University Institute of Technology

(UIT)

Silver Wood Estate, H. P. University, Shimla-171005

(NAAC Accredited "A-Grade" University)

DEPARTMENT

of

ELECTRICAL ENGINEERING

Course Structure & Syllabus

for

Bachelor of Technology

in

Electrical Engineering

Semester I - VIII

Effective for the Batch 2021-2023 and onwards

Also

Semester V-VIII

Effective for the Batch 2019-2023 and 2020-2024

Scheme of the Syllabus

Semester-I

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	AS-1001	Applied Mathematics-I	3	1	0	4	**4**	100	50
2.	IT-1011	Introduction to C Language	3	1	0	4	**4**	100	50
3.	HU-1001	Communication & Professional Skills in English	3	0	0	3	**3**	100	50
4.	EE-1001	Basic Electrical Engineering	3	1	0	4	**4**	100	50
5.	IT-1002	C Programming Lab	0	0	2	2	**1**	50	50
6.	EE-1002	Basic Electrical Engineering Lab	0	0	2	2	**1**	50	50
7.	EE-1003	Electrical Engineering Workshop	0	0	2	3	**2**	50	50
TOTAL						**22**	**19**	**550**	**350**
								Total = 900	

Semester-II

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	AS-2001	Applied Mathematics-II	3	1	0	4	**4**	100	50
2.	AS-2002	Applied Physics	3	1	0	4	**4**	100	50
3.	EC-2001	Basic Electronics	3	1	0	4	**4**	100	50
4.	ME-2001	Basic Mechanical Engineering	3	1	0	4	**4**	100	50
5.	AS-2003	Applied Physics Lab	0	0	2	2	**1**	50	50
6.	ME-2002	Engineering Graphics & Design Lab	0	0	4	4	**2**	100	50
7.	EC-2002	Basic Electronics Lab	0	0	2	2	**1**	50	50
TOTAL						**24**	**20**	**600**	**350**
								Total = 950	

Semester-III

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	EE-3001	Network Analysis and Synthesis	3	1	0	4	**3**	100	50
2.	EE-3002	Electrical and Electronic Measurements and Measuring Instruments	3	0	0	3	**3**	100	50
3.	ES-3005	Applied Mathematics – III	3	0	0	3	**3**	100	50
4.	EC-3040	Electromagnetic Field Theory	3	0	0	3	**3**	100	50
5.	EC-3002	Digital Electronics	3	0	0	3	**3**	100	50
6.	EE-3053	Electrical and Electronic Measurement Lab	0	0	2	2	**1**	50	50
7.	EE-3051	Network Analysis and Synthesis Lab	0	0	2	2	**1**	50	50
8.	EC-3052	Digital Electronics Lab	0	0	2	2	**1**	50	50
TOTAL						**22**	**18**	**650**	**400**
								Total = 1050	

Semester-IV

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	EE-4001	Electrical Machines -I	3	0	0	4	**3**	100	50
2.	EE-4002	Power Electronics	3	0	0	3	**3**	100	50
3.	EE-4003	Power Systems-I	3	0	0	3	**3**	100	50
4.	ES-4001	Numerical Methods	3	1	0	4	**4**	100	50
5.	PEE-4001	Microprocessor Architecture and Interfacing	3	1	0	4	**3**	100	50
6.	EE-4051	Electrical Machines-I Lab	0	0	2	2	**1**	50	50
7.	EE-4052	Power Electronics Lab	0	0	2	2	**1**	50	50
8.	PEE-4053	Microprocessor Architecture and Interfacing Lab	0	0	2	2	**1**	50	50
	TOTAL					**24**	**19**	**650**	**400**
								Total =1050	

Semester-V

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	CS-5011	Open Elective-01	3	1	0	4	**4**	100	50
2.	EE-5001	Electrical Machines -II	3	0	0	3	**3**	100	50
3.	EE-5002	Control Systems	3	0	0	3	**3**	100	50
4.	EE-5003	Protection and Switchgear	3	0	0	3	**3**	100	50
5.	EE-5051	Electrical Machines-II Lab	0	0	2	2	**1**	50	50
6.	EE-5052	Control Systems Lab	0	0	2	2	**1**	50	50
7.	EE-5053	Protection and Switchgear Lab	0	0	2	2	**1**	50	50
TOTAL						**19**	**16**	**550**	**350**
								Total = 900	

Semester-VI

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	IT-6020	Open Elective-02	3	1	0	4	**4**	100	50
2.	EE-6001	Power Systems Operation and Control	3	1	0	4	**4**	100	50
3.	PEE-6002	High Voltage Engineering	3	0	0	3	**3**	100	50
4.	EE-6003	Transducers and Signal Conditioning	3	0	0	3	**3**	100	50
5.	EC-5003	Digital Signal Processing	3	1	0	4	**4**	100	50
6.	EE-6061	Transducers & Signal Conditioning Lab	2	0	2	2	**1**	50	50
7.	HSMC-6001	Principles of Engineering Economics and Management	2	1	0	3	**3**	100	50
TOTAL						**19**	**22**	**650**	**350**
								Total = 1000	

Semester-VII

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext. Exam	IA
1.	PEE-7001	Program Elective-01*	3	1	0	4	**4**	100	50
2.	PEE-7002	Modern Control Systems	3	1	0	4	**4**	100	50
3.	PEE-7003	Communication Systems	3	1	0	4	**4**	100	50
4.	EE-7001	Major Project (Stage I)	0	0	6	6	**7**	250	150
5.	EC-3003	Signals and Systems	3	0	0	0	**3**	100	50
TOTAL						**18**	**22**	**650**	**350**
								Total = 1000	

Semester-VIII

Sr. No	Course Code	Course Title	L	T	P	Hrs/ Week	C	Semester End Marks	
								Ext.	IA
1.	PEE-8001	Program Elective-02*	3	0	0	3	**4**	100	50
2.	EE-8001	Major Project (Stage II)	0	0	6	4	**10**	250	150
3.	IT-8040	Open Elective-03	2	1	0	3	**3**	100	50
4.	PEE-8002	Renewable Energy Sources	3	1	0	4	**4**	100	50
5.	HSMC-8001	Organizational Behaviour	2	1	0	0	**3**	100	50
TOTAL						**14**	**24**	**650**	**350**
								Total = 1000	

Detailed Syllabus

Semester - I

Name of the Course	Applied Mathematics- I		
Course Code	AS-1001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator isallowed to use in examinations.

Course Objectives:

- To learn operations of matrices, echelon form of matrices and system of equations
- To introduce the concept of limits, continuity and maximum and minimum behavior of functions.
- To compute curl, divergence of vector fields and definite integrals

Section	Course Content
Section-A	Review of Matrices, Eigen values, Eigen vectors, Properties of Eigen values, Eigen values of Hermitian, skew-Hermitian and unitary matrices, Cayley Hamilton Theorem, Rank of matrix, Normal and Echelon form of matrix, Solutions of Homogeneous and Non-Homogeneous system of equations.
Section-B	Limit and Continuity of functions of two variables, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem, Jacobian, Taylor's and Maclaurin's infinite series, Maxima and minima of functions of two variables
Section-C	Double Integrals and Triple integrals (Cartesian and Polar Forms), Change of Order of Integration, Change of Variables, Applications of Double and Triple Integrals to find area and volume, Beta and Gamma functions
Section-D	Differentiation of vectors, Scalar and Vector point functions, Vector Operator 'Del', Gradient, Divergence, Curl and their Geometrical Interpretations, Del applied twice to point function, Del applied to product of point functions, Directional Derivative, Irrotational and Solenoidal Fields, Tangential Line Integral, Normal Surface Integral, Volume integrals.

Course Outcomes:

CO1: Perform matrix operations of addition, multiplication and solve system of linear equations.
CO2: Learn about the basic principle of calculus.
CO3: Calculate directional derivatives, gradient of vectors and understand their geometrical significance.
CO4: Students will be able to find maxima and minima functions of two variables.

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal: KhannaPublishers.
2. Engineering Mathematics (2ndedition): Vol-I and Vol-II, S. S. Shastri, Prentice Hall ofIndia.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig, John Wiley & Sons.
2. Differential and Integral Calculus: N. Piskunov,CBSPublishers.
3. Advanced Engineering Mathematics: R. K. Jain & S. R. K. Iyengar,NarosaPublicationHouse.
4. Advanced Engineering Mathematics: Michael D. Greenberg: PearsonEducation.

Name of the Course	Introduction to C Language		
Course Code	IT-1011	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- To introduce the concept of computer fundamentals and computer programming
- To enable the student to design algorithms
- To enable the students to understand "C" language and its application in problem solving.

Section	Course Content
Section-A	Problem solving with Computers: Algorithms, pseudo codes and Flowcharts.Overview of C Programming: Structure of C program, character set, keywords & identifiers, Data types, Constants, variables, expressions (arithmetic and logical), typedef, enum Operators: Arithmetic, relational, logical, bitwise, conditional and modulus operator, operator's precedence & associativity, preprocessors statements, data inputs and output functions, assignments statements.
Section-B	Conditional statements: If-else, nested if-else, switch case statement Control statements: for loop, while loop, do-while, nested loops, jump control statements: break, continue, goto, exit, return. Functions: Declaration of functions, definition of functions, calling of functions, call by value and call by reference
Section-C	Arrays: One dimensional arrays,–Declaration of 1D arrays –Initialization of 1D arrays –Accessing element of 1D arrays –Reading and displaying elements – Two dimensional arrays –Declaration of 2D arrays –Initialization of 2D arrays –Accessing element of 2D arrays –Reading and displaying elements. Storage classes, recursion. Strings versus character arrays:–Initializing strings, Reading strings, displaying string, String-handling functions.
Section-D	Pointer Concepts: Need of Pointers, Integer & Character pointers, array and functions, Array & pointers, function & pointers, Parameter passing by reference. Structure & Union: Definition of Structure & union, Structure & Pointers, Nesting of Structures, Structure and arrays, Arrays of pointer to structures

	Files Concepts in C: Using files in C, Buffer and streams, working with text files and Binary Files, file operations using standard library and system calls, File management I/O functions, Random Access Files Reading, Writing text and binary files.

Course Outcomes:

CO1: Know the basic components of the computer and working of each device.
CO2: Design algorithms and flowcharts.
CO3: Understand the fundamentals of C programming.
CO4: Use suitable data structure for problem solving.

Text Books:

1. Kanetkar, "Let us C", BPB Publications
2. E. Balaguruswamy, "Programming in C", Tata McGraw Hill

Reference Books:

1. V Rajaraman "Fundamentals of Computers"
2. D.Dromey, "How to Solve it by Computers" (Prentice Hall)
3. Richie and Kerningham, "C Programming"

Name of the Course	Communication & Professional Skills in English		
Course Code	**HU-1001**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To develop independent perspective through critical thinking.
- To communicate their perspective in clear and correctly articulated language through LSRW skills.
- To instil a lifelong habit of language learning.

Section	Course Content
Section-A	**Reading Skills:** The skill of effective reading – eye movements, fixations, regression and visual wandering, the right approach to reading; Factors affecting the style of reading – reader, related material related and environmental; Memory, retention, association of reading material. **Kinds of Reading:** Introduction to phonetics – familiarization withspeechsoundsandtheir symbols– articulation of speech sounds – stress andintonation. **Grammar:** Word building use of punctuation marks, articles, tenses, abbreviations, prepositions, idioms & phrases, transformation of sentences, incorrect to correct English, single word for a group of words.
Section-B	**Writing Skills:** Business letters: principles, structure and style of writing business i.e., sales letters, claim and adjustment letters, inviting quotations/tenders, writing a memo, job application letters, preparing a personal resume; Effective Meetings: Qualities i.e. planning, processing the discussion, conducting a meeting, use of differenttypeofquestions,summaries,handlingproblemsituationsandproblempeople,writingnotices,agenda andminutesofmeetings;Reportwriting:Characteristics,typesofreports,structureoftechnical/researchreports, preparatorystepstoreportwriting;Elementsofstyle:Definitionofstyle,characteristicsofagoodtechnicalstyle– practical hints to improve the style of writing; précis writing; Comprehension of passages.
Section-C	**Listening Skills:** Barriers to listening, effective listening and feedback skills, Telephone techniques. Considerations of listening and voice, developing telephone skills – preparing for the call, controlling the call, follow up action.

	Handling difficult calls and difficult callers.
Section-D	**Speaking And Discussion Skills:** Effective speaking: Preparation i.e., deciding the objective, preparing the environments, organizing the material selection of words, voice modulation, speed, expression, body language, dealing with questions, dealing with nervousness, presentation of audio-visual aids; Group Discussions: The art ofparticipatingingroupdiscussioni.e.,initiative,cooperationwithgroupmembers,analysisoftheissue,putting one's views effectively, establishingleadership. Assignments / Seminars / discussions may be given for following skill development. a) Word processing a (b) Report writing c) Preparing agenda for (d) Preparing minutes of the e) Press Releases (f) Preparing a Brochure g) Advertisements (h) Preparing a power point slide

Course Outcomes:

CO1. Identify the importance ofCommunication Skills.
CO2: Apply Critical Thinking to what they read, listen to and observe.
CO3: Apply principles of effective LSRW skills in professional & Social Communication.
CO4: Assess the verbal and non-verbal messages effectively.

Text Books:

1.	An Approach to Communication Skills	:I.Bhatacharya	:DhanpatRai& Co.
2.	Business Correspondence and Report writing	: R.C.Sharma& Krishna Mohan	:Tata McGraw Hill

ReferenceBooks:

3.	Business Communication	: K.K.Sinha	: Galgotia Publishing

Name of the Course	**Basic Electrical Engineering**

Course Code	EE-1001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
- To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
- Highlight the importance of electromagnetism and transformers in transmission and distribution of electric power.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.

Section	Course Content
Section-A	**D.C. circuits**: V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics and ratings of different types of R, L, C elements. Ohm's law, Kirchoff's Laws, delta-star transformation, Nodal and Mesh analysis, Thevenin's, Norton's, superposition theorem, Maximum power transfer theorem, Reciprocity, Compensation, Millman and Tellegan's Theorem.
Section-B	**A.C. Circuits,**Sinusoidal signal, instantaneous and peak values, RMS and average values, phase angle, polar and rectangular, exponential and trigonometric representations RL and C components, Concept of complex power, power factor. Series and Parallel A.C. circuit, Series and Parallel resonance. Q factor, cut off frequency and bandwidth. **Three phase circuits**: Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by 2-wattmeter method.
Section-C	**Magnetic Circuits:** Amperes circuital law, B-H curve, concept of reluctance, flux and mmf, analogies between electrical and magnetic quantities, solution of magnetic circuits, hysteresis and eddy current losses, mutual inductance and dot convention.

