and oscillator circuits	Cognitive	4	4
4.	Design of 555 timer circuits for monostable and astable operations and Design of Logic gates using CMOS Technology	Cognitive	6	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Classification of FETs, Construction, Working and Operation of FETs (JFET and MOSFET), DC analysis of FETs (JFET and MOSFET), Fixed Bias Configuration, Self- Bias configuration and Voltage Divider Biasing of JFET, D-MOSFET and E-MOSFET, Ac analysis of FET amplifiers, CS, CG and CD amplifier Circuits

Operational Amplifier, characteristics of ideal op-amps. Slew rate, CMRR, Bandwidth, offset voltage, I-V characteristics of Op-amp, Inverting and Non-inverting amplifier, Op-amp as differential amplifier, Op-amp as differentiator, Op-amp as integrator, Op-amp as summer and subtractor, IC-741 Pin diagram

555 Timer, operation modes of 555, mono-stable, astable and bi-stable circuits, Duty cycle of 555 timer

Introduction to logic families, TTL, CMOS, ECL, basic operational characteristics and parameters, practical considerations and inter-family interfacing, Design of logic gates using CMOS technology.

Practical:

Ser	LO	Domain	Taxonomy level	PLO
1.	Conduct the relevant experiments under the supervision of teacher.	Psychomotor	3	1
2.	Demonstrate and investigate different electronic circuits to achieve certain predefined outputs.	Psychomotor	4	2

S.No	Descriptions
17.	To measure the effect of drain voltage (VDS) on drain current (IDS) with zero gate bias.
18.	To measure the effect of drain voltage (VDS) on drain current (IDS) with negative gate bias.
19.	To construct a self-bias common source amplifier circuit and calculate the voltage gain.
20.	To construct a voltage divider bias common source amplifier circuit and calculate the voltage gain.
21.	To construct a common gate amplifier circuit and calculate the voltage gain
22.	To construct a common drain amplifier circuit and calculate the voltage

	gain
23.	To investigate the OP-AMP with & without feedback.
24.	To measure voltage gain of inverting and non-inverting OP-AMP
25.	To construct differentiator using OP-AMP
26.	To construct integrator using OP-AMP
27.	To construct summer circuit using OP-AMP
28.	To construct Hartley oscillator and calculate its frequency
29.	To construct Colpitts oscillator and calculate its frequency
30.	To construct crystal oscillator and calculate its frequency

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes
- Written exams

Assessment

Sessional (30%)

- Assignments 10%
- Quizzes 20%

Mid Term (20%)

- Written (Long Questions, Short Questions)

Final Term (50%)

- Written (Long Questions, Short Questions)

Text book:

- Electronic Devices and Circuit Theory, by Boylestad and Nashelsky
- Operational Amplifiers and Linear Integrated Circuits, by Coughlin and Driscoll.

Reference book:

- Electronic Principles, by Albert Malvino & David J Bates
- Electronic circuits, by Schilling and Belove
- Integrated Electronics by Millman and Halkias

EE-287: Engineering Economics

Contact Hours:	**Credit Hours:**
Theory =48	Theory = **3.0**
Practical = 0	Practical = **0.0**
Total = 48	Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Compare the intelligent decisions of project alternatives during the planning and implementation phases based on the cost / benefit analysis.	Cognitive	2	11
2.	Classify the total cost of a project over its entire life and make more informed decisions about maintaining/replacement of assets to enhance the quality of products and efficiency of machines.	Cognitive	3	11
3.	Formulate and select the best project among the alternatives keeping in view its impact on environment and society.	Affective	2	6

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☑	12	Lifelong Learning:	☐

Course outline:

- **Introduction**
  - Economics
  - Flow in an Economy
  - Law of Supply and Demand
  - Concept of Engineering Economics
  - Types of Efficiency
  - Definition and Scope of Engineering Economics
  - Elements of Costs
  - Other Costs/Revenues
  - Marginal Cost
  - Marginal Revenue
  - Sunk Cost
  - Opportunity Cost
  - Break-Even Analysis
  - Profit/Volume Ratio (P/VRatio)
  - Elementary economic analysis
  - Examples for Simple Economic Analysis

- **Interest formulas and their applications**
  - Time Value of Money
  - Interest Formulas
  - Single-Payment Compound Amount
  - Single-Payment Present Worth Amount
  - Equal-Payment Series Compound Amount
  - Equal-Payment Series Sinking Fund
  - Equal-Payment Series Present Worth Amount
  - Equal-Payment Series Capital Recovery Amount
  - Uniform Gradient Series Annual Equivalent Amount
  - Effective Interest Rate

- **How Organization generate the funds**
  - Sources of Income
  - Shares/Owners Equity
  - Preferred Share
  - Common Share
  - Own Money
  - Bonds
  - Zero Coupon Bond
  - Coupon Bond

- **Concept of Cash Flow and Tools of Evaluating**
  - Concept of Cash Flow in Decision Making
  - Types of Cash Flow
  - Estimation of Incremental Cash Flow
  - Pay Back Period
  - Rate of Return Analysis
  - NPV
  - Profitability Index
  - Tools for Evaluating:

- **Replacement and maintenance analysis**
  - Types of Maintenance
  - Types of Replacement Problem

Determination of Economic Life of an Asset
Replacement of Existing Asset with a New Asset
Capital Recovery with Return
Concept of Challenger and Defender
Simple Probabilistic Model for Items Which Fail Completely

- **Depreciation**
  Introduction
  Methods of Depreciation
  Straight Line Method of Depreciation
  Declining Balance Method of Depreciation
  Sum-of-the-Years-Digits Method of Depreciation
  Sinking Fund Method of Depreciation

- **Inflation adjusted decisions**
  Introduction
  Procedure to Adjust Inflation
  Inflation Adjusted Economic Life of Machine
  Economic Life Determination without Inflationary Effect
  Economic Life Determination with Inflationary Effect

Teaching Methodology

- Lecturing
- Written Assignments
- Exams on bi-weekly bases

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions) 50%
- Attendance 10%
- Assignments 20%
- Quizzes 20%

Final Term (75%)

- Written (Long Questions, Short Questions) 50%
- Attendance 10%
- Assignments 20%
- Quizzes 20%

Text book:

- Engineering Economy by Henry Malcolm

Reference book:

- Engineering Economy By William G, Sullivan, James A. Bontadelli, And Elin M. Wicks

EE-305: Power Electronics

Contact Hours: **Credit Hours:**

Theory =48 Theory = **3.0**
Practical = 48 Practical = **1.0**
Total = 96 Total = **4.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Discuss** switches in power electronic circuits, Linear and Switch Mode Operations. Also discuss power, voltage, and current computations for different power electronic circuits.	Cognitive	2	1
2.	**Discuss** power electronic circuits for application in controlled rectification, and a dc-dc conversion	Cognitive	2	2
3.	**Design** power electronic circuits for application in inversion and ac-ac conversion.	Cognitive	5	3
4.	**Analyze** power electronics devices and circuits in applications like Power Supplies and Protection.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Teamwork:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

POWER SEMICONDUCTOR DEVICES: Power Diode, Thyristor and its triggering circuits, TRIAC, Gate Turn off Thyristor, Power BJT, Power MOSFET, and Insulated Gate Bipolar Transistor (IGBT).

CONVERTER CIRCUITS

AC-DC Converters (Rectifying circuits): Circuit nomenclature, commutating diode. Single-phase half-wave (or single way). Bi-phase half-wave (or single-way). Single-phase bridge (or double way). Three-phase half-wave (or single-way), and Three-phase bridge (or double-way) circuits.

DC-DC Converters (Choppers): Principle of Switched Mode Power Supplies (SMPS), Step-down or buck (forward) converter. Step-up or boost (fly-back) converter, and Buck-boost converter, High-frequency resonant converter.
DC-AC Converters (Inverters): Single-phase half-bridge inverter. Single-phase bridge inverter. Three-phase inverters, Voltage control of inverters.

AC-AC Converters
a) AC Voltage Controllers: Single-phase regulation with resistive and inductive loads. Regulation by tapped transformer.
b) Cyclo-converters: Principle of Operation, Single-phase to single-phase cyclo-converter. Three-phase half wave cyclo-converter.

PROTECTION: Voltage and current protection of power electronic switches, Reduction of switching losses using snubbers.

Teaching Methodology

- Lectures
- Written Materials

Assessment

Sessional (20 %)

- Assignments (50 %)
- Quizzes (50 %)

Mid Term (20 %)

Final Term (60%)

Textbooks:

1. Power Electronics by C. W. Lander (3rd Edition)
2. Power Electronics by Daniel Hart (1st Edition)

Reference Books.

1. Power Electronics —Circuits, devices, and applications by M.H. Rashid.
2. Power Electronics —Devices, Drives, and Applications by B.W. Williams.

Lab:

S. No.	LO	Domain	Taxonomy level	PLO
1.	**Explain** knowledge of primary Power ELECTRONIC Instruments including PE Control Unit, PE Load Unit, Single Thyristor Circuit Module, Firing Circuits Module, DIAC, TRAIC, Inverse Parallel Thyristor, Bridge Rectifier and Oscilloscope	Cognitive	2	1
2.	**Operate** Power Electronic Circuits and Compute RMS and Mean Values using Observations via Oscilloscopes and by Numerical Analysis	Psychomotor	3	2
3.	**Conduct** experiments on Power Electronics Trainer and investigate the effects of different changes on the outcome	Psychomotor	4	4

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☑	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

S. No.	Descriptions
1.	Introduction to Power Electronics Trainer
2.	To Study Switching of an SCR (AC Test)
3.	To Study Switching of an SCR (DC Test)
4.	*To study Switching Characteristics of TRIAC*
5.	*To study Dynamic Characteristics of SCR*
6.	To Study Characteristics of DIAC
7.	To Study Single Phase Control of an SCR (Resistive Load)
8.	To Study Single Phase Control of an SCR (Inductive Load)
9.	To Study the Operation and Characteristics of Bi-Phase Half Wave Rectifier
10.	To Study Single Phase Bridge Rectifier (Resistive Load)
11.	To Study Single Phase Bridge Rectifier (Inductive Load) Without Commutating Diode
12.	To Study Single Phase Bridge Rectifier (Inductive Load) With Commutating Diode
13.	To Study Dynamic Characteristics of TRIAC
14.	To Study Voltage Regulation Using Controlled Operation of Inverse Parallel Thyristors
15.	To Design a Buck Converter and Study its Principle of Operation
16.	To Design a Boost Converter and Study its Principle of Operation

6TH SEMESTER COURSES

EE-391: Communication Systems

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.**
Practical = **1.**
Total = **4.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Classification of signals, knowledge of basic communication system model, Elements of communication system and signal parameters like power, energy and bandwidth**	**Cognitive**	**2**	1
2.	Analyze the periodic and non-periodic signals using trigonometric Fourier series and Fourier transforms respectively	**Cognitive**	**4**	2
3.	Analyze the behavior of amplitude and phase modulated signals both in time and frequency domain.	**Cognitive**	**4**	2
4.	Design of AM and FM Transmitter and receiver	**Cognitive**	**5**	3
5.	**Describe different line coding schemes, Sampling Theorem, Intersymbol Interference (ISI), Matched filter and Equalizers.**	**Cognitive**	**2**	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction: Fundamental terms and definitions, information, message, message, signal, analog and digital signals, elements of communication systems, modulating and coding need for modulation, coding methods and benefits.
Linear Modulation: Band pass systems and signals, AM, DSB, SSB, VSB, modulated signals, modulators, balanced modulator, & witching modulator, SSB generation (method), demodulators, synchronous, detection, heterodyne detection, envelope detection.
Exponential CW Modulation: Frequency and phase modulation, bandwidth criteria, generation methods, receivers, de-emphasis filtering.
Pulse Modulation: Sampling Theory, ideal sampling and reconstruction, aliasing, PAM, PWM, PPM.
Baseband Pulse Transmission, Matched Filters, Probability of Error due to Noise, Intersymbol Interference, Nyquist Pulse Shaping, Partial Response Signaling, M-ary PAM Transmission, Linear Equalizers, Adaptive Equalizers;
Digital Bandpass Transmission, Representations of Bandpass Signals and Systems, Signal-space Representations, Detection of Known Signals in AWGN, Correlation and Matched Filter Receivers, M-ary Modulation Techniques.

Practical:

Ser	LO	Domain	Taxonomy level	PLO
1.	To observe different data formats (Line codes).	Psychomotor	1	1
2.	Practice different modulation techniques.	Psychomotor	3	1
3.	Demonstrate AM and FM transmitters and Receivers.	Psychomotor	4	1

S. No	Descriptions
1	Amplitude Modulation with full carrier
2	Demodulation of DSB with full carrier using envelop detector
3	Demodulation of DSB with full carrier using product detector
4	Double side band with suppressed carrier modulation
5	Generation of SSB signals
6	Demodulation of SSB
7	FM Modulation concept
8	Frequency Modulator
9	Phase locked loop detector
10	AM Generator and Superheterodyne AM Receiver
11	FM Transmitter and Superheterodyne FM Receiver
12	Sending and Receiving Binary Data
13	Analog to Digital conversion, the transmission of digital data and its conversion from digital back to analog
14	Observe different data formats
15	Open Ended Lab

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Sessional (30%)

- Quizzes
- Assignments

Mid Term (20%)

- Written (Long Questions, Short Questions, MCQs) 100%

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs) 100%

Text book:

- Modern Digital and Analog Communication Systems, by B.P Lathi

Reference book:

- Communication Systems, by Bruce Carlson
- Analog and Digital Communication, by Simon Haykin.

CSE-303: Data Communication

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = 1.0
Total = 4.0

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S. No.	CLO	Domain	Taxonomy level	PLO
1.	Describe the fundamental concepts of data communication, elements of a protocol, and the concept of seven layers of OSI Model	Cognitive	2	1
2.	Understand signals, signal encoding methods, analog to digital and digital to analog conversion	Cognitive	2	1
3.	Illustrate different multiplexing, error detection and correction techniques in data communication	Cognitive	3	2
4.	Demonstrate flow control and multiple access techniques at data link layer	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Principles underlying communication network design, including physical layer. Internet structure, Internet protocol models. Physical layer description including modulation, data transmission, line encoding schemes, pulse code modulation (PCM), digital to analog conversion and multiplexing. Data link layer services including error correction and detection, flow control including stop and wait, Go Back N, Selective repeat, error control and High level data link layer control (HDLC). MAC layer description including ALOHA, CSMA/CD, CSMA/CA, controlled access and channelization.

Lab:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Acquire knowledge related to basic TCP/IP commands	Psychomotor	1	1
2.	Implement the concepts related to data communication using MATLAB	Psychomotor	4	1

S. No.	Descriptions
1.	Basic PC Network TCP/IP Configuration
2.	Using ping and tracert command Form a Workstation
3.	Straight-Through and Cross-Over Cables Construction
4.	Study the effects of transmission impairments on a digital signal
5.	Introduction to Line coding of digital signals using Matlab.
6.	Simulation of Line Encoding Schemes in Matlab (NRZ-L & NRZ-I)
7.	Simulation of Line Encoding Schemes in Matlab (AMI & Pseudoternary)
8.	Simulation of Line Encoding Schemes in Matlab (Manchester and Diff. Manchester)
9.	Simulation of Scrambling Techniques (Part 1)
10.	Simulation of Scrambling Techniques (Part 2)
11.	Analog Signal Generation using Digital Data in Matlab (ASK,PSK, FSK)
12.	Simulation of Direct Sequence Spread Spectrum

13.	Simulation of Code Division Multiple Access
14.	Introduction to Ethereal
15.	Capturing Data Through Ethereal

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Sessional (25%)

- Quizzes 15%
- Assignments 10%

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs)

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs)

Text book:

- Data communication and Networking by Behrouz Forouzan

Reference book:

- Data and Computer Communications by William Stallings

CE-230: Hydraulics and Hydraulic Machinery

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 0	Practical = **0**
Total = 48	Total = **3.0**

Course Outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Explain the fundamental properties of water, their relationships and measurement.	Cognitive	2	1
2.	Apply various principles and laws of hydraulics to hydrostatic and hydrodynamic phenomenon.	Cognitive	3	1
3.	Estimate main operating parameters of hydraulic pumps and turbines (forces, torques, flow rates, efficiencies) for their selection for hydropower plants.	Cognitive	5	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Outline:

Introduction:
Introduction, Properties of liquids, Properties of liquids
Fluid Statics:

Static pressure due to liquids, Hydrostatic force on a plane area, Devices for measurement of static pressure