Section-D	**Electromagnetic Theory of Electric Machines: Electrical Machines:** Basic concepts includingprinciple, construction and working of transformers and D.C. Machines.

Course Outcomes:

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

CO1: Identify and predict the behaviour of any electrical and magnetic circuit.

CO2: Formulate and solve complex AC and DC circuits.

CO3: Realize the requirement of transformers in transmission and distribution of electric power and other applications.

CO4: Identify the type of electrical machines used for that particular application.

Text Books:

1.Fundamental of Electric Circuits by Charles K Alexander and Matthew N. O. Sadiku,MH Publication.

2. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication.

3. Basic Electrical Engineering by V N Mittal &Arvind Mittal, TMH Publication.

Reference Books:

4. Basic Electrical Technology by A.E. Fitzgerald, McGraw Hill Publication.

5. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH Publication

Name of the Course	**C Programming Lab**		
Course Code	**IT -1002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Write a program to find the largest of three numbers (if-then-else).
2	Write a program to find the largest number out of ten numbers (for statement).
3	Write a program to find the average male height & average female heights in the class (input is in form of sex code, height).
4	Write a program to find roots of quadratic equation using functions and switch statement.
5	Write a program using arrays to find the largest and second largest no.
6	Write a program to multiply two matrices.
7	Write a program to read a string and write it in reverse order
8	Write a program to concatenate two strings.
9	Write a program to sort numbers using the Quick sort Algorithm. Represent a deck of playing cards using arrays.
10	Write a program to compute the Fibonacci series.
11	Write a program to find weather the number is palindrome or not.

Course Outcomes:

CO1: Identify and abstract the programming task involved for a given problem.
CO2: Design and develop modular programming skills.
CO3: Trace and debug a program.
CO4: Develop programs based on Fibonacci series.

Text Books:

1. Let us C: YashwantKanetkar: BPB Publication

Reference Books:

2. Programming in C: E.Balaguruswamy:Tata McGraw Hill

Name of the Course	**Basic Electrical Engineering Lab**		
Course Code	**EE – 1002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To verify KCL and KVL.
2	To study frequency response of series RLC circuit and determine resonance frequency and power factor for various values of R,L,C.
3	To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
4	To perform direct load test of transformer and plot efficiency v/s load characteristics.
5	To perform direct load test of the DC shunt generator and plot load v/s current curve
6	To study and verify Thevenins, Norton's, superposition, Milliman's, maximum power, reciprocity theorems.
7	To perform O.C and S.C test of transformer.
8	To study various types of meters.
9	Measurement of power by 3 voltmeter/ 3 ammeter method.
10	Measurement of power in 3-phase system by 2-wattmeter method.

Course Outcomes:

CO1: Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

CO2: Use different meters and instruments for the measurement of common electrical quantities

CO3: Understand the importance of various theorems and transformer tests

CO4: Know the methods of power measurement

Text Books:

1. Experiment in Basic Electrical Engineering: S. K. Bhattachrya& K.M. Rastogi: New Age International Pub.

Reference Books:

2. Experiment and Viva – Voce on Electrical Machines: V.N. Mittal & A. Mittal: Standard Publishers.

Name of the Course	**Electrical Engineering Workshop**		
Course Code	**EE-1003**	Credits-2	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

Sr. No.	**Name of the Experiment**
	List of Experiments (Fitting)
1	To make a square piece of mild steel.
2	To make V-matching joint of mild steel..
3	To make a V-notch.
	List of Experiments (Machine)
1	Facing and turning on mild steel rod on Lathe Machine
2	To make a groove on lathe machine.
3	Taper turning operation on Lathe Machine
	List of Experiments (Carpentry and Pattern making)
1	To make the 'T' lap joint.
2	To make 'T' Dove-tail joint.
3	To make Mortise &Tennon joint.
	List of Experiments (Welding)
1	To make a lap joint.
2	To make a T joint
3	To make a V-butt joint.
	List of Experiments (Smithy and Forging)
1	To make a ring of mild steel by cold forging process
2	To make S-hook by hot forging process
3	To make chisel by hot forging process.
	List of Experiments (Foundry)
1	Make a single piece pattern mould
2	To make spilt pattern mould
3	To make mould and core and assemble it
	List of Experiments (Electrical and Electronics)
1	Introduction to electric wiring
2	Exercises preparation of PCBs, involving soldering of electrical & electronic application

Course Outcomes:

CO1: Learn the basics of metal machining, welding, fitting, forging, carpentry and foundry related operations.

CO2: Apply basic concepts related to plumbing, building materials and construction.

CO3: Execute the basic house hold wiring, electrical circuits and basic electronics appliances

CO4: Identify and understand the functioning of common electrical appliances and their safe handling.

Text Books:

1. Workshop Technology: S. K. Garg:Luxmi Publication.

Reference Books:

2.A Course in Workshop Technology Vol. 1:B.S. Raghuwanshi:DhanpatRai and Co.

Semester - II

Name of the Course	Applied Mathematics – II		
Course Code	AS – 2001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- To explain the basics of linear algebra including matrix theory, system of linear equations, eigenvalues and eigenvectors.
- To elaborate the basic concepts of complex algebra and analysis for applications in engineering subjects.
- To demonstrate the basics of numerical methods for different kind of interpolations; finding roots of algebraic and transcendental equations etc.
- To demonstrate the basics of numerical differentiation and integrations and their applications.
- To display the theories of Laplace, Fourier transformations and their applications in differential equations.
- To impart competence to the students for solving problems of the standards pertaining to standards of the various national level competitive examinations like GATE, UPSC, PSUs etc.

Section	Course Content
Section-A	**Vector Calculus**: Tangent, curvature and torsion, Directional derivative, Gradient of a scalar field, divergence and curl of a vector field. Line, surface and volume integrals, theorem of gauss and Stoke's (proofs not needed).
Section-B	**Integral Transforms**: Fourier series, Euler's formula, even and odd functions, half range expansions. Fourier and Laplace transform, Inverse transform of derivatives and integrals, shifting theorem, application to periodic functions, unit step function.
Section-C	**Second order Differential Equations**: Solution by: Power series method and its basis, Solution of Bessel and Legendre differential equations, properties of Bessel and Legendre functions.
Section-D	**Partial Differential Equations (PDE)**: Formulation and classification. Solution of wave equation heat equation in one dimension and Laplace equation in two dimensions by the method of separation of variables.

Course Outcomes:

CO1: Gain the knowledge to develop the concepts of surface Z= f (x, y) its partial derivatives, Euler Theorem & modified Euler Theorem for homogenous function & deduction develops ability to solve problems related to partial derivatives.

CO2: Learn to expand any functions of two variables in the ascending power of variables and also develops error and approximation, extremum value of a given function related to engineering application.

CO3: Develops the ability to solve higher order & first degree linear non homogenous differential equation arising in various branch of engineering and related mathematical model develops arising to form mathematical modelling of Real-World Problem with its physical interpretation.

CO4:Solve some differential equation which is not solvable in ordinary case but its series solution gives an idea of developing special function which has important role in some physical phenomena arising in engineering problems.

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal: Khanna Publishers.
2. Advanced Engineering, Mathematics: R.K.Jain and. S. R. K Iyengar:Narosa Publishing House.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig:John Wiley & Sons (Asia) Pvt. Ltd.
2. Engineering Mathematics (2nd edition):S.S.Shastri: Prentice Hall of India Pvt. Ltd. Vol-I and Vol-II.
3. Differential and Integral Calculus: N.Piskunov: CBS Publishers and Distributors.
4. Advanced Engineering Mathematics: Michael D Greenberg: Pearson Education Asia.

Name of the Course	Applied Physics		
Course Code	AS – 2002	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50
	Instructions		

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator isallowed.

Course Objectives:
- To develop understanding of Quantum Mechanics and itsapplications.
- To understand various free electron gasmodels.
- Toknow the fundamental concept of theory ofrelativity and Electromagnetic waves.
- To understand principle and design of various Laser systems, optical fiberand their applications in upcoming technologies likephotonics.

Section	Course Content
Section-A	**Optics:** Methods of interference-division of wave front, division of amplitude, interference through thin films (qualitative only), Newton rings. Diffraction of light, diffraction through single slit, double slit and diffraction grating. **Theory of Relativity:** Galilean transformations. Postulates of Einstein's special theory of relativity, Lorentz transformations. Length contraction, time dilation, Variation of mass with velocity, mass-energyequivalence. **Electromagnetic Wave Theory:** Maxwell's equations and their significance, Electromagnetic waves, Poynting vector, Electromagnetic wave equation.
Section-B	**Quantum Mechanics:** Introduction to quantum mechanics, concept of de Broglie Waves, Davisson-Germer experiment, wave packet, Phase and Group Velocities (qualitative only), wave function and its properties, operators in quantum mechanics, expectation values, eigenvalues and eigen functions. Postulates of quantum mechanics, time dependent and timeindependentSchrodingerwaveequation,Application:Particleinabox,TunnelEffect.
Section-C	**Band Theory of Solids**: Free electron theory: Quantum theory of free electrons, Fermi Dirac distribution function and its variation with temperature. Periodic potential and Bloch theorem, Kronig Penney Model (qualitative), E-K diagrams, Brillouin Zones. **Superconductivity:**Superconductivity,effectofmagneticfield,Meissnereffect,typesof superconductors, BCS theory (qualitative only), Josephson effect, applicationsof superconductivity.

Section-D	**LASER**: Spontaneous and stimulated emission, LASER action schemes, characteristics of LASERbeam, ruby LASER, He-Ne LASER, semiconductor LASER (simple Ideas), applications of LASERs. **Fibre Optics**: Principle, structure, acceptance angle and acceptance cone, numerical aperture, single mode and multi-mode fibres,step index and graded index fibres, optical fibre communications, losses in optical fibres.

Course Outcomes:

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

CO1: Understand new methods of interference anddiffraction.

CO2: Understand the fundamentals of relativistic mechanics, Maxwell's equations and their relevance in the modern technology and the concept of electromagnetic waves.

CO3: Explain fundamentals of quantum mechanics and its applications in microscopic systems.

CO4: Understand the various models of free electron theories and basics of superconductivity.

CO5: Understand various laser systems and theory of fiber optics.

Text Books:

1. Modern Engineering Physics: A. S. Vasudeva: S. Chand Publications.
2. A text book of Engineering Physics: M. B. Avadhanulu, P. G. Kshirsagar: S. ChandPublications.

Reference Books:

1. Solid state Physics : Gupta &Saxena : Pragati Publications
2. Concepts of Modern Physics: Arthur Beiser : Tata McGraw Hill
3. Modern Engineering Physics : Bhattacharya Tando : Oxford
4. Modern Engineering Physics : Sharma & Sharma : Pearson

Name of the Course	Basic Electronics		
Course Code	EC– 2001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

Section	Course Content
Section-A	Brief review of Band Theory, transport phenomenon in semiconductors, Electrons and holes in Intrinsic semiconductor, Donor and acceptor Impurities, charge densities in semiconductor. PN Junction, Reverse and Forward bias conditions, Diode Characteristic and parameter, Ideal vs. Practical diode. Equivalent circuits and frequency response. rectification-half and full wave, Zener and Avalanche diode, its role as regulator, photodiode.
Section-B	Bipolar junction transistor (BJT) and their characteristics as circuit and gainelements. Two port network analysis, h-parameters and trans-conductance. Equivalent circuits for JFET and MOSFET, enhancement mode and depletion mode MOSFETS. Uni-junction transistor (UJT), UJT characteristics, parameters and circuit operation.
Section-C	Bias for transistor amplifier: fixed bias, emitter feedback bias. Feedback principles. Types of feedback, Stabilization of gain, reduction of non-linear distortion, change of inputs and output resistance by negative feedback in amplifier. Amplifiers coupling, types of coupling, Amplifier pass band, Eq circuits for BJT at high frequency response of CE, RC-Coupled amplifiers at mid, low and high frequencies.
Section-D	Semiconductor processing, active and passive elements, Integrated circuits, bias for integrated circuits. Basic operational amplifier, applications of operational amplifier – adder, subtractor, Integrator, differentiator and comparator, Photo transistor: its characteristics and applications.

Course Outcomes:

CO1: Understand the current voltage characteristics of semiconductor devices.

CO2: Analyse dc circuits and relate ac models of semiconductor devices with their physical Operation.

CO3: Design and analyse of electronic circuits.

CO4: Evaluate frequency response to understand behaviour of Electronics circuits.

Text Books:

1 Electronic Principles: A.P.Malvino : TMH

2 Electronic Fundamentals and Applications: J.D. Ryder : PHI

3 Electronic Circuits & Devices: J.Millman and C.C.Halkias: TMH

Reference Books:

4 Integrated Circuits & Devices: J.Millman&C.C.Halkias : TMH

5 Basic Electronic & Linear Circuits: N.N.Bhargava&Kulshrestha: TMH

Name of the Course	Basic Mechanical Engineering		
Course Code	ME– 2001	Credits-4	L-4, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- To understand the concept of stress and strain, Pure Bending andTorsion.
- To understand the concept of shear force and bending moments of beams and analysis oftrusses.

Section	Course Content
Section -A	**SimpleStresses&Strains:**Concept&typesofStressesandstrains,Poisson'sratio,stressesandstraininsimple and compound bars under axial loading, stress strain diagrams, Hooks law, Elastic constants and their relationships., Numericalproblems.
Section -B	**Automobileengineering-** components,basicstructure(frame,axels,suspension,wheel-overview),transmission system (layout &briefdescription).
Section -C	**Shear Force and Bending Moments:** Definitions, SF& BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM and SF and the point of contraflexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads. NumericalProblems.
Section -D	**Bending Stresses in Beams:** Bending Stresses, neutral axis, moment of area, section modulus, bending equation and its application to beams of circular, rectangular I & T Section, flexural strength, Composite beams, Torsions.

Course Outcomes:

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

CO1: Understand the basics of elasticity and elastic constants.

CO2: Understand the basics of automobiles.

CO3: Determine the shearforce,Bendingmomentofbeamsandanalysethetrussesandsolve related numerical problems.

CO4: Determine the stresses in beam for pure bending and effect of torsion inshafts.
Text Books: - 1. Strength of Material: R. S. Khurmi: S. Chand Publications. 2. Thermal Science and Engineering: Yadav, R: Central Publishing House, Allahabad. **Reference Books:** 3. Strength of Materials: G. H. Ryder: Macmillan India Third Edition in S I units 1969. 4. Mechanics of Materials: Dr. Kirpal Singh: Standard Publishers Distributors, New Delhi.