Types of Flows:

Laminar and turbulent flows of water

Energy in Steady Flow:

Energy of flowing water, Bernoulli's Equation

Fluid Flow Measurement:

Orifices, Notches, Weirs

Momentum and Forces in Fluid Flow:

Pressure due to jet of water on flat plate, pressure on fixed curved vanes, Flow over a radial vane, jet propulsion

Hydraulic Machinery – Turbines:

Classification of turbines, reaction and impulse turbines, Specific speed of turbines, the governing of turbines, Pelton wheel and Francis turbine, Velocity of Pressure Waves, Hammer pressure, Valve opening and closing

Hydraulic Machinery – Pumps:

Axial flow and Centrifugal pumps, head developed by pumps, Performance characteristics at constant and different speeds and sizes, Specific Speed, Selection of pumps, pump installations

Teaching Methodology

- Lecturing
- Written Assignments
- Written Quizzes
- Videos

Assessment

Mid Term (25%)

- Written (Short & Long Questions) 100%

Final Term (50%)

- Written (Short & Long Questions) 100%

Sessional (25%)

- Assignments 20%
- Quizzes 40%
- Attendance 40%

Text & Reference Books:

1. Finnemore E.J. and Franzini J. B. (2011). Fluid Mechanics with Engineering Applications, 10th Edition. McGraw Hill Education [ISBN-13: 978-0072432022 ISBN-10: 0072432020]
2. E.H. Lewitt (1963). Hydraulics and Fluid Mechanics, 10th Edition. Sir Isaac Pitman & Sons.
3. Bansal R.K. (2010). A Textbook of Fluid Mechanics and Hydraulic Machines 9th Revised Edition SI Units. Laxmi Publication (P) Ltd, New Delhi-110002

EE-205: Power Generation

Contact Hours:	**Credit Hours**
Theory =48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Discuss** switches in power electronic circuits, Linear and Switch Mode Operations. Also discuss power, voltage, and current computations for different power electronic circuits.	Cognitive	2	1
2.	**Discuss** power electronic circuits for application in controlled rectification, and a dc-dc conversion	Cognitive	2	2
3.	**Design** power electronic circuits for application in inversion and ac-ac conversion.	Cognitive	5	3
4.	**Analyze** power electronics devices and circuits in applications like Power Supplies and Protection.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Teamwork:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

POWER SEMICONDUCTOR DEVICES: Power Diode, Thyristor and its triggering circuits, TRIAC, Gate Turn off Thyristor, Power BJT, Power MOSFET, and Insulated Gate Bipolar Transistor (IGBT).

CONVERTER CIRCUITS

AC-DC Converters (Rectifying circuits): Circuit nomenclature, commutating diode. Single-phase half-wave (or single way). Bi-phase half-wave (or single-way). Single-phase bridge (or double way). Three-phase half-wave (or single-way), and Three-phase bridge (or double-way) circuits.

DC-DC Converters (Choppers): Principle of Switched Mode Power Supplies (SMPS), Step-down or buck (forward) converter. Step-up or boost (fly-back) converter, and Buck-boost converter, High-frequency resonant converter.
DC-AC Converters (Inverters): Single-phase half-bridge inverter. Single-phase bridge inverter. Three-phase inverters, Voltage control of inverters.

AC-AC Converters
a) AC Voltage Controllers: Single-phase regulation with resistive and inductive loads. Regulation by tapped transformer.
b) Cyclo-converters: Principle of Operation, Single-phase to single-phase cyclo-converter. Three-phase half wave cyclo-converter.

PROTECTION: Voltage and current protection of power electronic switches, Reduction of switching losses using snubbers.

Teaching Methodology

- Lectures
- Written Materials

Assessment

Sessional (20 %)

- Assignments (50 %)
- Quizzes (50 %)

Mid Term (20 %)

Final Term (60%)

Textbooks:

3. Power Electronics by C. W. Lander (3rd Edition)
4. Power Electronics by Daniel Hart (1st Edition)

Reference Books.

3. Power Electronics —Circuits, devices, and applications by M.H. Rashid.
4. Power Electronics —Devices, Drives, and Applications by B.W. Williams

EE-312: Signals& Systems

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S. No.	CLO	Domain	Taxonomy level	PLO
1	Express the concepts of signals and systems and their different types which can be used in a wide variety of disciplines in engineering.	Cognitive	2	1
2	Identify and report system properties such as causality, stability, linearity, and time invariance etc.	Cognitive	3	1
3	Apply the convolution sum/convolution integral formulas to determine the output of continuous time/discrete time systems.	Cognitive	3	2
4	Analyze continuous and discrete time signals and systems in the time/frequency-domain using Fourier and Laplace Transforms.	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Fundamental Concepts of Signals & Systems, Signals and Their Classification, Basic Continuous and Discrete Time Signals, Operations on Signals, Systems and Classification of Systems, Interconnections of Systems, Linear Time-invariant systems: convolution integral for continuous-time systems; convolution sum for discrete-time systems; properties of linear time-invariant systems; systems described by differential and difference equations. Fourier Series Representation of Periodic Signals: sinusoidal steady-state response; representation of periodic signals by trigonometric series; properties of continuous-time Fourier series; discrete-time Fourier series and its properties; continuous and discrete-time filtering. The Continuous-time Fourier Transform: definition of the Fourier transform and its inverse; properties of the transform; common transform pairs; convolution and multiplication theorems. The Discrete-Time Fourier Transform: definition and properties; convolution theorem; frequency response corresponding to difference equations. Laplace Transform; definition; region of convergence; properties; analysis of LTI systems; solution of differential equations, The Unilateral Laplace Transform.

Lab:

S. No.	New Proposed CLOs	Domain	Taxonomy level	PLO
1	Recognize basic concepts of programming in MATLAB, knowledge of handling matrices and use of built-in functions to perform assigned task.	Psychomotor	1	5
2	Produce signals and execute different transforms.	Psychomotor	4	5
3	Demonstrate use of simulink for filter design.	Psychomotor	4	5

S. No.	**Practicals Description / Titles**
1	Getting started with MATLAB
2	Introduction to Matrix , Programming in MATLAB
3	Plotting continuous time signals
4	Plotting of Oscillatory functions
5	Plotting Discrete time signals.
6	Plotting Piece wise signals.
7	Time Transformation of signals in MATLAB.
8	Differentiation in MATLAB, Integration in MATLAB, Solving Differential Equations

9	Continuous time Convolution in MATLAB Discrete time Convolution in MATLAB
10	Fourier series in MATLAB. Fourier Transform and Inverse Fourier Transform in MATLAB.
11	Implementation of Laplace Transform Implementation of Z Transform.
12	Introduction to Simulink.
13	Obtaining step response of given transfer function in MATLAB.
14	Designing different types of Filters in MATLAB.
15	Using "FVTOOL" to determine a) Magnitude response b) Phase response c) Pole-zero plot d) Impulse Response e) Step Response f) To find the impulse response from a given difference equation.
16	a) To find the impulse response from a given difference equation. b) Determining the step response c) Determining the stability of a system

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Sessional (25%)

- Quizzes 60%
- Assignments 40%

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs) 100%

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs) 100%

Text book:

Signals and Systems, 2nd edition, by Alan V. Oppenheim and Alan S. Willsky

Reference book:

Signals, Systems, and Transforms by Charles L. Phillips

EE-286: Technical Report Writing

Contact Hours:
Theory =48
Practical = 0
Total = 48

Credit Hours:
Theory = **3.0**
Practical = 0
Total = 3.0

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand the basics of technical report writing.	Affective	3	10,12
2.	Use correct English and comprehend complex English language and have skill to avoid commonly made errors in technical writing.	Affective	2	10,12
3.	Gain skill to use effective technical writing in Précis, Letters, Proposals, Reports, Thesis.	Affective	3	9,10,12

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☑
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☑

Course outline:

1. Words and Phrases
A brief history of words, Dictionary of Thesaurus, Elements of Style

2. Sentence Construction
Introduction, Guidelines for Effectiveness

3. Paragraph Development
Introduction, Central Components of a Paragraph, Length, Techniques for Paragraph Development

4. The Art of Condensation
Introduction, Steps to Effective Précis Writing, Samples, Guidelines

5. Reading Comprehension
Introduction, Purpose of Reading, Reading Rates, Reasons for Poor Comprehension, Improving Comprehension Skills, Techniques for Good, Comprehension, Worked Out Sample Passages