Name of the Course	Applied Physics Lab		
Course Code	AS-2003	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To find the wavelength of sodium light by Newton's rings experiment.
2	To find the wavelength of sodium light by Fresnel's bi-prism experiment
3	To find the wavelength of various colours of white light using plane transmission diffraction rating.
4	To find the wavelength of sodium light by Michelson interferometer
5	To find the refractive index and Cauchy's constant of a prism by using spectrometer
6	To find the resolving power of a telescope
7	To study the beam parameters of a helium-neon laser
8	To find flashing & quenching potentials of argon & hence to find the capacitance of unknown capacitor.
9	To find the value of high resistance by Substitution method
10	To convert a galvanometer into an ammeter of a given range
11	To study the variation of magnetic field with distance for Stewart and Gee's apparatus
12	To find the reduction factor of two turn coil tangent galvanometer using copper voltammeter
13	To find the value of e/m for electrons by Helical method.
14	To determine the charge of an electron by Millikan's oil drop method
15	To find the value of Planck's constant by using a photoelectric cell
16	To calculate the hysteresis loss by tracing a B-H curve for a given sample
17	To determine the band gap of an intrinsic semiconductor by four probe method
18	To determine the resistivity of a semi-conductor by four probe method at different temperatures
19	To determine the Hall co-efficient
20	To study the photovoltaic cell & hence to verify the inverse square law

Course Outcomes:

CO1: After performing the experiments related to optics, students shall be able to visualise fringe patterns and use them in determination of wavelength of light used.

CO2: Students shall be able to perform experiments based on electricity and magnetism.

CO3: Students shall be able to determine various properties of semiconducting materials.

CO4: Students shall be able to perform experiments based on bridges to determine the characteristic values of various circuit components.

Text Books:

1. Practical Physics: S. L. Gupta & V. Kumar: PRAGATI Publications.

Reference Books

2. Practical Physics for B.Sc. I, II and III: S. L. Arora: S. Chand Publications.

Name of the Course	Engineering Graphics and Design Lab		
Course Code	**ME-2002**	Credits-2	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Drawing Techniques: Various type of lines, principal of dimensioning, size & location as per IS code of practice (SP-46) for general engineering drawing. Practice of drawing, various types of lines & dimensioning exercises. Drawing exercises pertaining to symbols. Conventions & Exercise of lettering techniques. Free hand printing of letters & numerals in 3,5,8 & 12-mm sizes, vertical & inclined at 75°. Instrumental lettering in single stroke. Linear Scale, Diagonal scale &vernierscale. Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point & lines, true length of lines and their horizontal & vertical traces, projection of planes & their traces.
2	Projections of Solids: Right regular solids of revolution & polyhedrons etc. and their auxiliary views. Sectioning of Solids: Principal of sanctioning, types of sanctioning & their practice on projection of solids.
3	Practice In: Orthographic projections of individual blocks/ parts. Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views.
4	Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc.Intersection of Surfaces: Intersection of cylinders, cones & prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder & cylinder, cylinder & cone, prism & prism.

Course Outcomes:
CO1: Student's ability to hand letter will improve.
CO2: Student's ability to perform basic sketching techniques will improve
CO3: Students will be able to draw orthographic projections and sections
CO4: Student's ability to use architectural and engineering scales will increase

Text Books:

1. Elementary Engineering Drawing: N.D. Bhatt: Charotar Pub. House.
2. Engineering Drawing &Engg. Graphics. P.S.Gill: S.K.Kataria& sons
3. Engineering Graphics: L.V. Lakshminarayan& R.S. Vaish
4. Engineering Drawing Plane and Solid Geometry: N.D. Bhatt V.M. Panchal: Charotar Pub. House, 2002.

Reference Books

1. Engineering Graphics with AutoCAD 2002: James D. Bethune: Pearson Education
2. Engineering Graphics and Drawing: P.S.Gill: S.K.Kataria.
3. Engineering Graphics usingAUTOCAD 2000: T. Jeyapoovan:VikasPublishing House.
4. Engineering Drawing andGraphics + AutoCAD 4th Edition: K. Venugopal:NewAge International

Name of the Course	Basic Electronics Lab		
Course Code	EC-2002	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To study the use and scope of using an oscilloscope as a measuring device in an electronic laboratory
2	To study the use and scope of using a millimetre (digital and analog) as a measuring device in an electronics laboratory
3	To study the use and scope of function generator as a signal source in an electronics laboratory.
4	Draw forward bias and reverse bias characteristics of a p-n junction diode and use it as a half wave and full wave rectifier
5	Draw the characteristics of a zener diode and use it as a voltage regulator
6	Draw characteristics of common base configuration of p-n-p transistor
7	Draw characteristics of common emitter configuration of annpn transistor
8	Draw characteristics of common drain configuration of a MOSFET
9	Find the voltage and current gain of single stage common emitter amplifier.
10	Draw the characteristics curve of UJT.
11	Find the voltage gain of single stage voltage series feedback amplifier
12	Use operational amplifier as: a) Inverting amplifier , b) Non-inverting amplifier, c) Comparator, d) Integrator e) Differentiator, f) Adder, g) Precision amplifier

Course Outcomes:

CO1: To study basics of semiconductor & devices and their applications in different areas

CO2: To study different biasing techniques to operate transistor, FET, MOSFET and operational amplifier in different modes.

CO3: Analyse output in different operating modes of different semiconductor devices.

CO4: To know the applications of an operational amplifier.

Text Books:

1. Basic Electronic & Linear Circuits :N.N.Bhargava&Kulshrestha: TMH

Reference Books:

2. Electronic Devices & Circuit Theory: Robert L.Boylestad, Louis Nashelsky: Pearson Edu.

Semester – III

Name of the Course	**Network Analysis and Synthesis**		
Course Code	**EE- 3001**	**Credits-3**	**L-3, T-1, P-0**
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min. Pass Marks: 40**	**Max. Time: 3 Hrs.**
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- To make the students capable of analysing any given electrical network.
- To make the students understand concepts of network theorems, Laplace transform, different two port network, graph theory and network filters.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.

Section	Course Content
Section -A	**Network Analysis Techniques:** Reciprocity Theorem, Milliman's Theorem, Telegen's Theorem and Maximum PowerTransferTheorem – ApplicationsofNetworkTheoremstonetworkanalysisbothwithdcandacinputsand magneticcoupling. **Applications of Laplace Transform:** Introduction, some basic theorems, solutions of Linear Differential Equations for electric network-problems, partial fraction expansion-Heaviside's Expansion Theorem, Application ofLaplaceTransformanalysisofelectricalcircuits– Lineartimeinvariantfirstandsecondordercircuits.Impulse response of first and second order circuits, time varying circuits, Introduction to FourierTransform.
Section -B	**NetworkFunctions:**Portsandterminalpairs,networkfunctions,Polesandzeros,necessaryconditionsfordriving point functions and transfer functions, Time domain behaviour from pole-zeroplot. **Two Port Networks:** Introduction, Characterization of linear time invariant two port networks, Z-,Y-, h- and transmission parameters, Interrelationship between these parameters, Interconnection of 2-port networks, Image parameters, Attenuation and phase shift in symmetrical T- and pi- networks.
Section -C	**Filters and Active Networks:** Classifications of filters, Filter networks, pass band and stop band types, Constant k-low pass and high pass filters, Characteristics impedance and cut off frequency, m-derived filters. **Graph Theory and Network Equations**: Introduction, graph of a network, trees, co- trees and loops, incidence matrix, Cut-set matrix, Tie-set matrix and loop

	currents, Analysis of networks using graph theory.
Section -D	**Network Synthesis:** Introduction, Hurwitz polynomials, positive real functions, driving point and transfer impedance function, LC-network, synthesis of dissipative network, Two-terminal R-L network, Two-terminal R- C networks, Synthesis of R-L and R-C networks by Cauer and Foster – methods.

Course Outcomes:

CO1; Understanding the various laws and theorems related to electric networks.
CO2: Understanding the concept of two port networks.
CO3: Familiarisation with network synthesis.
CO4: To Analyse the concept of filters, graph theory and Laplace transform.

Text Books:

1. Van-Valkenburg M E, "Network Analysis*",*Prentice Hall, NewDelhi
2. Sudhakar, A, "Circuits and Networks", TataMcGraw-Hill
3. Hayt, W., "Engineering Circuit Analysis", TataMcGraw-Hill

Reference Books:

1. Bell D A, "Electric Circuit," Oxford Universitypress

Name of the Course	**Electrical and Electronic Measurements and Measuring Instruments**		
Course Code	**EE-3002**	**Credits-3**	**L-3, T-1, P-0**
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min. Pass Marks: 40**	**Max. Time: 3 Hrs.**
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculatorisallowed.

Course Objectives:

- To know the necessity of different measuring instruments and their design principle
- To understand the working principle of different measuring instruments and technical solutions to handle different errors.
- To learn the architecture and working principle of advanced measuring instrument and their applications.

Section	Course Content
Section -A	**Introduction to Measurement Systems:** Static error, Static calibration, Error calibration curve, Limiting errors, Relative limiting errors, Types of errors: Gross Errors, Systematic Errors, Random Errors; Propagation of Errors, Sensitivity, Linearity, Hysteresis, Threshold, Dead Time, Resolution of instrument, loading effects, Introduction to measurement standards, uncertainty, Accuracy, and Precision index. **Potentiometer:** Introduction to basic principle, Laboratory type Crompton's potentiometer, Dual range potentiometer, Volt ratio box, application of dc potentiometer, self- balancing potentiometer.
Section -B	**Electrical and Magnetic Measurements:** Introduction, D'Arsonval galvanometer, moving iron and moving coil instruments,Electrodynamometer,ElectrostaticInstruments,Inductiontypeenergymeter,wattmeter.Determination of B-H curve and Hysteresisloop. **Measurement of Power Factor and Frequency:** Single phase and three phase electrodynamometer type power factor meter. Moving iron power factor meters, types of frequency meter, mechanical resonance type, electrical resonance type, Ratio meter type.
Section -C	**Resistance Measurements**: Methods of measurement of low, medium and high resistance, measurement of earth resistance, localization of cable faults by Murray and Varley loop test. **Inductance and Capacitance Measurements:** Measurement of inductance and capacitance by A.C. Bridge methods, Q-factor and dissipation factor. Sources of

	errors in bridge circuits, shielding of bridge elements, Wagner Earthing Device.
Section -D	**Instrument Transformers:** Introduction, use of instrument transformers, ratios, basic constructional features of C.T. and P.T., ratio and phase angle errors, reduction oferrors. **Cathode Ray Oscilloscope:** Principle and working of CRO, Block diagram presentation of CRO and brief description of various elements of CRO – CRT, horizontal Deflecting system, Vertical deflecting system, CRO screen, Measurement of voltage, frequency and phase angle using CRO, CRO probes.

Course Outcomes:

CO1: Learn units, dimensions, standards and errors and basics of different types ofmeasuring instruments to measure different electrical quantities.
CO2: To apply their knowledge to measure electrical quantities using standard analoganddigital measuring instruments.
CO3: To measure different electrical parameters using conventional bridges and acquiredata through digital measuring instruments and interpret the data.
CO4: To study principles and working of a CRO.

Text Books:

1. Cooper W D, "Electronic Instrumentation and Measurement Techniques", Prentice Hall, NewDelhi.

Reference Books:

2. Bell David A, "Electronic Instrumentation and Measurements", Prentice Hall, Inc, NewDelhi.

Name of the Course	Applied Mathematics - III		
Course Code	**ES-3005**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- Mathematics fundamentals necessary to formulate, solve &analyse engineering problems.
- An understanding of Fourier series and Laplace Transform to solve real world problems.
- An understanding of Linear Algebra through matrices.
- An understanding of Complex integration.

Section	Course Content
Section -A	Lineardependenceofvectorsandrankofmatrices,lineartransformationsandinverseofmatrices,reduction to normal form, bilinear form and quadratic form, consistency and solution of linear algebraic system of equation, Eigen values, Eigen vectors and their applications to system of ordinary differential equations, Cayley Hamilton theorem, orthogonal, unitary, Hermitian and similarmatrices.
Section -B	**Magnetostatics:** Force due to a Magnetic field, Force due to combined Electric and Magnetic fields, Biot-Savart Law,calculationofMagneticFieldforsimplecoilconfigurations,Ampere'sLaw,Magneticflux,Stokestheorem, Magneticmaterials,magneticboundaryconditions,Inductancecalculationsfromphi=L*I,forcommongeometries and Force on adipole.
Section -C	**Slowly Time-Varying Systems:** Frames of reference and motional emf. Faraday's law, Stored energy in the magnetic field. The Inductance equation, Examples from electric machines and transformers.
Section -D	**Time-Varying Fields**: The Displacement current. Maxwell's Equation, The wave equation in 1-Dimension, Solution of the wave equation. Plane waves, Wave propagation in vacuum and lossy dielectrics, Skin depth and frequency dependence of lumped elements. Energy transport by waves. The Poynting vector, Reflection at boundaries. Normal incidence formula and Impedance matching.

Course Outcomes:
CO1: Understand the basic mathematical concepts related to electromagnetic vector fields.

CO2: Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions and electric energy density. CO3: Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density. CO4: Understand the concepts related to Faraday‘s law, induced emf& Maxwell‘s equations.
Text Books: 1. HaytWHandJABuck,“EngineeringElectromagnetics”,TataMcGrawHillPublishing 2. Edminister J A, “Schaum’sOutline of Theory and Problems of Electromagnetics”, Tata McGrawHill Publishing Co.,NewDelhi. **Reference Books:** 1. Kraus J D, “Electromagnetics”, McGraw Hill,NewYork 2. Sadiku M N O, “Elements of Electromagnetics”, Oxford UniversityPress 3. Jordon E C and K G Balmain, “Electromagnetic waves and radiating systems”, PrenticeHall.

Name of the Course	Electromagnetic Field Theory		
Course Code	EC- 3040	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- Create and develop the basic skills to design various applications involve electromagnetic fields.
- Analyse Maxwell's equation and apply them to diverse engineering problems.
- Apply the concept of electromagnetism in modern communications such as antenna and microwave engineering.

Section	Course Content
Section-A	**Vector Analysis:** Introduction to Coordinate systems and Transformation, Differential Length, Area and Volume, Line, Surface and Volume Integrals, Del Operator, Gradient, Divergence and Curl, Stoke's Theorem, Divergence Theorem, Laplacian of a Scalar..
Section-B	**Electrostatics** : Coulomb Law, Permittivity and Electric flux density, Gauss Law, Applications of Gauss's Law, Electric potential, Continuity Equation, Relaxation time, boundary conditions, Poisson's and Laplace's Equations. Magnetostatics: Biot Savart Law, Ampere's circuit law and its application, Magnetic flux and magnetic flux density, Derivation of the steady magnetic field laws
Section-C	**Waves and Applications:** Faraday's law, Transformer and Motional EMFs, Displacement current, Maxwell's equations in point form and integral form for steady fields, Phasor form of Maxwell's equation. Electromagnetic Wave Propagation: Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, plane wave in free space, plane waves in good conductors, power and the pointing vector, Reflection at boundaries..
Section-D	**Transmission lines and Antenna Introduction:** Introduction, Circuit representation of parallel plane transmission lines, Transmission lines with losses, Characteristic impedance, Propagation constant, Attenuation constant and phase constant, Reflection, Reflection coefficient, Expression for input impedance in terms of reflection coefficient, Standing wave ratio (SWR),

	Relation between SWR and reflection coefficient, Principle of impedance matching devices, Smith Chart Antenna Introduction: Basic antenna parameters: Reflection and Radiation Mechanism: Patterns, Beam area (or Beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and Gain G, Antenna apertures, Antenna temperature, Antenna impedance.

Course Outcomes:

CO1: Get ready for advanced courses in antenna, microwave, radar, and wireless Communication.

CO2: Able to understand and compute Electromagnetic fields and apply them for design and analysis of electrical equipment and systems.

CO3: Have knowledge of physical interpretation, and ability to apply Maxwell'sequations to determine field waves, potential waves, energy and chargeconservation conditions.

CO4: Be familiar with Electromagnetic wave propagation and wave polarization.

Text Books:

1. Matthew N.O. Sadiku,"Principles of Electromagnetics", Oxford University Press.

Reference Books:

1. William H.Hayt,Jr And John A.Buck,"Engineering Electromagnetics", McGraw Hill Education.
2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, 2017

Name of the Course	Digital Electronics		
Course Code	EC- 3002	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- Understanding the basics of digital electronics and different number systems and conversion between them.
- Design and construction of the basic and universal logic gates.
- Study and construction of sequential logic circuits, understanding various design offlip flops.
- Studying the programmable logic devices, shift registers counters and various memory devices.

Section	Course Content
Section-A	**Number System and Boolean Algebra:** Digital and Analog quantities, Binary digits, logic levels & digital waveform. Review of number system (Binary, Octal, Decimal, Hexadecimal, Number base conversions), compliments, and signed binary numbers. Binary arithmetic (addition, subtraction, division, and multiplication), Binary codes: Weighted- BCD- 8421- gray code- ASCII code – Excess 3, error detecting (Parity, checksum and block parity) and correcting code (hamming code). **Minimization of logic function:** Binary Arithmetic (Addition, subtraction, multiplication and division) OR,AND,NOT,NOR,NAND,EX-OR, implementation of logic functions using NAND and NOR gate, Boolean postulates and laws, De –Morgan's theorem ,minimization of Boolean expression, sum of product (SOP),product of sum(POS), canonical forms , Karnaugh map, and Q-M method of minimization
Section-B	**Combination Circuits:** Design procedure: Binary Adders&Subtractors (half & full) magnitude Comparator, Multiplexer and Demultiplexer. Encoder/Decoder, code converters, parity generators and checkers. **Digital Logic Families:** Introduction to bipolar Logic families: RTL, DCTL, DTL, TTL, ECL and MOS Logic families. TTL and CMOS logic comparison in terms of threshold voltage, Fan in ,Fan out, Propagation delay , Noise margin,

	voltage and current parameters, operating temperature and speed power product
Section-C	**Sequential Circuit:** Flip flops SR, JK, T, D and Master slave- Characteristics table & equation, Excitation table, Realization of one flip flop using other flip flops. Classification of sequential circuits, Registers. Design & analysis of synchronous and asynchronous sequential circuits: Counters.
Section-D	**D/A Converter and A/D converters:** Basic concepts, Weighted Resistor D/A converter, R-2R Ladder D/A converter. A/D Converter: Analog to digital conversion using Successive approximation method, Dual slope method. **Semiconductor Memories:** program and data memory, types and terminology, SRAM and DRAM. Implementation of combinational logic ROM, PAL, and PLA.

Course Outcomes:

CO1: understand the basics of difference between analog and digital circuits and their applications.
CO2: Implement simple logical operations required for the designing of digitalcircuits and understand common forms of number representation.
CO3: Understand the reduction of Boolean expressions for the designing of minimized Logical circuits.
CO4: Design and implementation of combinational circuits.
CO5: design and implementation of sequential circuits and their application.

Text Book:

1. A. Anand Kumar, Fundamentals of digital circuits, 3rdEdition,PHI.
2. M. Morris Mano, Digital Design, 4.ed., Prentice Hall of India Pvt. Ltd., New Delhi, Sixth impression /Pearson Education (Singapore) Pvt. Ltd., NewDelhi.
3. Jain R. P. "Modern Digital Electronics", 3rd edition, Tata McGraw-Hill2003.
4. Malvino and Leach "Digital principles and Applications", 5th edition, Tata McGraw Hill,2003.

Reference Book:

1. Thomas L. Floyd, 10thEdition, Digital Fundamentals, PearsonPublications.
2. James W. Bignell and Robert Donovan, "Digital Electronics", 5th edition, Delmar Publishers,2007.

Name of the Course	**Electrical and Electronic Measurement Lab**		
Course Code	**EE-3053**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr. Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Study of Cathode Ray Oscilloscope, its various controls and their functions.
2	To measure amplitude and frequency of the signal using CRO.
3	Measurement of medium resistance with the help of a Wheat stone Bridge.
4	Measurement of low resistance with the help of a Kelvin Double Bridge.
5	Measurement of high resistance using a Megger.
6	Measurement of capacitance and inductance by Maxwell's Bridge.
7	Measurement of capacitance by Schering Bridge.
8	Measurement of frequency by Wein's Bridge.
9	To study potentiometer and to plot EMF Vs. Displacement characteristics of a potentiometer.
10	To plot calibration curve for PMMC, Moving Iron and Electrodynamometer type of voltmeters.
11	Find the voltage gain of single stage voltage series feedback amplifier.
12	Use operational amplifier as: a) Inverting amplifierb) Non-inverting amplifier, c) Comparator, d) Integrator e) Differentiatorf) Adder, g) Precision amplifier

Course Outcomes:

CO1: Upon completion of study of the course should be able to calibrate and test single phase energy meter, calibrate PMMC voltmeter and calibrate LPF wattmeter.
CO2: Student should be able to measure resistance, inductance and capacitance.
CO3: Students should be able to measure 3-Φ active power and reactive power.
CO4: Students should be able to measure quality factor and iron losses.

Name of the Course	**Network Analysis and Synthesis Lab**		
Course Code	**EE-3051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To verify maximum power transfer theorem.
2	To verify superposition theorem.
3	Determination of peak and average voltage in ac circuits
4	To check polarity markings of a transformer and to determine self and mutual inductance of windings.
5	To measure inductance of a coil by: a) Three voltmeter method b) Three ammeter method c) Voltmeter, ammeter and wattmeter method.
6	To find Z, Y, ABCD and H parameters for a two port network
7	To obtain time constant for a RC circuit when: a) RC circuit is switched on with a dc supply. b) Capacitor is discharged through resistance.
8	To charge and discharge a condenser through a resistance using neon bulb.
9	To study characteristics of various active filters.
10	To study RC circuits with varying EMF.
11	To study change over logic in typical offline UPS and its implementation in respect of UPS trainer.
12	To study working of pulse width modulated and Q-sine wave inverter.

Course Outcomes:

CO1: Apply the fundamentals of circuit theoryin solving and verifying various Laws and Theorems.

CO2: Express given electrical circuit in terms of A,B,C,D and Z,Y parameter models and solve thecircuits.

CO3: Be able to determine time constants from RC and RL circuits.

CO4: To study and implement the working of PWM inverters.

Name of the Course	**Digital Electronics Lab**		
Course Code	**EC-3052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Verify the truth tables of all logic gates on trainer kit using TTL ICs.
2	Design and implement half and full adder using basic/universal gates.
3	Design and implement half and full subtractor using basic/universal gates.
4	To design and verify the operation of magnitude comparator.
5	Implementation of 4x1 multiplexer using logic gates.
6	Implementation of 1x4 de-multiplexer using logic gates.
7	Design and implement a code converter that converts gray code to binary code and vice-versa.
8	To verify the truth tables of S-R; J-K; T and D type flip flops.
9	To verify the operation of SISO, SIPO, PISO and PIPO shift register..
10	Design, and verify the 4- bit synchronous counter.
11	Design, and Verify the 4-Bit asynchronous counter.
12	Implement and verify the operation of BCD to 7 segment display.

Course Outcomes:

CO1: understand the digital logic and create various systems by using these logics.
CO2: develop an understanding of design and simulation of digital logic circuits.
CO3: get a basic understanding of layout of electronic circuits.
CO4: use the Multisim tool for design and simulation.

Semester - IV

Name of the Course	Electrical Machines-I		
Course Code	EE- 4001	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr. Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- To have knowledge about operation, testing, efficiency and various configurations of single phase & three phase transformers.
- To understand the concepts of rotating electrical machines and principle of energy conversion.
- To impart knowledge about operation, various characteristics, starting and control of DC machines.

Section	Course Content
Section-A	**Principle of Electromechanical Energy Conversion:** Review of magnetic circuits, Principle of energy conversion, singly and doubly excited magnetic system, Dynamic equations. **DC Machines:** Action of commutator, E.M.F. generated in armature, Torque in DC machines, Methods of excitation, armature reaction, MMF and flux density waveform of DC Machines, Commutation process, interpoles and compensating windings, Basic performance equations of DC machine, Magnetization and operating characteristics of DC generators and DC motors, DC motor starting and speed control, Ward Leonard system, losses and efficiency, applications of DC motors.
Section-B	**Transformers:** Construction and working principle, type of single-phase transformer, concept of ideal transformer, emf equation, transformer on load, phasor diagram on no load and on load, equivalent circuit, O.C and S.C tests, Regulation and efficiency, Pulse transformer. Low, intermediate and high frequency response, Three Phase Transformers, Auto Transformer: Principle of operation, advantages, phasor diagram, equivalent circuit.
Section-C	**Single Phase Induction Motors:**Principle of operation on the basis of double revolving field theory, Equivalent circuit, performance calculations and characteristics, Starting methods, Maximum starting torque conditions in single

	phase induction motors, Hysteresis motor, Reluctance motor and stepper motor. induction motor, equivalent circuit, phasor diagram, characteristics, hysteresis motor, reluctance motor, universal motor and their characteristics, applications.
Section-D	**Specialty Motors:** Construction and principle of operation,double revolving field theory, types of single phase induction motor, equivalent circuit, phasor diagram, characteristics, hysteresis motor, reluctance motor, universalmotor and their characteristics, applications.

Course Outcomes:

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

CO1: Know the principles of electromechanical energy conversion.

CO2: Identify the various types of machines and know their applications.

CO3:Apply the concepts and be able to operate varied machines in industry.

CO4:Apply the principles and be able to understand the applications of specialty motors.

Text Books:

1. Hubert C I, Electric Machines: Theory, Operating Applications, and Controls", PearsonEducation
2. Nagrath I J and Kothari D P, "Electric Machines", Tata McGrawHill

Reference Books:

1. Say M G "Alternating Current Machines",ELBS
2. Mcpherson George, Laramore R D, "Introduction to Electric Machines and Transformers",John Wiley andSons
3. Fitzegerald A F, Kingsley C and Umans S D, "Electrical Machinery", Tata-McGrawHill

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Name of the Course	Power Electronics		
Course Code	EE- 4002	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculator isallowed.

Course Objectives:
- To impart knowledge about construction, working principles of key power electronic switches & their switching characteristics.
- To introduce the fundamental concepts relevant to operation of power electronic converters and output waveforms.
- To enable the students understand about various factors which must be considered while designing power electronic systems.

Section	Course Content
Section-A	**Solid State Power Devices:** Principles of operation, characteristics & switching behaviour of different solid-state devices namely power diode, power transistors, MOSFET, insulated gate bipolar transistor (IGBT), thyristor.SCR: two-transistor model, ratings, gate characteristics, protection & commutation techniques.
Section-B	**AC to DC Converters:** Classification of Rectifiers,diode based rectifiers and phase controlled rectifiers. Single phase half wave converters, single phase full wave converters (mid-point and bridge), half controlled rectifiers, three phase converters using diodes, three phase full converters, three phase semi converters and Dual converters.
Section-C	**DC to DC Converters:** Principle of chopper operation, **s**tep up and step down choppers, types of chopper circuit: type A, B, C, D and E. Thyristor choppers circuits: voltage, current and load commutated. Basic principles of DC-DC switch mode converters: buck, boost and buck-boost converters & applications.
Section-D	**DC to AC Inverters:** Operating principle ofvoltage source inverters, single phase and three phase inverters, current source inverters. **AC to AC Converters**: Types of AC voltage controllers, single-phase voltage controllers, Principle of operation of cycloconverter, types of

	cycloconverter, waveforms and control technique.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Identify role of uncontrolled and controlled power electronic AC and DC Converter systems in developing drive applications.

CO2: Describe contribution of Source Impendence, nature of loads and harmonics on performance of power electronic systems.

CO3: Apply principles of phase control, integral cycle control and resonance for affecting AC and DC circuit performances.

CO4: Assess the role of harmonic mitigation circuits in improving power quality issues amongst power electronic converters

Text Books :

1. Modern Power Electronics by B.K.Bose, IEEE Press, NewYork.
2. AnIntroductiontoThyristorandTheirApplications:byM.Ramamoorty,EastWestPress,NewDelhi.
3. Power Electronics by P.S.Bhimbra, Khanna Publishers,Delhi.

Reference Books:

4. ThyristorisedPowerControllers:byDubey,Doradla,JoshiandSinha,NewageInternationalPub.,NewDelhi.
5. PowerElectronics-Circuits,DevicesandApplicationsbyM.H.Rashid,PearsonEducation.