6. Business Letters
Business letters, Memos, E-mails

7. Reports
Introduction, Objectives, Characteristics of a Report, Types of Reports, The Importance of Reports, Formats, Prewriting, Structure of Reports, Writing the Report, Revising, Editing, and Proofreading, Samples Exercises

8. Technical Proposals
Definition Purposes, Types, Characteristics, Elements of Structure, Style and Appearance, Evaluation

9. Research Paper, Dissertation, and Thesis
Introduction to Research Paper, Dissertation, Thesis

Teaching Methodology

- Lecturing
- Written Assignments
- Report Writing

Assessment

Mid Term (40%)

- Written (Long Questions, Short Questions, MCQs) 50%
- Presentation 20%
- Assignments 20%
- Report Writing 10%

Final Term (60%)

- Written (Long Questions, Short Questions, MCQs) 50%
- Presentation 20%
- Assignments 20%
- Report Writing 10%

Text book:

- Technical Communication: Principles and Communication
  Author: Meenakshi Raman and Sangeeta Sharma

Reference book:

- Basic communication skills for Technology by Andrea J. Rutherford.
  ISBN 978-8177584073

7TH SEMESTER COURSES

EE 407: High Voltage Engineering

Contact Hours:
Theory = 48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**State** the principles to generate high voltages	Cognitive	1	1
2.	**Apply** various methods to calculate and grade electrostatic fields and the mechanisms of partial discharges and breakdown of dielectrics	Cognitive	3	1
3.	**Compare and Analyze** electrical breakdown phenomena in gases, liquids and solids and relate principles of application of these materials to the design of high voltage insulation	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Basic concept, physics of electrical insulation, basic insulating materials, dielectric properties, ionization processes, arc formation, breakdown phenomena in gases, liquid and solid dielectrics, tracking, treeing, streamers, high voltage measurement techniques, instrumentation used: potential dividers, current limiting resistances, air gaps, high voltage testing, wet and dry withstand tests, BIL, HVAC, HVDC and impulse testing of insulation, Cascade transformers, impulse generators, voltage doublers, dielectric measurements, non- destructive testing, over voltages, surge voltage and lightning strokes, traveling waves, arcing grounds, insulation coordination, insulators under polluted conditions.

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	**Discuss** knowledge of High Voltage Lab Equipment, Safety Procedures Etc.	Cognitive	2	1
2.	**Operate under supervision** different type of Tests on Insulation Materials	Psychomotor	3	4
3.	**Practice** basic High Voltage Test Bench/ Setup and investigate effect of different changes on the outcome	Psychomotor	3	4

List of Experiments:

S. No.	Descriptions
1.	AC High Voltage Characteristics of uniform field using Rogowski profile
2.	DC High Voltage Characteristics of uniform field using Rogowski Profile
3.	AC High Voltage Characteristics of uniform field using spherical Electrodes
4.	DC High Voltage Characteristics of uniform field using spherical Electrodes
5.	Solid Insulation testing using HVDC
6.	Solid Insulation testing using HVAC
7.	Transformer Oil Testing
8.	HVDC Characteristics of non-uniform field (Positive point Corona)

9.	HVDC Characteristics of non-uniform field (Negative point Corona)
10.	HVAC Characteristics of non-uniform fields (Positive point corona)
11.	HVAC Characteristics of non-uniform fields (Negative point corona)
12.	Commercial Testing of Cable
13.	Study of Vande-Graff Generator
14.	Study of Impulse Generator
15.	Impulse Voltage testing of Solid Insulation

Teaching Methodology

- Lectures
- Written Materials
- Presentation Slides

Assessment

Sessional (25 %)

- Class Participation (20 %)
- Assignments (40 %)
- Quizzes (40 %)

Mid Term (25 %)

- MCQ's
- Definitions
- Short Questions
- Long Questions
- Scenario Based Problems

Final Term (50%)

- MCQ's
- Short Questions
- Long Questions
- Numerical Problems

Text Books:

1. High Voltage Engineering by Kuffel and Zaengle
2. High Voltage Testing, Measurement and Design by Pearman and Gallagher

Reference Books:

1. High Voltage Engineering by Prof. DR. M. Naeem Arbab

EE-403: Power System Analysis

Contact Hours:
Theory = 48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Discuss** different power system terminologies and per unit systems.	Cognitive	2	1
2.	**Analyze** symmetrical faults, admittance matrix formation, and load flow problems in power System.	Cognitive	4	2
3.	**Analyze** different types of unsymmetrical faults in power systems using symmetrical component method.	Cognitive	4	2
4.	Apply stability equation, swing equation and equal area criteria to power systems.	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Teamwork:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Basic concept, components of electric power system, line diagram, reactance diagrams, per unit system, active and reactive power, power circle diagrams, Zbus and Ybus matrices, formation of bus equations, ABCD parameters, synchronous reactance, two reactance theory, transient and sub-transient reactances, concept of rotor angle, modified vector diagram of power system, fault analysis, symmetrical and un-symmetrical faults, positive, negative and zero sequence quantities, calculation of fault currents and short circuit MVA, load flow analysis, Gauss-Seidel and Newton-Raphson method, power system stability studies, equal area criterion, swing equation and machine constants.

Teaching Methodology

- Lectures
- Written Materials
- Presentation Slides

Assessment

Sessional (20 %)

- Assignments (50 %)
- Quizzes (50 %)

Mid Term (20 %)

Final Term (60%)

Textbooks:

1. Power System Analysis, by Grainger and Stevenson
2. Power Systems by William D. Stevenson

Reference Books:

1. Power System Analysis by Hadi Saadat

EE-403L: Power System Analysis Lab

Contact Hours: **Credit Hours:**

Practical = 48 Practical = 1.0

Course Outcome:

Upon successful completion, the student will be able to:

Sr. No.	CLO	Domain	Taxonomy level	PLO
1.	**Demonstrate** the fundamentals of power systems analysis and the components for power systems modeling, Line and Phase currents and voltages of a transformer.	Cognitive	3	1
2.	**Perform** experiments of active and reactive power in a large power system, symmetrical and unsymmetrical faults in power systems transmission line.	Psychomotor	5	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Sr. No.	Experiments	CLO
1	Introduction to Power System Laboratory	
2	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during No-Load Condition • Transformer equivalent circuit diagram	1

	• Multi-phase transformer operating with no load and with a short-circuited secondary • Multi-phase transformer with resistive, inductive, and capacitive loads • Parallel operation of multi-phase transformers • Current distribution for different vector groups • Determining zero impedance • Investigation of the transformation ratio	
3	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during Short Circuit Condition	1
4	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during Resistive Load Condition • Both Primary and Secondary side • Losses/faults • Effects	1
5	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during Inductive Load Condition • Both Primary and Secondary side • Losses/faults • Effects	1
6	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during Capacitive Load Condition • Both Primary and Secondary side • Losses/faults • Effects	1
7	Investigation of Line Voltage, Phase Voltage, Line Current, Phase Current, Power Factor, Active Power, Reactive Power and Apparent Power of 3-phase transformer during Asymmetric Load Condition • Both Primary and Secondary side • Losses/faults • Effects	1
8	Investigation of a transformer Protection • Over Current Time • Differential	
9	Investigating three-phase overhead power line • Characteristic parameters of lines	2

	• Line operation under no-load • Line operation during matching • Line operation during symmetric short circuit • Line operation under different load types (resistive, inductive) • Transmission losses, efficiency • Reactive power compensation (parallel and series mode)	
10	Investigating three-phase overhead power line parallel connection • Power and current distribution in the case of parallel lines of equal length • Power and current distribution in the case of parallel lines of unequal length • Power and current distribution in the case of series-connected lines of equal length • Power and current distribution in the case of series-connected lines of unequal length • Load distribution, power flow • Voltage distribution • Quantitative and qualitative assessments of operational relationships	2
11	Investigating three-phase overhead power line series connection • Power and current distribution in the case of parallel lines of equal length • Power and current distribution in the case of parallel lines of unequal length • Power and current distribution in the case of series-connected lines of equal length • Power and current distribution in the case of series-connected lines of unequal length • Load distribution, power flow • Voltage distribution • Quantitative and qualitative assessments of operational relationships	2
12	Investigation of Line with earth fault compensation • Characteristic parameters of lines during asymmetric operation • Symmetric short circuits • Asymmetric short circuits • Neutral-point connection method • Earth fault compensation	2
13	Investigation of Transmission systems with a synchronous generator isolated operation • Interaction between a three-phase, multi-function machine as a synchronous generator and a line model during operation in	2

	isolated mode • Isolated operation with the line model under no load • Isolated operation involving supply for various types of load	
14	Investigation of Transmission systems with a synchronous generator parallel operation • Manual network synchronization of the generator with the connected line model • Parallel operation of a generator and line with the network • Power and current distribution in a network fed by a generator	2
15	Investigation of Synchronization of different Generating stations	
16	Open-Ended Lab Investigation of a transformer and/or Transmission Line at different specified Resistive, Capacitive, and Inductive Load.	