Name of the Course	Power System-I		
Course Code	EE- 4003	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- Identify major components of power transmission and distribution systems.
- Describe the principle of operation of transmission and distribution equipment.
- Know and appreciate the key factors in equipment specification and network design

Section	Course Content
Section-A	**Introduction to Power System, Load Characteristics and Economic Aspects:** Basic structure of power system, sources of electric energy: conventional and non-conventional; cogeneration, combined heat and power, captive power plants, distributed generation. Commonly used terms and factors, curves useful in system operation and planning, economics of power factor improvement, interconnection of power stationsandtariffs. **Transmission Line Parameters:** Types of conductors, Ampere's law, inductance of a conductor, inductance of a single phase line, inductance of a three-phase line, inductance of three-phase double circuit line, bundled conductors,skineffect,proximityeffect,Guy'stheorem,Capacitanceofsinglephaseline,capacitanceofathree- phase line, capacitance of double circuit three phase line, effect of earth oncapacitance.
Section-B	**Transmission Line Performance:** Classification of lines, models, circuit constants of transmission lines: short, mediumandlonglines;Ferrantieffect,powerflowthroughaline,sendingandreceiving endpowercirclediagram, reactive power generation/absorption of line, compensation and voltagecontrol.
Section-C	**InsulatorsforOverheadTransmissionlinesandMechanicalDesignofTransmiss**

	ionline: Typesofinsulators, ratings, voltage distribution across suspension insulators, string efficiency, methods to improve string efficiency. Calculation of sag and tension, equivalent span length and sag, effect of ice and wind loading, stringing chart, sag template, conductor vibrations and vibrationdampers.
Section-D	**Corona and Radio interference**: Critical voltages, corona loss, advantages and disadvantages of corona, factors affecting corona loss, effect of corona on line design, radio interference **Distribution System and Insulated Cables:** Effect of voltage on transmission efficiency, Kelvin's law, radial and ring main distributors, interconnectors, methods of feeding distributors, ac distribution, three-phase, four wire distribution system, stepped and tapered mains. Cable conductors, insulating materials, insulation resistance, electrostatic stress in cables, grading of cables, capacitance of a three-core cable, dielectric loss, dielectric power factor, classification of cables, cable performance.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1:Comprehend various elements of power system, its changing landscape and different sources of energy.

CO2:Able to produce concepts regarding basics of Electrical Engineering such as KW, KVAR, KVA.

CO3:Able to understand importance of power factor, capacitor bank and metering system in industrial and residential area.

CO4:Able to analyse the Performance of Transmission Lines, Efficiency in Transmission Lines

Text Books:

1. Electric Power systems by C.L. Wadhwa, New Age international, NewDelhi.
2. ElectricPowergenerationtransmissionanddistributionbyS.N.Singh,Prentice-hallofIndia,PrivateLimited, NewDelhi.

Reference Books:

3. Elements of Power System Analysis by W.B. Stevenson McGrawHill.
4. PowerSystemEngineeringbyD.P.KothariandI.J.Nagrath,TataMcGrawHill,NewDelhi.

Name of the Course	Numerical Methods		
Course Code	ES- 4001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment:(based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculator isallowed.

Course Objectives:
- To introduce the fundamental concepts relevant to function of complex variable, numerical differentiation and integration and numerical solution of linear, non-linear and system of equations.
- To have the idea of evaluation of real integrals using complex variable.
- To understand the concept of approximating & interpolating polynomials and finding values of function at arbitrary point.
- To impart knowledge of various numerical technique to solve ODE.

Section	Course Content
Section-A	**Solution of algebraic and transcendental equations:** Bisection method, method of false position, secant method, Iteration method Newton-Raphson method. **Solution Of Simultaneous Algebraic Equations:** Gauss elimination method, Jacobi's method, Gauss-Seidal method.
Section-B	**FiniteDifferences&Interpolation:**Forwardandbackwarddifferenceoperators,Newton'sforwardandbackward interpolation formulae, central difference interpolation formulae, Gauss's forward &backward interpolation formulae,Lagrange'sinterpolationformulae&Newton'sdivideddifferenceformula e.
Section-C	**Numerical Methods To Solve Differential Equations:** Solution of first order differential equations using Taylor's series, Euler's, Picard's and Runge-Kutta method uptofourthorder, Predictor-Corrector methods, simultaneous differential equations of first order, differential equations of second order.
Section-D	**Numerical Integration:** Numerical integration using Trapezoidal rule, Simpson's 1/3rd and 3/8th rules, two point and three point Gauss quadrature method.

Course Outcomes:

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

CO1: Understand and analyze the concept of Numerical Solution of Linear and Non-Linear Equations, Ordinary Differential Equations and Function of complex variable

CO2: Identify an appropriate technique to solve the linear, non-linear equations, ordinary differential equations

CO3: Formulate the problems on related topics and solve analytically

CO4: Apply the concepts of linear, non-linear equations, differential equations and complex analysis in variousengineering problems.

Text Books:

1. Sastry SS, Introductory Methods of Numerical Analysis, Prentice Hall ofIndia
2. ChapraSCandCanaleRP,NumericalMethodsforEngineers,McGrawHillBookCompany

Reference Books:

3. Grewal, BS, "Numerical Methods", KhannaPublishers
4. Computer Oriented Numerical Methods By: V. Rajaraman, PHI Learning Pvt.Ltd

Name of the Course	Microprocessor Architecture and Interfacing		
Course Code	PEE- 4001	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time:3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- To impart knowledge about microcomputers, microprocessor, associated hardware and its architecture.
- To enable students to write program in assembly language.
- To enable the students to understand about the interfacing and peripherals used and application of 8085 microprocessor and its applications.

Section	Course Content
Section-A	**Introduction to 8-Bit Microprocessor:** General 8-bit Microprocessor and its architecture – Intel 8085 Microprocessor, Pin Configuration, CPU Architecture, Registers, ALU Control Unit, Stack.
Section-B	**Microprocessor Instruction Set (INTEL 8085):** Complete instruction set of INTEL 8085, instruction format, types of instructions, various addressing modes, Timing diagrams – T-states, machine cycles, instruction cycle. **Assembly Language Programming:** Programming of Microprocessors using 8085 instructions, use of Arithmetic, logical, Data transfer, stack and I/O instructions in programming, Interrupt in 8085
Section-C	**PeripheralsandInterfacingfor8085Microprocessors:**Memoryinterfacing,I/Oin terfacing –memorymapped and peripheral mapped I/O, Data transfer schemes – Programmed, Interrupt driven and Direct memory Access (DMA) data transfers, Block diagram representation, Control word formats, modes and Simple programming of 8255A PPI, 8254 Programmable Interval Timer, Interfacing of Data converters (A/D & D/A), Serial I/O and data communication
Section-D	**Introduction to 8086 Microprocessors:** Architecture of 8086, block diagram, register set, flags, Queuing, concept of segmentation, Pin description, operating modes, addressing modes and interrupts. **Pentium Microprocessors:** Introduction to Pentium processors.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Identify various hardware components of microcomputers and peripherals.

CO2: Describe the various cycles and execution of instructions in CPU.

CO3: Write assembly language program and able to execute the same.

CO4: Assess the performance 8085 microprocessor and its applications.

Text Books:

1. Gaonkar R S, "Microprocessor Architecture, Programming and Application with8085",Wiley.
2. Ram B, "Fundamentals of Microprocessors and Microcomputers", DhanpatRaiandSons.

Reference Books:

1. Liu Yu-Cheng, "Microcomputer Systems", The 8086/8088 Family," PrenticeHall.
2. Mathur AP, "Introduction to Microprocessors", Tata McGrawHill.
3. Ray AK and Bhurchandi KM. "Advanced Microprocessor and Peripherals: Architecture Programming and Interfacing", Tata McGrawHill.

Name of the Course	Electrical Machines-I Lab		
Course Code	EE-4051	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To perform Ratio, Polarity and the Load Test on a Single Phase Transformer.
2	To perform Open Circuit and Short Circuit Test on a Single Phase Transformer and hence determine its Equivalent Circuit Parameters.
3	To perform Parallel Operation on two Single Phase Transformers.
4	Speed Control of a DC Shunt Motor.
5	To obtain Magnetization characteristics of: a) A separately excited DC Generator. b) Shunt Generator.
6	To obtain the load characteristics of: a) a DC Shunt Motor. b) a DC Cumulative Compound Generator.
7	To perform no-load test and blocked rotor test on a three-phase induction motor and hencedetermine its equivalent circuit parameters.
8	To perform load test on a three-phase induction motor and obtain its various performance characteristics.
9	To perform the retardation test on a three phase induction motor and obtain its moments of inertia.
10	To perform no-load and blocked-rotor test on a single phase induction motor and hence determine its equivalent circuit parameters.
11	To study dc shunt motor starters.
12	To perform reversal and speed control of Induction motor.
13	Identification of different windings of a dc compound motor.

Course Outcomes:

CO1: Perform various configuration tests on electrical single phase AC transformer.

CO2: Understand the working of single phase and three phase electrical motors along with their construction.

CO3: Acquire knowledge about the functioning of DC motor and generator.

CO4: To understand themethods of speed control of induction motors.

Name of the Course	Power Electronics Lab		
Course Code	**EE-4052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max.Time:3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min.Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To determine the V-I characteristics of silicon controlled rectifier (SCR).
2	To study the output and transfer characteristics of MOSFET.
3	To study output and transfer characteristics of IGBT.
4	To determine the V-I characteristics of DIAC.
5	To determine the V-I characteristics of TRIAC.
6	To observe output waveform across RC load of a chopper which is a voltage commutated SCR.
7	To study the action of voltage commutated chopper and plot output waveform.
8	To study action of single phase half wave rectifier with resistive load.
9	To study operation of single- phase full wave rectifier.
10	To study the operation of a single phase to single phase step down cyclo-converter.

Course Outcomes:

CO1: Explain the basic operation of various power semiconductor devices and its applications.

CO2: Analyse power electronic circuits.

CO3: Acquire knowledge about the functioning of DC motor and generator.

CO4: To study the operation ofrectifier and cyclo-converter

Name of the Course	Microprocessor Architecture and Interfacing Lab		
Course Code	**PEE-4053**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	a) Familiarization with the 8085 kit (trainer kit) b) To execute at least 8 programs on the above kit.
2	a) Familiarization with the 8085 kit(trainer-cum-development) b) To execute at least 5 program on the above kit.
3	Study of 8155card
4	Study of 8212card
5	Study of 8255card
6	Study of 8253card
7	Study of 8251card
8	Study of latch, buffer, decade, RAM study card.
9	Study of 8257/8237 DMA control study card
10	Study of DC motor study card
11	Study of traffic control study card.
12	Study of A to D and D/A converter.
13	Familiarization with 8086 trainer kit

Course Outcomes:

CO1: Program 8085 Microprocessors using assembly language.

CO2: Interface peripheral devices such as PPI, Timer, ADC/ DAC with microprocessor.

CO3: Learn implementation of microprocessor based applications such as of Stepper Motor Controller.

CO4: Understand the A to D and D to A converters

Semester V

Name of the Course	Data Science (Open Elective-01)		
Course Code	CS- 5011	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time: 3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- Knowledge of Data Science
- Knowledge of Python
- To understand Panda

Section	Course Content
Section-A	Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.
Section-B	User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling. OOPs Concepts - Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance. NumPy Basics: Arrays and Vectorized Computation- The NumPyndarray - Creating nd arrays - Data Types for ndarrays - Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.
Section-C	Introduction to Pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format
Section-D	Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Course Outcomes:

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

CO1: Have comprehensive knowledge of Data Science and working of Python and Panda as an advanced course

CO2: To know different modules and packages in Python

CO3: To get familiarized with Pandas data structures

CO4: Have comprehensive knowledge of Data cleaning and preparation

Text Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.

Reference Books:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and I Python", O'Reilly, 2nd Edition, 2018.
2. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.

Name of the Course	Electrical Machines – II		
Course Code	EE- 5001	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max. Marks: 100	Min.Pass Marks: 40	Max.Time: 3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:

- To learn about operation, characteristics, testing and control of induction machines.
- To have knowledge about operation, starting, characteristics and testing of synchronous machines.
- To impart knowledge about synchronization methods and parallel operation of alternators.

Section	Course Content
Section-A	**SynchronousMachines:**Types of Exciters for synchronous machines, flux and MMF phasor diagrams for cylindrical rotor synchronous machines, Armature reaction, open and short circuit characteristics, Leakage reactances, Synchronous reactance, Phasor diagram under loaded conditions, operating characteristics of alternators and their ratings, Predetermination of regulation by EMF and Potier triangle.
Section-B	Synchronous Machines: Methods for non-salient pole alternators, Steady state power flow equations, Power angle characteristics, Constant excitation and constant power output, Circle diagram for synchronous machines. Two reaction theory for salient pole alternators and pre-determination for regulation, slip test, V curves, Hunting and its suppression, Starting of synchronous motor, Synchronous condenser.
Section-C	Polyphase Induction Machines: Theory of three phase induction motors, Principle of operation, slip, phasor diagram, equivalent circuits, expression for torque, maximum torque, starting torque and output power, torque-slip and power-slip characteristics, Circle diagram, Predetermination of characteristics from the circuit diagram, Drawing circle diagram from design parameters and no load and blocked rotor test data, power factor control of three phase induction motor, Starting of Induction motors, Speed control of induction motor, Cogging & Crawling, applications of poly-phase induction motors.

Section-D	Parallel Operation of Alternators: Synchronization of alternators by dark lamp method, Parallel operation of alternators, Alternator on infinite bus bar, Effect of change of excitation and prime mover inputs.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1:Explain characteristics of induction machines from the testing data available.

CO2:Drawandexplaincirclediagramforinductionmachinesandsynchronousmachines.

CO3: Carry out calculations for flux, MMF and various parameters of synchronous machines.

CO4:Explain various phenomena associated with synchronous machines.

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Text Books:

1. ElectricalMachinerybyP.S.Bhimbra,KhannaPublishers,Delhi.
2. ElectricMachinerybyA.E.Fitzerald,C.KingsleyandS.D.Umans,TataMcGrawHill.

Reference Books:

1.Theoryof ACMachinery by A.S.Langsdorf, Tata McGraw Hill.

Name of the Course	Control Systems		
Course Code	EE- 5002	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time: 3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- Toimpartknowledgeaboutdevelopingmathematicalmodelsofphysicalsystemsandderivingtheirtransferfunction.
- To introduce the concept of analysing the LTI systems for stability in time domain and frequency domain.
- To enable the students to understand the basic control design methods to meet out desired performance/specifications.

Section	Course Content
Section-A	**Introduction to Control system:** Historical overview, system, servo-mechanism, open loop and closed loop systems, mathematical modelling of physical systems, mechanical and electrical system analogy. Feedback and Non-Feedback Systems: Block diagram representation and reduction techniques, Signal flow graphs, Mason Gain Formula,
Section-B	**Feedback and Non-Feedback Systems:** Feedback and non-feedback systems, regenerative and degenerative feedback, effect of variation of system parameters on system performance, advantages of feedback, Control Components, general block diagram of a control system, a.c. and d.c. Servomotors, a.c. tachometer, synchro transmitter and receiver, synchro pair as control transformer, a.c and d.c position control system, stepper motor, etc.
Section-C	**Time Domain Analysis:** Introduction, standard input signals, Response of 1st and 2nd order systems, time domain specifications i.e. rise time, peak time, delay time, peak overshoot, settling time steady state error etc., different types of feedback systems, Steady state errors for unit step, unit ramp and unit parabolic inputs, Effect of addition of zero to the system.