Assessment:
Rubrics Based Assessment

- **Sessional (20 %)**
- **Mid Term (20 %)**
- **Final Term (60%)**

EE-496: Computer Networks

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = 1.0
Total = 4.0

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand and describe fundamental concepts of communication protocols and layered network architectures, especially information related to TCP/IP architecture	Cognitive	2	1
2.	Recognize different internetworking devices and their functions within a network	Cognitive	2	1
3.	Discuss features, services and operations of various network and transport layer protocols of communication stack.	Cognitive	2	2
4.	Analyze operations of different routing protocols	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Layered architectures (Internet and the OSI Reference Model), Overview of networking and communication software (Sockets), Standards in networks access protocols (CSMA, etc.), Architectures and control algorithms of local-area, point-to-point, and mobile networks, Models of network interconnection, Design issues and protocols in the data link, network, and transport layers. Packet-Switched Networks, Switching and Forwarding, Bridges and LAN Switches, Internetworking, Internet Protocol (IP), Unicast and Multicast Routing, Global Internet, End-to-End Protocols, UDP and TCP.

Lab:

Ser	LO	Domain	Taxonomy level	PLO
1.	Identify and describe the function of common networking devices	Psychomotor	1	1
2.	Construct different networking scenarios with help of simulation software	Psychomotor	3	5
3.	Develop troubleshooting and diagnostic skills for common networking issues	Psychomotor	3	4

S. No.	Descriptions
1.	Networking Basics
2.	Network Basic commands
3.	Cable construction
4.	IP Addressing
5.	Introduction to Cisco Packet Tracer
6.	Building a switched based Local Area Network (LAN)
7.	Interconnecting two different Local Area Networks
8.	Subnetting a network using VLSM
9.	Connecting to a Router
10.	Introduction to interface configuration
11.	Static routing and RIP

12.	Introduction to OPNET
13.	Utilizing Bus topology in OPNET
14.	Creating a network with Subnets in OPNET
15.	Simulation of Link state algorithm (OSPF) in OPNET

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs)

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs)

Sessional (25%)

- Assignments (10%), Quiz (15%)

Text book:

- TCP/IP Protocol Suite by Behrouz A. Forouzan, 4th Edition.

Reference book:

- Computer Networks: A Systems Approach, 3rd Edition by Larry Peterson, Bruce Davie, Morgan Kaufman Publishers
- Computer Networks, 3rd edition by Andrew S. Tannenbaum
- Computer Networks Top Down Approach by Kurose

EE-413: Digital signal Processing

Contact Hours:
Theory = 48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Identify the signals and systems	Cognitive	1	1
2.	Apply the principles of discrete-time signal analysis to perform various signal operations	Cognitive	2	2
3.	Apply the principles of z-transforms to finite difference equations	Cognitive	2	1
4.	Apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems	Cognitive	3	2
5.	Apply the principles of signal analysis to filtering	Cognitive	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z-transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

Lab:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Produce and process signals in time domain i.e. Sampling, quantization, convolution, correlation in MATLAB.	Psychomotor	2	1
2.	Model FIR and IIR filters to meet specific requirements using MATLAB	Psychomotor	3	2
3.	Design of Filters for imagery auditory and stationary signals.	Psychomotor	4	3

S. No.	Descriptions
1.	Introduction to MATLAB
2.	Basic Signal Processing Methodology and Technique
3.	Sampling and Aliasing
4.	Convolution and Moving Average Filter
5.	Z-Transform and Discrete Fourier Transform
6.	Filter Implementation Using MATLAB
7.	IIR Filter Design
8.	FIR Filter Design
9.	Analog Filtering via Digital Filter
10.	Flip and Slide Convolution & Frequency Response

11.	Power Spectrum for Random Signals
12.	FFT Algorithm & High Speed (Block) Convolution
13.	Audio Processing using MATLAB
14.	Audio Processing using MATLAB- Continued
15.	Image Processing using MATLAB
16.	Image Processing using MATLAB- Continued

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Sessional (25%)

- Quizzes 15%
- Assignments 10%

Mid Term (25%)

- Written (Long Questions, Short Questions, MCQs)

Final Term (50%)

- Written (Long Questions, Short Questions, MCQs)

Text book:

- Digital Signal Processing by J. P. Proakis and D. G. Manolakis.

Reference book:

- Discrete Time Signal Processing By Alan V. Oppenheim, Ronald W. Schafer, John R. Buck

EE-440: Electrical Machines

Contact Hours:	**Credit Hours:**
Theory =48	Theory = **3.0**
Practical = 48	Practical = **1.0**
Total = 96	Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Explain the fundamental theories related to Electromagnetic circuits applied to Electric Machines: motors, generators and transformers.	Cognitive	2	1
2.	Explain the construction, working principles, characteristics and equivalent circuit of three phase transformers, synchronous machines.	Cognitive	2	1
3.	Illustrate different types of test to calculate losses, efficiency, voltage regulation and selection of Transformer, DC machines and AC machines.	Cognitive	3	2
4.	Compare voltage-current characteristics, commutation of DC generators, torque speed characteristics and speed regulation of DC-AC motors.	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐

4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Magnetic Circuit: Magnetic units and relationships, composite magnetic circuit, magnetic leakage and fringing, hysteresis, current-ring theory of magnetism, minimum volume of magnet, load line of magnet, long solenoid, magnetic pull, force between current-carrying conductors.

Direct Current Machines: Ring-wound and drum-wound armature, commutator, lap and wave windings, e.m.f. equation, armature reaction, commutation. Methods of excitation, speed and torque characteristics, starting, speed control by rheostats and thyristors.

Direct Current Generators: Armature and field connections, open-circuit characteristic, load characteristics of shunt, compound and separately excited generators.

Transformers: Principle of action, e.m.f. equation, useful and leakage fluxes, leakage reactance, equivalent circuits, voltage regulation, losses and efficiency, open-circuit and short-circuit tests, three-phase transformer, auto-transformer, current transformer, and magnetizing current waveform.

A.C. Synchronous Machine Windings: Construction of salient-pole and cylindrical-rotor types, stator windings, e.m.f. Equation, distribution and pitch factors, resultant magnetic flux due to two-phase and three-phase currents, synchronous speed, reversal of direction of rotation of magnetic flux.

Characteristics of A.C. Synchronous Machines: Armature reaction in synchronous generator, voltage regulation, synchronous impedance, introduction to synchronizing and parallel. operation of synchronous generators, synchronous motor, effects of varying load and excitation, starting.

Three-Phase Induction Motors: Principal of action, relationship between slip and rotor I2R loss, torque/slip characteristics, speed control of motor having slip-ring rotor, starting of motor having cage rotor.

Single-Phase Motors: Construction and working principal of single-phase motor, capacitor' motors, shaded pole motors, Universal motors, Reluctance motor, Hysteresis motors.

Teaching Methodology

- Lecturing
- Written Assignments
- Quizzes

- Written exams

Assessment

Sessional (25%)

- Assignments 10%
- Quizzes 10%
- Attendance 5%

Mid Term (25%)

- Written (Long Questions, Short Questions)

Final Term (50%)

- Written (Long Questions, Short Questions)

Text book:

- Electric Machinery Fundamentals 2nd edition, by Stephen J. Chapman
- Electrical Technology by Hughes 8th edition.