	Stability Analysis: Introduction, concept of stability, conditions for stable system, asymptotic, relative and marginal stability, Routh-Hurwitz criterion for stability, Root Locus Technique, concepts of root locus, construction of root loci, and various rules pertaining to locus diagram development.
Section-D	**Frequency Domain Analysis:** Introduction, Relation between time and frequency response for 2nd order system, Bode plot, construction procedure for bode plot, gain crossover and phase cross over frequency, gain margin and phase margin, Nyquistplot&Nyquist stability criterion. Control System Design: Selection and realization of basic compensators like lead, lag and lag- lead compensators etc., Introduction to PID Control.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1:Identify different physical systems and classify them as open loop and close loop control systems.

CO2: Describe the mathematical relation between input and output for LTI systems.

CO3: Apply different time domain and frequency domain tools to analyze the absolute and relative stability of LTI systems.

CO4:Assess the performance of LTI systems to different inputs and to design basic controllers to meet desired performance.

Text Books:

1. Control System Engineering: by I.J. Nagrath and M. Gopal, Wiley Eastern.
2. Modern Control Engineering: by K. Ogata, Prentice Hall India.
3. Control System Engineering: by N.S. Nise, Wiley India (P) Limited.

Reference Books:

1. Automatic Control Systems: by B.C. Kuo, Prentice Hall India.
2. Digital Control and State Variable Methods: by M. Gopal, Tata McGraw Hill.

Name of the Course	Protection and Switchgear		
Course Code	EE- 5003	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time: 3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators isallowed.

Course Objectives:
- To impart knowledge about the fault analysis and to understand the impact of fault in a power system.
- To introduce the fundamental concepts relevant to per-unit system their usefulness in fault analysis.
- To understand and implement the protection of transmission lines, transformer and bus bar protection.
- To explain the working principle, applications of circuit breakers.

Section	Course Content
Section-A	**Per-UnitSystemandFaultAnalysis**: Change of base, per unit quantities in three phase system, selection of base values, base quantities in terms of KV and MVA, per unit load impendence, advantages of per unit representation, one-line diagrams, preparation of impendence and reactance diagrams. Type of faults and their occurrence, symmetrical short circuit on the terminals of an unloaded generator, unsymmetrical faults on the terminals of an unloaded generator.
Section-B	**Introduction to Power System Protection:** Abnormal operating conditions, protective system and its attributes, various principles of power system protection. **Protection of Transmission Lines:**Over current protection through fuse, thermal and over current relay, IDMT relay and application on distribution feeder, directional over current relays, differential and percentage differential protection, distance protection of transmission lines through impedance, reactance and mho relay, comparison between distance relays.
Section-C	**Transformer and Bus Bar Protection:** Over current protection, percentage differential protection, incipient faults in transformers, inter-turn fault, protection against over fluxing. Differential protection of busbars. **Generator Protection:** Various faults and abnormal operating conditions, protection against unbalanced loading, over speeding, loss of excitation, loss of prime mover.

Section-D	**Advance Protective Systems:**Carrier aided protection of transmission lines, static comparators as relays, synthesis of various distance relays using static comparators, numerical protection. **CircuitBreaker:**Arc initiation and arc quenching theories, circuit breaker ratings, air circuit breaker, minimum oil circuit breaker, bulk oil circuit breaker, air blast circuit breaker, SF6 circuit breaker and vacuum circuit breaker.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Understand and implement the per-unit system and utilize it for fault analysis purpose.

CO2: Realize the importance of power system protection and judicious selection of type of protection to be applied.

CO3: Understand the various types of circuit breakers according to their application.

CO4: To know and implement advanced protective systems and circuit breakers

Text Books:

1. Elements of Power System Analysis by W.D. Stevenson, McGraw Hill.
2. Modern Power System by D.P. Kothari and I.J. Nagrath, Tata McGraw Hill New Delhi.
3. Electrical Power systembyAshfaqHussain, Vikas Publisher.
4. Power System Analysis by HadiSaadat, Tata McGraw Hill, New Delhi.

Reference Books:

1. Switchgear and Protection by Sunil S. Rao, B.Ravindernath& M. Chander, Khanna Publishers, Delhi.

Name of the Course	Electrical Machines–II Lab		
Course Code	**EE-5051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks:25

List of Experiments

Sr. No.	Name of the Experiment
1	To Obtain Open Circuit and short circuit characteristics of a synchronous generator and calculate its synchronous impedance Zs
2	To estimate hysteresis and Eddy currents losses of single -phase Transformer at rated voltage and frequency by conducting variable frequency at no load test.
3	To Perform load test on 3 phase induction motor.
4	To perform load test on self-excited induction generator.
5	To conduct slip test on the salient pole synchronous machine and calculate X_d and X_q parameters
6	To perform no load and block rotor test on three phase induction motor and determine the equivalent circuit parameter from these tests
7	To measure the zero- sequence reactance of synchronous machine.
8	To perform starting and the synchronization of three phase synchronous machine by light and dark lamp method.
9	To plot V curves of a synchronous motor.
10	To study the dissectible machine system
11	To control the speed of 3 phase induction motor using pole changing method
12	To control the speed of a slip ring induction motor by varying in rotor resistance

Course Outcomes:

CO1: Ability to conduct experiments on A.C. Machines to find the characteristics.
CO2: Knowledge to perform load tests on induction motors
CO3: Able to plot V curves of synchronous motors
CO4: Control the speed of different types of induction motors

Name of the Course	**Control Systems Lab**		
Course Code	**EE-5052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min.Pass Marks:20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks:25

List of Experiments

Sr. No.	Name of the Experiment
1	To study potentiometer based error detector and to draw its characteristics.
2	To study speed control and reversal of stepper motor using microprocessor.
3	To study synchro transmitter – receiver pair and its operation as an error detector.
4	Study of two phase AC servo motor and draw its speed torque characteristics
5	To study voltage sensitive bridge and to analyze its sensitivity and linearity
6	To study D.C. position control system and to execute position control through continuous and step command.
7	To design, implement and study the effects of different cascade compensation networks for a given system.
8	To study the Digital control system and to implement digital PID control for a modeled process.
9	To study relay as nonlinear element and effect of dead-zone and hysteresis on the controlled process.
10	To study speed control of DC Servomotor using PID controller
11	To study magnetic amplifier and to plot control current versus load current characteristics for series, parallel and self-saturation mode configuration
12	To study and perform simple two step open loop control and proportional control on process control simulator kit

Course Outcomes:

CO1: Understand and evaluate the steady state and transient performance of LTI systems

CO2: Design and develop simple control mechanisms for given LTI systems

CO3: Understand the characteristic behaviour of AC/DC actuators and their industrial applications.

CO4: Study and perform speed control of servomotors

Name of the Course	Protection and Switchgear Lab		
Course Code	**EE-5053**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min.Pass Marks:20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks:25

List of Experiments

Sr. No.	Name of the Experiment
1	To study the DMT and IDMT characteristics of micro controller based over current relay
2	To study the DMT and IDMT characteristics of micro controller based over & under voltage relay.
3	To study the characteristics of micro controller-based earth fault relay using IDMT and DMT.
4	To study the DMT and IDMT characteristics of micro controller based over frequency relay
5	To study the DMT and IDMT characteristics of micro controller based under frequency relay.
6	To study the IDMT characteristics of electro mechanical type earth fault relay
7	To study the characteristics of electromechanical type over frequency relay
8	To study the characteristics of electro mechanical type over voltage relay.
9	To study the characteristics of electro mechanical type under voltage relay.
10	To study the characteristics of electro mechanical type over current relay at different current setting

Course Outcomes:

CO1: Identify the various practical problems of power system protection.

CO2: To know the practical concepts of power system protection.

CO3: To understand the fundamental practical concepts of various types of relays.

CO4: Tostudy the characteristics of various relays

Semester VI

Name of the Course	Python Programming (Open Elective-02)		
Course Code	IT-6020	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time: 3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:
- To develop an understanding of programming
- To develop an ability to carry out programming in Python
- To be updated in the knowhow of the latest programming language

Section	Course Content
Section-A	Parts of Python Programming Language, Identifiers, Keywords, Statements Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs,
Section-B	Strings, Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. Dictionaries, Creating Dictionary, Accessing and Modifying key value Pairs inDictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement, Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozen set.
Section-C	Files, Types of Files, Creating and Reading Text Data File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules, Regular Expression

	Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module
Section-D	Object-Oriented Programming, Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism

Course Outcomes:

CO1: To practically apply python programming in applications.
CO2: To know the fundamentals of python programming.
CO3: To practically apply files and types of files.
CO4: To know the fundamentals of Object-Oriented Programming

Text Books:

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor &Francis, 2018.

Reference Books:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media.
2. AurelienGeron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems".
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition,Pearson Education India.
4. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python.

Name of the Course	Power System Operation and Control		
Course Code	EE-6001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To impart knowledge about the power system operation and control.
- To introduce the fundamental concepts relevant to economic dispatch, load frequency control, neutral grounding.
- To enable the students to understand the factors that cause the generation of surge voltages on transmission lines.

Section	Course Content
Section-A	**Power System Control Centres:**Aim of control centre, planning objective, functions of control centres, central facilities, communication, telemetry, emergency control. **Economic Dispatch:**Characteristics of power generation unit; cost curves, incremental cost curve, heat rate curve, incremental efficiency, constraints in economic operation of power system, optimal allocation of total load among different units, derivation of kron's loss formula, optimal allocation of total load when transmission losses are considered.
Section-B	**Load Frequency Control:**Types of alternator exciters, exciter modelling, modelling of alternator, static performance of AVRloop, dynamic performance of AVRloop, compensation in AVR loop, automatic load frequency control, types of turbine representation, steady state performance of the speed governing system, complete structure of primary ALFC loop and its responses, secondary ALFC loop and its performance, extension of ALFC loop to multi-area system, tie-line power flow model, static and transient responses of two area system.
Section-C	**GroundingSystem:**Resistance of grounding system, design principles of substation grounding system, neutral grounding, ungrounded system, resonant, solid, resistance, reactance, earthing, transformer grounding, neutral grounding practice. **HVDC Transmission:**Limitation of AC transmission system, advantages and disadvantages of HVDC transmission.
Section-D	**Travelling Waves:**Propagation of surges, energy and power of a surge, velocity of travelling waves, reflection and refraction of waves, line connected to cable, reflection and refraction at a T-junction, junction of several lines, attention and

	distortion of travelling waves.

Course Outcomes:

CO1: Identify different types of power system operation and control problems.
CO2: Describe HVDC transmission, grounding methods, corona loss formula.
CO3: Identify different types of grounding systems
CO4: Study about the travelling waves.

Text Books:

1. Power System Analysis by HadiSaadat Tata McGraw Hill, New Delhi.
2. Power System Analysis Operation and Control by AbhijitChakrabarti and SunitaHalder, PHI New Delhi
3. Electrical Power SystemsbyAshfaqHussain, CBS publication.

Reference Books:

1. Power System Operation & Control by K. Uma Rao, Wiley India Pvt. Ltd.

Name of the Course	High Voltage Engineering		
Course Code	PEE-6002	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:
- To impart knowledge about the breakdown in gases, liquid and solid materials.
- To introduce the fundamental concepts relevant to generation of high voltage.
- To understand and implement the measurements of high voltage and current.
- To explain the lightning switches, switching over voltages.

Section	Course Content
Section-A	**Breakdown in Gases:** Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge. **Breakdown in liquid and solid Insulating materials:** Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.
Section-B	**Generation of High Voltages**: Generation of high voltages, generation of highD. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.
Section-C	**Measurements of High Voltages and Currents:** Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.
Section-D	**Lightning and Switching Over-voltages:** Charge formation in clouds, stepped leader, dart leader, lightning surges. Switching over-voltages, protection against over-voltages, surge diverters, surge modifiers.

Course Outcomes:

CO1: Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
CO2: Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.

CO3: Knowledge of tests on H. V. equipment and on insulating materials, as per the standards. CO4: Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.
Text Books: 1. M. S. Naidu and V. Kamaraju, " High Voltage Engineering", McGraw Hill Education, 2013. **Reference Books:** 2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

Name of the Course	Transducers and Signal Conditioning		
Course Code	EE-6003	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:
- To identify, formulate and solve the Transducers and signal conditioning based problems.
- To provide the students with a strong foundation in subject fundamentals required to solve industry based problems.
- To acquire the basic knowledge of transducers and signal conditioning for research applications.

Section	Course Content
Section-A	**Transducers** Introduction, classification, Mechanical devices as primary detectors, Basic requirements of a transducer, Electrical transducers, Type of transducers for measuring displacement, strain, vibration, pressure, Flow, temperature, force, torque, liquid level, Humidity, P. H. value, velocity (angular and linear), acceleration, Basic principles of resistive transducers, Inductive transducers, capacitive transducers, Thermoelectric transducers, Piezoelectric transducers, Hall effect transducers, Electromechanical transducers, Photoelectric transducers, Digital transducers.
Section-B	**Signal Processing Circuits** Introduction, ideal op-amp, Operational amplifier specifications, Zero crossing detector, Zero crossing detector with Hysteresis, inverting and non-inverting amplifiers, Voltage-follower, adder, subtractor, integrator, Differentiator, voltage to current converter, current to voltage converter, Phase shifter circuit, Absolute-Value circuit, Peak detector, AC to DC converter, logarithmic converter, Differential-amplifier, Instrumentation amplifier, Analog Modulators and demodulators.
Section-C	**Data Display and Recording Systems** Introduction to Analog and digital display methods, Analog Recorders, C.R.O., digital input- output Devices, Digital frequency meter, Digital Voltmeter. **Data Transmission and Telemetry** Introduction, Methods of data transmission, General telemetering system, Electrical telemetering systems.
Section-D	Transmission channels and media, Multiplexing in telemetering systems,Characteristics of Frequency division multiplexing, Time-division

	multiplexing. **Data Acquisition and Conversion:** Introduction, signal conditioning of the inputs, single channel D A S, Multi-channel D A S, Data Conversion, Multi-plexer, S/H circuit, A/D converter

Course Outcomes:

CO1: Describe working principles of sensors and transducers.

CO2: Understand working principle of transducers used for measurement and comparative study of various transducers.

CO3: The Understanding of different transducers and sensors for applications in industry.

Text Books:

1. A course in Electrical, Electronic Measurements and Instrumentation by A.K. Sawhney, DhanpatRai& Sons.
2. Transducers and Instrumentation by D.V.S. Murty, Prentice Hall of India Private Limited.

Reference Books:

3. Measurement Systems (Application & Design) by Ernest O. Doebelin, McGraw Hill Higher Education, New Delhi.
4. Instrumentation Devices and Systems by C.S. Rangan, G.R. Sharma, and V.S.V. Mani, TMH New

Name of the Course	Digital Signal Processing		
Course Code	**EC-5003**	**Credits-4**	**L-3, T-1, P-0**
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation and analysis DSP systems.

Section	Course Content
Section-A	**Discrete-Time Signals And Systems:** Basic Elements of a Digital Signal Processing System, Advantages of Digital Signal Processing, Classification of Signals, The Concept of Frequency In Continuous-Time and Discrete-Time Domain, Discrete-TimeSignalsandSystems,AnalysisOfDiscrete-TimeLinearShift-Invariant Systems, Linearity, Causality And Stability Criterion, Discrete-Time Systems Described By Difference Equations.
Section-B	**Discrete-Time Fourier Transform:** Fourier transform of discrete-time signals (DTFT), properties of the DTFT, the frequency response of an LTI discrete-time system, the Fourier series of discrete-time signals (DTFS). **Discrete Fourier Transform:**Frequency domain sampling and the DFT, properties of the DFT, linear filtering methods based on the DFT, efficient computation of the DFT: decimation-in-time and decimation-in frequency fast Fourier transform algorithms.
Section-C	**Z-Transform:** Introduction to the z-transform & the inverse z-transform, properties of the z-transform, relationship between the Fourier transform and thez-transform,rationalz-transforms&thesystemfunction,analysisoflinear time-invariant systems in the z-domain. **Digital Filter Structures:** digital filter categories, realization structures for FIR&IIR digital filters, representation of numbers: fixed-point,floating point, error resulting from rounding and truncation.
Section-D	**Digital Filter Design:** General considerations; design of IIR filter from analog filters: IIR filter design using Approximation of derivative, impulse invariant method, bilinear transformation; design of linear phase FIR digital filters:symmetry and anti-symmetry FIR filters, FIR digital filter design using the windowing method and the frequency-sampling method.

Course Outcomes:

CO1: Interpret, represent and process discrete/digital signalsand systems

CO2: Through understanding of frequency domain analysis of discretetime signals.

CO3: Ability to design &analyse DSP systems like FIR andIIRFilteretc.

CO4: Understanding of spectral analysis ofthe signals.

Text Book:

1. Digital Signal Processing: Principles, Algorithms and Applications by John G. Proakis&Dimitris G. Manolakis; Pearson Education.

Reference Books:

1. Digital Signal Processing by Sanjit K. Mitra; Tata McGrawHill Publication.
2. Digital Signal Processing by P Ramesh Babu; SCITECH Publication (India)Pvt Ltd.

Name of the Course	Transducers and Signal Conditioning Lab		
Course Code	**EE-6061**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks:20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment:20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Study of Cathode Ray Oscilloscope, its various controls and their functions.
2	Measurement of AC and DC voltage signals, current, frequency using CRO.
3	To study the characteristics and measure displacement using displacement transducers**.**
4	To study piezoresistive transducer for pressure measurement
5	To study speed sensing transducers and plot its characteristics
6	Measurement of temperature using: (i) Thermistor (ii) Thermocouple (iii) RTD
7	To study airflow sensor.
8	Measurement of forced/load using strain gauge transducer
9	To study Vibration sensor
10	To study the characteristics of LVDT and measurement of displacement
11	Study of passive/active/M derived filter

Course Outcomes:

CO1: To identify various errors in measurement system and correct them.

CO2: To know the fundamentals of measuring systems including the particular limitations and capabilities of a number of measuring devices (LVDT, pressure transducers, strain gages, thermocouples, LDR, etc.) and Equipment's (oscilloscope, signal generator, recorders,etc.).

CO3: To be familiar with characteristics of various transducers.

CO4: Tostudy airflow sensors and their applications

Name of the Course	Principles of Engineering Economics and Management		
Course Code	**HSMC-6001**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculatorisallowed.

Course Objectives:
- To understand fundamental concepts of economics
- To understand various theories of economics
- To understand basic principles of managements

Section	Course Content
Section-A	Economics: Definitions; Nature & scope of Economics; Economics Systems-meaning of Capitalism; Socialism & mixed economy. Demand and supply analysis: Law of demand and supply, exception to the law of demand; Elasticity of demand and supply and their types; Methods of measuring elasticity of demand andsupply..
Section-B	Theory of production: Scales of production, Law of returns; Break even analysis. Monetary and Fiscal policy: Meaning & objectives of fiscal policy in a developing country like India; Functions of Reserve Bank of India and commercial banks. Economics & business environment: Privatization; Growth of private capitalism in India; Business/Trade Cycles – Meaning; Characteristics & classification; foreign capital & economic development.
Section-C	Management principles: Meaning & types of Management; Concept of Scientific Management; Management by Objectives; System Approach to Management. Financial management: Meaning; Functional areas of financial management; Sources of Finance; Meaning of financial accounting; accounting principles-concepts&conventions;Importanceoffinalaccounts–profit&lossa/candbalance sheet; Need and importance of capitalbudgeting. Marketing management: Introduction to marketing management; Market segmentation; Developing & managing advertising programs; Deciding on media & measuring effectiveness
Section-D	Analysis: Production Management: Procedure for production planning & Control; Plant Location & Lay-out; Routing; Scheduling; CPM & PERT Quality Management: Quality Management System, Quality Management Principles, ISO 9001 Structure, Quality Audits, ISO Registration, Requirements, Benefits of ISO registration.

Course Outcomes:

CO1: Identify and discuss the role and importance of economics in civil engineering.
CO2: Identify and discuss the issues and concepts related to production and quality management.
CO3:Apply cost estimation and alternative analysis techniques for engineering applications.
CO4: Identify and discuss the complex issues related to management

Text Books:

1.Business Organisation& Management by B.P.Singh, T.N.Chabra, Dhanpat Ra & Sons
2.Modern Economic Theory by K .K. Dewett, S.Chand& Co
3. Marketing Management by Philip Kotler, Prentice Hall of India
4.Financial Management by I.M. Pandey, VikasPublishin g House
5. Indian Economic by RuddarDutt, K. P. M. Sundaram, S.Chand&Co
6. Advanced Economic Theory by H.L.Ahuja, S.Chand&Co
7. Production Operation Management by Dr. B.S. Goel, Pragati Prakashan
8. Statistical Quality Control by Grant, Leaven worth, Tata Mc. GrawHill
Personnel Management by, Edwin B.Flippo, Tata Mc. GrawHll

.**Reference Book:**

1. IEE Tutorials on 'Flexible ac transmission systems' published in Power Engineering Journal, IEEPress.

Name of the Course	**NCC ELECTIVE COURSE**		
Course Code	**NCC-01**	Credits: 03	L-3, T-1, P-0
Lectures to be	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
INSTRUCTIONS: This course shall be studied, and the examination set, according to the course design for NCC elective course by UGC, attached as "Appendix A" at the end			

Semester VII

Name of the Course	FACTS Devices* (Program Elective-01)		
Course Code	**PEE-7001**	**Credits-4**	**L-3, T-1, P-0**
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min. Pass Marks: 40**	**Max. Time: 3 Hrs.**
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculatorisallowed.

Course Objectives:

- To introduce the various topologies of the power electronics circuits.
- To provide basic understanding of the emerging power electronics technologies for power utility applications.
- To enable students to understand the harmonics issues in power utility and means of controlling it using power electronics.
- To enable students to design power electronics circuit that can control active and reactive power flow.

Section	Course Content
Section-A	**Introduction:** Fundamentals of ac power transmission, Concept & Power Electronic Controllers, Static Shunt Compensators.
Section-B	**Principles of Compensation:** Static Series Compensators, Static Voltage and Phase Angle Regulators.
Section-C	**Various Compensators**: Unified Power Flow Controller (UPFC), Interline Power Flow Controller.
Section-D	**Analysis:** Stability Analysis, Application and HVDC controlled link

Course Outcomes:

CO1: Describe the technical characteristics and performance of the electric power system with and without power electronics support.
CO2: Identify, formulate and analyse complex problems in electric power engineering.
CO3: Identify different power electronic based solutions for improving both the steady state and the transient.
CO4: Communicate and work effectively on why and how power electronics can be used for power utility applications

Text Books:

1.Flexible ac transmission systems(FACTS) by Y. H. Song, and T. Allan, Institution of Electrical Engineers Press, London.

2.Concepts and Technology of flexible ac transmission system by Hingorani and L.Gyugyi, IEEE Press New York.

Reference Book:

3.IEE Tutorials on 'Flexible ac transmission systems' published in Power Engineering Journal, IEEPress.

Name of the Course	Modern Control Systems		
Course Code	PEE-7002	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- To impart knowledge about developing state space models from differential/transfer function-based descriptions of linear systems.
- To introduce difference equation description of discrete time LTI systems and analysing their stability.
- To introduce the typical behaviours shown by nonlinear systems and to analyse the stability of such systems.
- To introduce the preliminary understanding about the advanced control methodologies used to handle systems with uncertainty

Section	Course Content
Section-A	State Variable Analysis and Design: Introduction, concept of state, state variable and state model, state space representation of systems, block diagram for state equation, Transfer function decomposition, direct, parallel and cascade decomposition, solution of state equations, concept of controllability and observe ability, controller design using pole placement by state feedback, controller design using state observer.
Section-B	Sampled Data Control: Introduction, digital control systems, quantization concept, data acquisition, conversion and distribution system, z-transform, Important properties, inverse z- transform, difference equation and solution using z-transform, Impulse sampling and data hold, reconstruction of original signals from the sampled version
Section-C	Analysis of Discrete Time Systems : Pulse transfer function for open loop and closed loop systems, mapping between z-plane and s-plane, stability analysis using Jury's test, bilinear transformation and Schur-Cohn criteria, state space representation of discrete time systems and solution of discrete time state equations.
Section-D	Nonlinear Systems: Introduction, different non-linearities, phase plane method, singular points, stability of nonlinear systems, construction of phase trajectories, phase plane method, concepts of describing function method, stability analysis using describing function method, jump resonance phenomena, Liapunov and Popov stability criterion Advanced Control Systems: Introduction to Uncertain

	systems, robust and H-infinity control, Model Reference Adaptive Control

Course Outcomes:

CO1: Develop different state space representations for linear time invariant systems.

CO2: Write descriptions for discrete time systems and analyse the stability of such systems.

CO3: Understand and justify the peculiar behaviours shown by nonlinear systems

CO4: Analyse the stability of nonlinear systems using phase plane, describing function and Lyapunov method.

Text Books:

1. Discrete Time Control Systems: by K. Ogata, Prentice Hall International E. Balaguruswamy, "Programming in C", Tata McGraw Hill.
2. Control System Engineering: by I.J. Nagrath and M. Gopal, Wiley Eastern.
3. Digital Control Systems by B.C. Kuo, Oxford University Press.

Reference Book:

4. Digital Control and State Variable Methods: by M. Gopal, Tata McGraw Hill.
5. Applied Nonlinear Control by J.J.E. Slotine& W. Li, Prentice Hall, Englewood Cliffs, New Jersey.

Name of the Course	Communication Systems		
Course Code	PEE-7003	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for thecourse.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculatorisallowed.

Course Objectives:

- To introduce the fundamental concepts of communication systems.
- To understand the basic concept of analog modulation schemes using continuous wave and pulse train as carrier signal.
- To study the working of the practical receiver used in broadcasting applications.
- To learn the sampling process and different schemes for digital modulation.
- To introduce the fundamental concepts of advanced communication systems.

Section	Course Content
Section-A	**Introduction to Communications Systems:** Communication process, sources of information, communication channels, base band and pass band signals, representation of signals and systems, switched communication systems. **Continuous-wave Modulation:** Amplitude modulation (AM), frequency spectrum of the AM wave, representation of AM, power relations in the AM wave, AM detector, vestigial side-band modulation.
Section-B	**Angle Modulation:** Frequency spectrum of Frequency Modulation (FM) and Phase Modulation, generation of FM (direct and indirect method), demodulation of FM signal. **Radio Receiver:** Tuned Radio-Frequency (TRF) receiver, super heterodyne receiver.
Section-C	**Pulse Modulation:** Sampling process, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM). **Digital Modulation Techniques:** Quantization process, Pulse Code Modulation (PCM), Differential Pulse Code Modulation (DPCM), Delta Modulation (DM), Adaptive Delta Modulation
Section-D	Amplitude –Shift Keying (ASK), Frequency-Shift Keying (FSK), Phase-Shift Keying (PSK).

	Advanced Communication Systems: Computer communication system, satellite communications, mobile communication systems: Introduction to Uncertain systems, robust and H-infinity control, Model Reference Adaptive Control

Course Outcomes:

CO1: Understand the basic communication systems, various sources of information, and communication channels.
CO2: Describe various analog modulation scheme and their relative merits and demerits.
CO3: Understand the basis for digital modulation scheme and its advantages over analog modulation scheme.
CO4: Realize the basic concept of advanced communication systems.

Text Books:

1. Communication Systems by Simon Haykin, John Wiley & Sons Pvt. Ltd.
2. An Introduction to Analog and Digital Communications by Simon Haykin, Wiley India Pvt. Ltd.
3. Principles of Communication Systems by H. Taub and D.L. Schilling, McGraw-Hill Education

Reference Book:

4. Electronic Communication Systems by George Kennedy, McGraw-Hill Education
5. Principles of Communication Engineering by Anokh Singh, S. Chand & Co.

Name of the Course	Signals and Systems		
Course Code	EC-3003	Credits-3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- Understanding the fundamental characteristics of signals and systems.
- To provide with necessary tools and techniques to analyze electrical networks and systems.
- Analyze signals and systems to represent real world system in terms of both the time and transform domains.
- Develop the mathematical skills to design solutions to real world problems using convolution, filtering, modulation and sampling.