Reference book:

- Electrical Machines, by Hindmarsh
- Electrical Technology by B.L Theraja.
-

Lab Learning Outcome:

Ser	LO	Domain	Taxonomy level	PLO
1.	To **follow** safety instruction and SOPs for the conduction, operation and practice of the experiment according to the Lab Rubrics To **observe** various parts of the Electric Machines and their operation according to the Lab Rubrics	Affective	2	1
2.	To **Demonstrate** and **explain** the basic theory, objective and the circuit diagram of the experiment according to the weekly plan. Similarly, weekly assessment of the Rubric base technical Lab Report of the students	Cognitive	3	2

3.	To **operate under supervision** to investigate and analyze various electrical characteristics of DC/AC Machines under consideration. Rubric base assessment and evaluation by Lab examination	Psychomotor	3	4

List of experiments

1.	Introduction to Electrical Machines Lab
2.	To study basic parts of DC Machines
3.	To study no load magnetization curves of separately excited DC Generator
4.	To study no load magnetization curves of self-excited shunt wound DC Generator
5.	Speed control of shunt wound DC motor (CLO-3, PLO-4)
6.	To study speed vs. applied load characteristics of compound wound DC motor
7.	To study basic parts of AC machines
8.	To perform open and short circuit test on single phase transformer
9.	To connect three phase transformer in various configuration
10.	To start induction motor by resistance starting method
11.	To start induction motor by star-delta starting method
12.	No load magnetization curves of synchronous generator
13.	To study the V curves of synchronous motor

14.	Inverter base H-bridge drive of induction motor
15.	Inverter base 3-phase and 4-phase drive of stepper motor
16.	Introduction to rotary converter

Grading Policy:

- Lab Performance (30%)
- Lab Reports (30%)
- Lab Examination (40%)

EE-463: Microwave Engineering

Contact Hours:
Theory =48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = 1.0
Total = 4.0

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.No	CLO	Domain	Taxonomy level	PLO
1.	Explain the Phenomenon and characteristics of Electromagnetic wave propagation in guided and unguided media	Cognitive	2	1
2.	Calculate transmission line parameters using transmission line theory	Cognitive	3	2
3.	Explain TEM, TE and TM modes propagation through transmission lines and waveguides	Cognitive	2	1
4.	Analyze the effect of mismatch of generator and load with transmission line on power transmission and select the appropriate impedance matching circuit	Cognitive	4	3

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Introduction to microwave engineering, Maxwell's equation, fields in media and boundary conditions, the wave equation, general plane solutions, plane wave reflection from a media interface, oblique incidence at a dielectric interface, image theory, transmission line theory, the lumped element circuit model for a transmission line, field analysis of transmission lines, the terminated lossless transmission line, the smith chart, the quarter wave transformer, generator and load mismatches, lossy transmission lines, transmission lines and waveguides, general solutions for TEM, TE and TM waves, parallel plate waveguide, rectangular waveguide, coaxial line, strip line, micro strip, wave velocities and dispersion, microwave network analysis, impedance and equivalent voltages and currents, impedance and admittance matrices, the scattering matrix, the transmission (ABCD) matrix, impedance matching and tuning, matching with lumped elements, single stub tuning, double stub tuning, the quarter-wave transformer, the theory of small reflections, multi section transformers, tapered line.

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Sessional (20%)
Assignments (10%), Quiz (10%)

Mid Term (20%)
Written (Long Questions, Short Questions, MCQs)

Final Term (60%)
Written (Long Questions, Short Questions, MCQs)

Text book:

- David M. Pozar, "Microwave Engineering", 4th Edition by Wiley

Reference book:

- Robert E. Collins "Foundations for Microwave Engineering", 2nd Edition by Wiley

Lab Outcomes:

Upon successful completion of this lab course, the student will be able to:

S.No	LO	Domain	Taxonomy level	PLO
1.	Demonstrate working principle of microwave devices and their practical use.	Psychomotor	4	1
2.	Measure the behavior of passive microwave devices using microwave waveguide bench.	Psychomotor	3	2
3.	Analyze a typical microwave system for impedance matching behavior.	Psychomotor	3	2
4.	Use modern EM tool for modeling and simulation of microwave components.	Psychomotor	4	5

List of Labs

S.No	Description
16.	Introduction of a Microwave Waveguide Bench
17.	Measurement of source frequency
18.	Measurement of source wavelength.
19.	Measurement of Voltage Standing Wave ratio (VSWR)
20.	Measurement of Diode detector Law
21.	Measurement of unknown load impedance
22.	Measurement of impedance mismatching and use of tuning/matching circuit
23.	Horn Antenna investigations
24.	Use of Directional Coupler in power transmission and reflective measurements
25.	Series, Shunt and Hybrid T Junctions
26.	Waveguide to coaxial transformers
27.	Microwave Radio Link investigations
28.	Introduction to ADS (Advance Design System) or SimSmith
29.	Design and simulation of Single Stub tuner in ADS/SimSmith
30.	Design and Simulation of Double Stub Tuner ADS/SimSmith

Teaching Methodology

- Lecturing
- Lab Demonstration

Assessment

- Lab Demonstration (20 %)
- Lab Test (20 %)
- Lab Report (20 %)
- Final Viva (40 %)

8TH SEMESTER COURSES

EE-481: Control Systems

Contact Hours:
Theory = 48
Practical = 48
Total = 96

Credit Hours:
Theory = **3.0**
Practical = **1.0**
Total = **4.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Acquire sufficient knowledge to mathematically **Model** the behavior of different physical systems	Cognitive	3	1
2.	**Analyze** the behavior of system using mathematical techniques	Cognitive	4	2
3.	**Design** controllers to meet the specified control design objectives such as faster transient response and smaller steady state errors while ensuring system stability.	Cognitive	5	3
4.	Use **Modern Tools** for system modeling, analysis, design validation and performance comparison of different types of controllers.	Cognitive	6	5

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

I. **Systems and their models, dynamic response** (4 weeks)
Modeling examples, differential equations, impulse response, transfer functions, poles and zeros, feedback.

II. **Root locus design** (4 weeks) Evans' root locus method, dynamic compensation.

III. **Frequency response design** (4 weeks)
Bode plots, Nyquist stability criterion.

IV. **State space design** (4 weeks)
Introduction to modern control, linear pole placement, estimator design, LQR.

Lab Learning Outcome:

Ser	LO	Domain	Taxonomy level	PLO
1.	To **Demonstrate** the operation of servo motor in open loop and in close loop to control the speed and precise position of the various plants**.** To **follow** safety instruction and SOPs for the conduction, operation and practice of the experiment according to the Lab Rubrics	Cognitive	2	1
2.	To **operate under supervision** and to implement P, PI, PD and PID controller for Magnetic levitation System, Inverted pendulum and twin rotor MIMO system. Similarly, weekly assessment of the Rubric base technical Lab Report of the students	Psychomotor	3	4
3.	To express the knowledge of Matlab-Simulink to model and **Design** various controllers in time and frequency domain to meet the specified **control** design objectives.	Psychomotor	7	3

S. No.	**Descriptions**

31.	Introduction to Matlab Basics in Control System Engineering
32.	To study Op-Amp as a summer and gain controller
33.	To study speed vs input voltage of armature controlled DC motor in open loop
34.	To study speed vs input voltage of armature controlled DC motor in close loop with increased gain
35.	To study speed vs applied torque of armature controlled DC motor in open loop
36.	To study speed vs applied torque of armature controlled DC motor in close loop with increased gain
37.	To study Automatic position control system in closed loop with variable gain (P compensation)
38.	To study the effect of velocity feedback on position control system (PD compensation)
39.	System Modeling and Analysis of antenna azimuth position control in time domain and frequency domain using MATLAB-Simulink.
40.	Step response of various second order system in Matlab Simulink
41.	PID position control on analogue servo fundamental trainer
42.	P/PI/PD/PID position control on Digital servo fundamental trainer
43.	PD/PID Compensator for Position Control on Magnetic Levitation System.
44.	PI/PID Compensator for Trajectory following on Twin rotor MIMO System, with One and Two Degrees of Freedom.
45.	PID stabilization of Inverted pendulum with reference input. PID Control for reference tracking of Inverted Pendulum in Crane Configuration.
46.	PI, PD and PID compensator design in Matlab-Simulink

Grading Policy:

- Lab Performance (25%)
- Lab Reports (25%)
- Open ended lab (10%)
- Lab Examination (40%)

Teaching Methodology

- Assignments for reinforcement of concepts and supplementing the lectures
- Quizzes and Exams for assessment.

Grading Policy

Mid Term (25%)

- Written (Long Questions, Short Questions) 100%

Final Term (50%)

- Written (Long Questions, Short Questions) 100%

Sessional (25%)

- Assignments 20%
- Quizzes 80%

Text book:

- Norman S. Nise, "Control Systems Engineering", seventh edition.

Reference book:

- Franklin, Powell and Emami-Naeini, "Feedback Control of Dynamic Systems", seventh edition.

EE-495: Mobile Networks

Contact Hours:
Theory = 48
Practical = 0
Total = 48

Credit Hours:
Theory = **3.0**
Practical = **0**
Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

S.no	CLO	Domain	Taxonomy level	PLO
1	Discuss features, services and operation of physical layer and data link layer in the context of Mobile networks	Cognitive	2	1
2	Understand the basic principles, techniques and architecture of 802.11 WLANs, MANETs and Bluetooth	Cognitive	2	1
3	Describe the operation of different networks layer protocols and services in Mobile networks	Cognitive	3	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Mobile data networks,
Mobility issues in networking,
Fundamentals of mobile network architectures,
Routing schemes for mobile and nomadic hosts,
Mobile IP,
Mobile ad hoc network (MANET) protocols,
DHCP and IPv6,
Basics of Wireless Networks and Mobile Computing,
Mobility Management in Bluetooth PANs,
IEEE 802.11 Wireless LANs,
IEEE 802.15.3 Wireless PANs,
IEEE 802.16 WiMAX, GPRS,
UMTS WANs and Wireless ATM. Multiple Access Methods,
Wireless Sensor Networks,
Mobility support in DHCP and IPv6

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (40%)

- Written (Long Questions, Short Questions) 100%

Final Term (60%)

- Written (Long Questions, Short Questions) 100%

Sessionals (25%)

- Assignments 40%
- Quizzes 60%

Text book:

- Mobile Communication by Jochen Schiller

Reference book:

- Wireless Communication and Networks by William Stallings
- Ad Hoc Networking by Charls Perkins, Eddison-Wesley

EE-494: Wireless Communication

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 0	Practical = **0**
Total = 48	Total = **3.0**

Course Outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand the basic concepts of Wireless Propagation	Cognitive	2	1
2.	Explain different aspects of Wireless Communication Systems	Cognitive	2	1
3.	Analyze different components of Cellular Networks	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Outline:

Introduction to Wireless Communication Systems and Networks,

Cellular Wireless Networks and System Principles,

Antennas and Radio Propagation,

Signal Encoding and Modulation Techniques,

Coding and Error Control,

Multiple Access Techniques,

1G, 2G, 2.5G, 3Gand 4G Wireless Systems (AMPS, GSM, GPRS, EDGE, LTE, LTE Advanced),

The UMTS Network and Radio Access Technology,

Wireless LANs and IEEE 802.1x,

Small and Large Scale Fading

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Short & Long Questions) 100%

Final Term (50%)

- Written (Short & Long Questions) 100%

Sessionals (25%)

- Assignments 50%
- Quizzes 50%

Text & Reference Books:

- "Wireless Communications" by Theodore S. Rappaport
- "Wireless Communications & Networks" by William Stallings

EE 406: Power System Protection

Contact Hours:
Theory = 48
Practical = 00
Total = 48

Credit Hours:
Theory = **3.0**
Practical = **0.0**
Total = **3.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Identify** the main components and features of a protection scheme and understand how to implement this using relay	Cognitive	1	1
2.	**Apply** conventional and numerical relays to the protection of rotating machines, bus-bars, transformers and feeders	Cognitive	3	1
3.	**Perform** over-current grading and distance-protection grading studies on radial distribution and transmission networks, respectively	Cognitive	4	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Basic concept of power system security, HRC fuses, relays, EM type and solid state type relays, over current relays, impedance relays, reverse power relays, over current protection, instrument transformers, CT and PT, telemetry system, differential protection, protection of transformers, feeders, generators and bus bars, different protection schemes, circuit breakers, types, oil, air blast, SF6 circuit breakers, arc formation, physics of arc, RRRV, current chopping, protection against over voltages, surge arresters types, concept of power line carrier and its function in protection schemes

Teaching Methodology

- Lectures
- Written Materials
- Presentation Slides

Assessment

Sessional (25 %)

- Class Participation (20 %)
- Assignments (40 %)
- Quizzes (40 %)

Mid Term (25 %)

- MCQ's
- Definitions
- Short Questions
- Long Questions
- Scenario Based Problems

Final Term (50%)

- MCQ's
- Short Questions
- Long Questions
- Numerical Problems

Text Books:

1. Power System Protection & Switchgear by Badis Ram & DN. Vishwa Karma

EE-401: Power Transmission & Distribution

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 00	Practical = **0.0**
Total = 48	Total = **3.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Discuss** the importance of Electrical Power Transmission and compare various transmission systems	Cognitive	2	1
2.	**Describe** the components of a transmission system with respect to the conditions of short, medium and long lines	Cognitive	2	1
3.	**Explain** Electrical and Mechanical Design of Transmission System	Cognitive	2	1

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Prerequisite: Power Distribution and Utilization

Objectives: The course presents basics of electrical power transmission along with electrical and mechanical design impacts on power transmission in detail and HVDC transmission is introduced.

Course Outline:

Percent and per-unit quantities, selection of base and change in base of per unit quantities, node equations, one-line diagram, choice of voltage and choice of AC/DC systems, economic comparison of various transmission systems, standard voltages in Pakistan and abroad for transmission and sub-transmission. Introduction to HV, EHV and UHV system. Conductor types; resistance, skin effect, line inductance based and flux considerations. Inductance of single phase and three phase lines, inductance of composite conductor line, inductance of bundled conductors, capacitance of single phase and three-phase lines, effect of earth on capacitance, capacitance of bundled conductors, parallel circuit lines, Ferranti effect. Short, medium and long transmission lines, solution of equations. Traveling waves, surge impedance loading, equivalent circuit, power flow through the line, voltage regulation and line surges. Line supports, sag and tension calculation, total length of conductor supports at different levels, mechanical degree of safety, effect of wind pressure and ice loading, conductor vibration and use of dampers. Insulator material, types of insulators, voltage distribution over insulator string, string efficiency, methods of improving the string efficiency, testing of insulators, corona effect, corona loss, radio interference due to corona. Underground cables: types, calculation of inductance and capacitance, insulation resistance, insulation breakdown of cables, thermal characteristics of cables, calculation of current rating of the cables, fault locating techniques, cable jointing techniques. Introduction and classification of HVDC transmission.

Teaching Methodology

- Lectures
- Written Materials
- Presentation Slides

Assessment

Sessional (25 %)

- Class Participation (20 %)
- Assignments (40 %)
- Quizzes (40 %)

Mid Term (25 %)

- MCQ's
- Definitions
- Short Questions
- Long Questions

- Scenario Based Problems

Final Term (50%)

- MCQ's
- Short Questions
- Long Questions
- Numerical Problems

Text Books:

1. Stevenson, "Elements of Power System", Latest Edition.

Reference Books:

1. Grainger and Stevenson, "Power System Analysis", Latest Edition.

EE-388 Engineering Management

Contact Hours:

Theory = 32

Total = 32

Credit Hours:

Theory = **2.0**

Total = **2.0**

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**Identify** some of the basics of management, its levels, styles, responsibilities and tasks. Describe the traditional and contemporary perspectives of management	Cognitive	1	9
2.	**Know** about organizations, its environmental factors, and changes occurring in it and also about different management techniques	Cognitive	1	11
3.	**Describe** elements of planning, decision making, strategy formulation & implementation, managing new venture formation & entrepreneurship, and design of organization	Cognitive	1	7

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☐	7	Environment and Sustainability:	☑
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☑
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☑
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course outline:

Weeks	Topics
1	An introduction to management, levels of management. Basic management functions, planning and decision making, organizing, leading and controlling. Fundamental management skills and roles.
2	The evolution of management. The historical/traditional and contemporary context of management. An Integrated Frame work of management perspectives.
3	The organizations environments. External environment, General Environment and its factors, Task Environment, and its factors. Internal Environment, and its factors, Environmental change, Complexity and Uncertainty
4	Organizational Culture, Managing organizational culture. Organizational environment relationship. How organization adopt to

	their environments. The environment and organizational effectiveness. A model of organizational effectiveness.
5	The ethical and social environment of Management. Individual Ethics in Organization. Managerial Ethics. Managing ethical behavior. A guide for ethical decision making. Emerging ethical issues in Organization.
6	Social Responsibility. Arguments for and against social responsibility. Organizational Approaches to social responsibility. How business and government influence each other.
7	The global Environment. Trends in international business. Levels of international Business activity. Managing the process of globalization. Environmental challenges of international management.
Exam Week	MID TERM EXAM
8	The multicultural environment. Diversity and multiculturalism in organization. Dimension of diversity and multiculturalism, Effects of diversity and multiculturalism in organization. Managing diversity and multiculturalism organization. How diversity and multiculturalism promote competitive advantage.
9	Basic Elements of Planning and Decision Making. Organizational goals, Purpose of Goals, Kinds of Goals. Kinds of Organizational plans. Tactical plan Development and Execution. Types of Operational Planning. Contingency planning and crisis Management.
10	Managing Strategy and Strategic Planning. The nature of strategic management, its components. Types of strategic Alternatives, Strategy Formulation and Implementation using SWOT analysis, Formulating Business level Strategies, Porter's Generic Strategies, The miles and snow typology, Strategies based on the products life cycle.