Section	Course Content
Section-A	Introduction to Signals and Systems: Signal basics, classification of signals, Elementary signals, Transformations of the independent variables, Exponential and Sinusoidal signals, signal operations, signal properties, Sampling and Reconstruction of signals, System basics, classification of systems, Continuous-Time Systems, Discrete-Time Systems, system properties, linearity, time/shift-invariance, causality, stability.
Section-B	Linear Time-invariant Systems: Continuous-time Linear Time-invariant (LTI) system, Discrete-time LTI system, Properties of LTI systems, Impulse response and step response, response to an arbitrary input, Convolution, Correlation, System representation through linear constant coefficient differential equations.
Section-C	Frequency Analysis of Signal and Systems: Fourier series representation of continuous- time periodic signals, Properties of continuous-time Fourier series, Fourier series and LTI systems, Representation of aperiodic signals, The Fourier transform for periodic signals, Properties of the Continuous-time Fourier transform (CTFT), Convolution and multiplication properties and their effect in the frequency domain. Frequency Analysis of Continuous-Time Signals, Frequency Analysis of Discrete-Time Signals, Properties of Discrete-Time Fourier Transformation (DTFT), Frequency-domain characteristics of

	Liner-Invariant Systems
Section-D	Laplace Transform and Z -Transform: The Laplace transforms for continuous-time signals and systems, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform, z-transformation, Properties of the Z-Transformations, Inversion of the z-transform, The One-Sided Z-transformation, Analysis of Linear-Time-Invariant Systems in the Z-Domain.

Course Outcomes:

CO1: Classify signals and systems based on their properties and determine the response of LTI system using convolution.

CO2: Analyze the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.

CO3: Analyze system properties based on impulse response and Fourier analysis.

CO4: Apply the Laplace transform and Z- transform to analyze continuous-time and discrete-time signals and systems..

Text Books:

1. A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, "Signals and Systems", Prentice Hall, 2nd Edition, 2003.
2. B.P. Lathi, "Principles of Linear Systems and Signals", Oxford University Press, 2nd Edition, 2009

Reference Books:

1. B. V. Veen, "Signals and Systems‖ 2nd Edition", Wiley, 2007.
2. M. J. Roberts, "Fundamentals of Signals & Systems", Tata McGrawHill, 2007.
3. R. E. Zeimer, W. H. Tranter and R. D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson Education, 2007

Semester VIII

Name of the Course	Fundamentals of Electric Drives*(Program Elective-02)		
Course Code	PEE-8001	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- To impart basic knowledge on electrical drive.
- To introduce the fundamental concepts relevant to ac and dc motor drives.
- To enable the students to understand the factors that causes the selection of a drive for particular application.

Section	Course Content
Section-A	Introduction to Electrical Drives; Dynamics of Electrical Drives; Review of Torque-Speed Characteristics of DC Motors (Shunt and Series) including Motoring and Braking Converter (Half Controlled Converter, Full Controlled Converter, Dual Converters); Control of DC Motor Drives; Torque Speed Characteristics of Converter-fed DC Drives
Section-B	Chopper Controlled DC Drives (Single and Multi-quadrant Converters), Motoring and Braking operations, Induction Motor Drives – Equivalent circuits; Torque- speed characteristics; Operation of Induction Motor with Unbalanced Source Voltages; Analysis of Induction Motor from Non-sinusoidal Voltage Supply; Starting and Braking of Induction Motor
Section-C	Stator Voltage Control of Induction Motor; Variable Voltage/ Current; Variable Frequency Control of Induction Motor Fed from VSI and CSI;Control of Slip-ring Induction Motor Synchronous Motor Characteristics (Cylindrical and Salient Pole); CSI-fed Synchronous Motor Drive; Permanent Magnet Synchronous Motor Drive; Brushless DC Motor Drives
Section-D	Traction Drives – Characteristics of Traction Drives; Drive Power Requirement; DC and AC Traction Switched Reluctance Motor – Construction; Analysis and Closed-loop Control; Various Types of Stepper Motor and their Characteristics

Course Outcomes:

CO1: Identify suitable electric motor drive for particular application.
CO2: Describe the operation of dc motor drives to satisfy four-quadrant operation.
CO3: Explain the working of various phase-controlled converters used in AC Drives.
CO4: Understand on the operation, working, and controlling of VSI based drives.

Text Books:

1. Electric Motor Drives by R. Krishnan, PHI.
2. Electric Driveby M. Chilikin, Medtech.
3. Power Semiconductor Controlled Drivesby G. K. Dubey, Prentice Hall.

Reference Books:

4. Power Semiconductor Drives by S. B. Dewan, G. R. Slemon, and A. Straughen, John Wiley.

Name of the Course	Open Source Technologies (Open Elective-03)		
Course Code	**IT-8040**	Credits-3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- The syllabus covers the study open source principles, strategies, how to contribute, Linux distributions, source code management tools, automation tools and reporting tools.

Section	Course Content
Section-A	The syllabus covers the study open source principles, strategies , how to contribute , Linux distributions, source code management tools, automation tools and reporting tools
Section-B	Open source development, Proprietary software development model vs. Open Source software development model, models for FOSS- Cathedral model and Bazaar model. Introduction to collaborative development (Developer commSectionies, mailing lists, IRC, wiki, version control, bug tracking, handling non-technical issues, localization, accessibility, documentation by doxygen). Software package management (RPM, DEB - building, and creating software repositories) Open Standards, Licensing and legal aspects in detail.
Section-C	Configuration of Network communication services and File system DHCP, DNS, WINES, NFS, NIS, Web server, Ftp Server, E-mail Server, Telnet Server, etc. Configuration through webmin or usermin, Installing and configuring of Cygwin, Installing and configuring of CMS – moodle, druple etc.
Section-D	Useful tool and Scripting languages Shell programming, AWK, python etc, Report writing tools. Operating System utilities, TCP/IP utilities, Network analyzer, Traffic analysis, Protocol analysis, Network Management Using SNMP

Course Outcomes:

CO1: Demonstrate the configuration of software services on servers.
CO2: Exercise the FOSS tools for the software development.
CO3: To understand the configuration of Network communication services.
CO4: To study useful tools and scripting languages

Text Books:

1. Distributed Systems and Networks “by William Buchanan TMH Publication.
2. The complete reference Linux” by Richard L. Peterson Tata Mcgraw Hill Publication

Reference Books:

3. Introduction to Free Software” - by SELF project.

Name of the Course	Renewable Energy Sources		
Course Code	**PEE-8002**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:

- To familiarize the students with general power scenario, various renewable energy technologies and grid integration of renewable energy resources.
- To familiarize the students with renewable energy sources like solar, geothermal, wind and fuel cell.
- To familiarize the students with thermos-electric power generation

Section	Course Content
Section-A	Introduction to Energy Sources: World energy futures, Conventional energy sources, Nonconventional energy sources, Prospects of Renewable energy sources. Solar Energy: Introduction to solar radiation and its measurement, Introduction to Solar energy Collectors and Storage, Solar thermal electric conversion, Thermal electric conversion systems, Solar electric power generation, Solar photo-voltaic, Solar Cell principle, Semiconductor junctions, Conversion efficiency and power output, Basic photo- voltaic system for power generation
Section-B	Wind Energy and Wind Energy Conversion: Introduction to wind energy conversion, the nature of the wind, Power in the wind, Wind data and energy estimation, Site Selection considerations, basic Components of a Wind energy conversion system, Classification of WEC Systems, Schemes for electric generation using synchronous generator and induction generator, wind energy storage.
Section-C	Direct Energy Conversion Processes: Magneto Hydro Dynamic Power Generation: Principles of MHD power generation, Open cycle systems, Closed cycle systems, Voltage and power output, Materials for MHD generators. Thermo-Electric Generation and Thermionic Generation: Basic principles of thermo- electric power generation, Seebeck, Peltier, Thomson effects, Thermo-Electric power generator, and Analysis materials. Thermionic emission and work function, Basic thermionic generator.
Section-D	Thermo-Nuclear Fusion Energy and Fuel Cells: The basic Nuclear Fusion and Fission Reactions Plasma confinement, Thermo-Nuclear function reactors. H2,

	O2 cells, classification of fuel cells, types, Advantages, Electrodes, Polarization Energy from Biomass: Biomass conversion technologies, photosynthesis, Bio-gas generation, types of bio-gas plants, Biomass as a Source of Energy: Methods for obtaining energy from Bio-mass, Bio-logical conversion of Solar energy.

Course Outcomes:

CO1: Analyze the energy scenario of the world and nation.

CO2: Carry out a comparative analysis of different types of coal, including their treatment, liquefaction and gasification.

CO3: Compare the liquid and gaseous fuels sourced from petroleum including their characterization.

CO4: Analyze the potential of alternate energy sources and their scope and limitations.

CO5: Solve energy related problems related to combustion and non-combustion.

Text Books:

1. Renewable energy sources and conversion technology by N.K. Bansal, M. Kleemann, & M. Heliss, Tata McGraw-Hill.
2. Renewable Energy by S. Bent, Academic Press.

Reference Books:

3. Renewable Energy: Power for a Sustainable Future by G. Boyle, Oxford University Press.

Name of the Course	Organizational Behaviour		
Course Code	**HSMC – 8001**	Credits-3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculatorisallowed to use in examinations.

Course Objectives:
- To understand fundamental concepts of organization.
- To understand various aspects of behaviour
- To understand basic of management.

Section	Course Content
Section-A	OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager LEARNING: Nature of learning, How learning occurs, Learning & OB
Section-B	PERSONALITY: Meaning & Definition, Determinants of Personality Personality Traits, Personality & OB PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OBMOTIVATION: Nature & Importance, Herzberg's Two Factor theory and Maslow's Need Hierarchy theory
Section-C	GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioral Theory Contingency Theory, Leadership & Followership, How to be an Effective Leader CONFLICT: Nature of Conflict & Conflict Resolution
Section-D	ORGANIZATIONAL CULTURE AND CLIMATE: Factors affecting organizational climate, Importance JOB SATISFACTION: Determinants, Measurements, Influence on behaviour, STRESS: Work Stressors, Prevention and Management of stress, Balancing work and Life

Course Outcomes:

CO1: Identify and discuss the role and importance of organizational behaviour in Engineering.

CO2: Identify and discuss the issues and concepts related behavior. CO3: Identify and discuss issues related to working in organisation. CO4: Identify and discuss the complex issues related to management.
Text Books: 1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition. 2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007. **Reference Books:** 3. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.

Appendix "A"

BROAD COURSE DESIGN FOR NCC GENERAL ELECTIVE CREDIT COURSE

NCC GENERAL ELECTIVE CREDIT COURSE DESIGN SUMMARY					
Semester	Credits Allocated			Total	Remarks
	Theory	Practical	Camp		
Semester - I	1	1		2	
Semester - II	1	1		2	
Semester – III	1	1	5	7	Credits of 1st Camp merged with 3rd Sem
Semester – IV	2	1		3	
Semester – V	1	1	5	7	Credits of 2nd Camp merged with 5th Sem
Semester - VI	2	1		3	
Total	08	6	10	24	Twenty-Four Credits

INSTITUTIONAL TRAINING SYLLABUS

COMMON SUBJECTS				
S no.	Subject	Periods (1 hour duration each)		
		Lectures/Tutorials	Practicals	Total
1.	NCC General	06	-	06
2.	National Integration	04		04
3.	Drill	-	45	45
4.	Weapon Training	-	25	25
5.	Personality Development	25		25
6.	Leadership	12	-	12
7.	Disaster Management	13		13
8.	Social Service & Community Development	08	39	47
9.	Health & Hygiene	-	10	10
10	Adventure	01		01
11	Environmental awareness & conservation	03		03
12.	Obstacle Training	-	09	09
13.	General Awareness	04		04
14.	Border & Coastal Areas	06		06
		82	**128**	**210**
	SPECIALZED SUBJECTS (ARMY)			
1.	Armed Forces	09	-	09
2	Map Reading	-	24	24
3	Communications	03	03	06
4	Infantry Weapons	03	03	06
5.	Field Craft & Battle Craft		22	22
6	Military History	23	-	23
TOTAL HOURS SPECIALISED SUBJECTS		**38**	**52**	**90**
GRAND TOTAL HOURS (TOTAL CREDITS)		120 (08 cr)* *15 HOUR THEORY = 1 CREDIT POINT	180 (6 cr)** **30 HOURS PRACTICAL TRAINING = 1 CREDIT POINT	**300**

SEMSTER WISE DISTRIBUTION OF NCC SYLLABUS FOR THEORY

S. NO.	SUBJECT	SEMESTER						TOTAL
		I	II	III	IV	V	VI	
1	NCC General	6	-	-	-	-	-	6
2	National Integration and Awareness	4	-	-	-	-	-	4
3	Personality Development	2	5	5	4	6	3	25
4	Leadership	-	5	4	3	-	-	12
5	Disaster Management	-	-	3	10	-	-	13
6	Social Service and Community Development	3	5	-	-	-	-	8
7	Adventure	-	-	1	-	-	-	1
8	Environmental awareness & conservation	-	-	-	3	-	-	3
9	General Awareness	-	-	-	4	-	-	4
10	Border & Coastal Areas	-	-	2	-	2	2	6
11	Armed Forces	-	-	-	6	-	3	9
12	Infantry Weapons	-	-	-	-	3	-	3
13	Communication	-	-	-	-	-	3	3
14	Military History	-	-	-	-	4	19	23
	Total Periods	15	15	15	30	15	30	120
	Total Credit Points	1	1	1	2	1	2	08

SEMSTER WISE DISTRIBUTION OF NCC SYLLABUS FOR PRACTICAL

S. NO.	SUBJECT	SEMESTER						TOTAL
		I	II	III	IV	V	VI	
1.	Drill	12	12	8	7	3	3	45
2.	Field Craft & Battle Craft	3	4	4	4	4	3	22
3	Map Reading	3	5	4	4	4	4	24
4	Weapon Training	5	4	4	4	4	4	25
5	Communication	-	-	-	-	-	3	03
6	Infantry Weapons	-	-	-	-	-	3	03
7	Social Service and Community Development	7	5	5	6	5	10	38
8	Health & Hygiene	-	-	-	5	5	-	10
9	Obstacle Training	-	-	5	-	5	0	10
10	Total Periods	30	30	30	30	30	30	180
	Total Credit Points	1	1	1	1	1	1	6

NCC CAMP TRAINING SYLLABUS

COMMON SUBJECTS				
S No.	Subjects	Periods		Total
1.	Physical Training	-	18	18
2.	Drill	-	32	32
3.	Weapon Training	08	28	32
4.	National Integration and Awareness	08	-	04
5.	Personality Development	08	12	20
6.	Leadership	08	-	04
7.	Disaster Management	08	-	04
8.	Social Service and Community Development	-	08	08
9.	Health & Hygiene	08		04
10.	Obstacle Training	-	04	04
11.	Military History	04	-	-
12.	Communication	04	-	-
13.	Games	-	18	18
14.	Culture	-	18	18
15.	Spare	-	04	04
	TOTAL	**56**	**142**	**170**
SPECIALISED SUBJECTS				
1.	Map Reading			
2.	Infantry Weapons	04	24	24
3.	Field Craft & Battle Craft		02	04
	TOTAL	04	12	12
		60(4 cr)	**180(6 cr)**	**240(10 cr)**