11	Formulating Corporate level Strategies. Implementing Corporate Level Strategies. International and Global Strategies. Managing Diversification. Portfolio Management techniques, BCG Matrix and GE business screen method.
12	Managing Decision Making and problem solving. The nature of decision making, types of Decision. Decision Making Conditions. Rational perspective on decision making. The classical model of decision making. Steps in Rational decision making. Behavioral aspects of decision Making. The administrative model. Group and team decision Making in Organization.
13	Managing New venture formation and entrepreneurship. The nature of entrepreneurship. Strategy for interprenueral organizations. Emphasizing distinctive competencies. First-Mover advantage. Writing business plan. Structure of entrepreneurial organization.
14	Basic Elements of Organizing. Job specialization. Alternatives to specialization. Grouping Jobs; Departmentalization. Functional Departmentalization, Location Departmentalization, Product Departmentalization. Establishing reporting Relationships. Distributing Authority. Decentralization and Centralization. Coordinating Activities. Need for Coordination. Structural coordination techniques.
15	Managing Organizational Design. Bureaucratic Model. Behavioral Model. System 1, System 4. Situational influences on Organizational Design. Basic forms of Organizational Design. Functional (U Form), Conglomerate (H Form), Divisible (M Form), Matrix, Emerging issues in Organizational design, Team Organization, Virtual Organization, Learning Organization.

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (20%)

- Written (Long Questions) 100%

Final Term (50%)

- Written (Long Questions) 100%

Sessionals (30%)

- Assignments 50%
- Quizzes 50%

Textbook: Fundamentals of Management By Ricky W. Griffin (8th Edition)

EE-363: Digital Communication

Contact Hours:	**Credit Hours:**
Theory = 48	Theory = **3.0**
Practical = 00	Practical = **0.0**
Total = 48	Total = **3.0**

Course Outcome:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand the basic functionality of a digital communication system (transmitter block, receiver block, channel)	Cognitive	2	1
2.	Demonstrate knowledge about digital modulation, Analog to digital conversion, Interference, line coding, coding techniques and synchronization.	Cognitive	2	2
3.	Derive the expressions of probability of error for the performance of various modulation schemes over AWGN channel	Cognitive	3	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Week	Course/Topics
1	Digital Communications Basic Blocks, Introduction, Revision of Basic DSP Concepts
2	Sampling Theorem, Aliasing, Over Sampling, Sampling and Quantizing effects, Channel effects, Signal to Noise Ratio
3	Random Variables and Random Processes
4	Conversion of analog signals to digital signals, Pulse Code Modulation, Uniform, and Non-Uniform Quantization, Companding.
5	PCM waveform types, Line Coding, Source Coding
6	Intersymbol Interference, Pulse shaping to reduce ISI, Error Performance, Eye Patterns
7	M-ary Pulse Modulation and Demodulation, Matched Filter, Optimum Detection
	Midterm Exam
8	Error Performance, Degradation in Digital Communication Systems, Fading Channels
9	Inter-symbol interference, Pulse shaping, Equalization
10	Synchronization, Channel Estimation and Channel Equalization
11	Error performance of bandpass modulation schemes
12	Channel coding, error correction and detection
13	Linear block codes and Hamming and Cyclic codes
14	Convolutional codes, encoder structure
15	State diagram and trellis, ML decoding, Soft and hard decisions decoding using, Viterbi algorithm.

Teaching Methodology

- Lectures
- Written Materials
- Presentation Slides

Assessment

Sessional (25 %)

- Assignments (10 %)
- Quizzes (10 %)
- Complex Engineering Problem (5%)

Mid Term (25 %)

Final Term (50%)

Text Books:

- Digital Communications: Fundamentals and Applications", by Bernard Sklar, Prentice Hall, 2001, ISBN 0-13-084788-7

Reference Books:

- Communication systems engineering", by John G. Proakis and Masoud Salehi, Prentice Hall, 2002.
- "Introduction to digital communications", by Michael B. Pursley, Pearson, Prentice Hall, 2005
- "Digital communications", by Ian A. Glover and Peter M. Grant, Pearson, Prentice Hall, 2004, second edition

EE-4XX: Introduction to Machine Learning

Contact Hours:
Theory = 45
Total = 45

Credit Hours:
Theory = **3.0**
Total = **3.0**

Course outcome:

COURSE LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	Understand the fundamental concepts and techniques of machine learning	Cognitive	2	1
2.	Identify the appropriate machine learning algorithm for a given problem	Cognitive	4	3
3.	Implement machine learning algorithms using Python	Cognitive	3	5
4.	Evaluate machine learning models and select the best one for a given problem	Cognitive	6	2

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☑	8	Ethics:	☐
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☑	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

Course Description:

This course provides an introduction to the fundamental concepts and techniques of machine learning. Students will learn about the different types of machine learning algorithms, their applications, and how to implement them using Python. By the end of the course, students will have a solid understanding of the principles of machine learning and the ability to build simple machine learning models.

Prerequisites: Basic programming skills in Python and familiarity with mathematical concepts such as linear algebra, calculus, and probability.

Course Outline:

1) Introduction to Machine Learning
    - What is machine learning?
    - Types of machine learning
    - Applications of machine learning
    - Tools and technologies used in machine learning
2) Data Preparation
    - Data cleaning and preprocessing
    - Exploratory data analysis
    - Feature engineering
    - Data visualization
3) Supervised Learning
    - Classification
    - Regression
    - Decision trees
    - Random forests
    - Naive Bayes
    - Support Vector Machines (SVMs)
    - Evaluation metrics
4) Unsupervised Learning
    - Clustering
    - Dimensionality reduction
    - Principal Component Analysis (PCA)
    - K-Means clustering

5) Deep Learning

- Neural networks
- Convolutional Neural Networks (CNNs)
- Recurrent Neural Networks (RNNs)

Teaching Methodology

- Lecturing
- Written Assignments

Assessment

Mid Term (25%)

- Written (Long Questions)

Final Term (50%)

- Written (Long Questions)

Sessional (25%)

- Assignments 10%
- Quizzes 15%

Reference books:

- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
- Python Machine Learning" by Sebastian Raschka and Vahid Mirjalili

EE-478: Final Year Project

Contact Hours:
Theory = 0
Practical = 270
Total = 270

Credit **Hours:**
Theory = **0**
Practical = **6.0**
Total = **6.0**

LEARNING OUTCOMES:

Upon successful completion of the course, the student will be able to:

Ser	CLO	Domain	Taxonomy level	PLO
1.	**PLAN** the project activities to fulfill the proposed research problems	Cognitive	C4	6,8,10
2.	**MANAGE** the project plan to accomplish project objectives	Cognitive	C3	2,3,4,11
3.	**EXECUTE** the project plan	Psychomotor	P4	3,5,9
4.	**ANALYZE** project results using appropriate technique or tools	Cognitive	C4	2,7,12
5	**PRODUCE** a project report in accordance with specified standard format	Cognitive	C4	2,12
6	**PRESENT and DEFEND** the project outcomes effectively	Affective	A3	9,10

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☑
2	Problem Analysis:	☑	8	Ethics:	☑
3	Design/Development of Solutions:	☑	9	Individual and Team Work:	☑
4	Investigation:	☑	10	Communication:	☑
5	Modern Tool Usage:	☑	11	Project Management:	☑
6	The Engineer and Society:	☑	12	Lifelong Learning:	☑