SYLLABUS

B.Tech
I Year I Semester

B.Tech
I Year I Semester

S.No	Course Code	Course Title
1	19BST04	Engineering Mathematics-I
2	19BST02	Engineering Chemistry
3	19CST01	Programming for Problem Solving
4	19ECT01	Basic Electronics Engineering
5	19BST13	Essence of Indian Knowledge Tradition
6	19BSP02	Engineering Chemistry Lab
7	19CSP01	Programming for Problem Solving Lab
8	19MEP01	Engineering Graphics Lab
9	19ECP01	Basic Electronics Engineering Lab

19BST04: ENGINEERING MATHEMATICS – I

Credits - 4 **Sessional Marks: 30**

L: T: P:: 3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To introduce the mean value theorems and the fallouts of Rolle's Theorem that is fundamental to application of analysis to engineering problems.
2. To familiarize the students with techniques in integral calculus and introduce the idea of applying integral calculus to notations of curvature.
3. To acquaint the student with different effective mathematical tools for the solutions of differential equations that model physical processes.
4. To equip the students with standard concepts in vector calculus and its applications.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Identify the extrema of a function on an interval and classify them as maxima, minima or saddle using the first derivative test.
CO2. Calculate double and triple integrals and apply to measure the area of a plane and volume of a solid.
CO3. Use the tools of Calculus to sketch the graphs of functions, Critical points, intercepts, Asymptotes etc.
CO4. Solve second and higher order linear differential equations with constant coefficients.
CO5. Analyze the methods for finding the solutions of linear differential equations.
CO6. Memorize definitions of Curl, Gradient and Divergence of vector field and compute them.
CO7. Understand the statements of Stoke's, Green's and Divergence theorem and apply them in solving Engineering problems.

UNIT I

Calculus: Roll's and Mean value theorems, Taylor's theorem, Maclaurins theorem - Maxima & minima for functions of two variables – Curve tracing.

UNIT II

Multiple integrals: Double and triple integrals, Change of order of integration, Change of variables – Simple applications – areas & volumes.

UNIT III

Differential Equations-I: Exact, Linear and Bernoulli's equations, orthogonal trajectories; Homogeneous and Non-Homogeneous linear differential equations of second and higher order with constant coefficients.

UNIT IV

Differential Equations-II: Linear equations with variable coefficients-Euler equations, Method of variation of parameters, Simultaneous equations.

UNIT V

Vector Calculus: Gradient, Divergence, Curl and related properties; Line, surface and volume integrals; Stokes, Greens and Gauss-Divergence theorems.

Text books

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition.

Reference Books

1. T.K.V.Iyengar & B.Krishna Gandhi et., "Engineering Mathematics – I, II ";S. Chand & Company.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H		L								
CO2	H	M		L								
CO3	H	H	M	L								
CO4	H	M	L									
CO5	H	M			L							
CO6	M	H			L							
CO7	M	H			L							

19BST02: ENGINEERING CHEMISTRY

Credits – 4 **Sessional Marks: 30**
L: T: P::3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
2. To strengthen the fundamentals of chemistry in Atomic Structure and then build an interface of theoretical concepts with the engineering applications.
3. To help students understand the fundamental concepts and achieve Advanced Knowledge about the interactions of Spectroscopy and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
4. To Implement the concepts of chemistry in respect of Electrochemical cells, Thermodynamic process, mechanism of corrosion and factors to influence, polymers with their applications and analytical methods.
5. To understand the upcoming technologies like Fullerenes, carbonnanotubes, applications of Telecommunications in Nano materials.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Explain the basic concepts of Atomic and Molecular structures and the band theory of solids.
CO2. Solve problems related to the structure , purity and to study Molecular interactions by Spectroscopic methods
CO3. Apply knowledge of Substitute metals with Conducting polymers and also produce Bio-degradable polymers to reduce Environmental Pollution
CO4. Understand the mechanism of Electro Chemical corrosion of metals ,use of appropriate design criteria and apply corrosion protection techniques.

CO5. Give idea of synthesis, characterisation of Nanomaterials and applications of latest technology on Carbon Nano wires and medicinal applications.

UNIT I

Atomic and molecular structure: Schrodinger equation. Particle in a box solutions and their applications for conjugatedmolecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots ofthese functions to explore their spatial variations. Molecular orbitals of diatomic moleculesand plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energylevel diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

UNIT II

Spectroscopic techniques, applications and Organic reactions and synthesis of a drug molecule: Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and itsapplications

in medicine. Vibrational and rotational spectroscopy of diatomic molecules.Applications. Nuclear magnetic resonance and magnetic resonance imaging, surfacecharacterization techniques. Diffraction and scattering. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction,cyclization and ring openings. Synthesis of a commonly used drug molecule.

UNIT III

Polymers: Mechanism of polymerization and synthesis of polymers. Molecular weight, shape andconformation of polymers. Crystallinity, melting point and glass transition.Copolymerization. Viscoelasticity. Elastomers-structure, applications and curing. Conductingpolymers and applications. Dendrimers. Solubility of polymers. Fabrication and moulding ofpolymers. Synthesis, properties and uses of PE, PVC, PMMA, formaldehyde resins,melamine-formaldehyde-urea resins. Adhesives, adhesive mechanism and applications.Composites: characteristics, types and applications. Nanocomposites. Metallic and nonmetallic fillers.

UNIT IV

Surfactants and Lubricants and Corrosion: Methods of preparation, cleaning mechanism. Critical micelle concentration and itsdetermination. Hydrophobic and hydrophilic interactions. Micelles and reverse micelles.Detergents. Fricohesity of surfactants. Lubricants-physical and chemical properties, typesand mechanism of lubrication. Additives of lubricants and freezing points of lubricants.Thermodynamic overview of electrochemical processes. Reversible and irreversible cells.Chemical and electrochemical corrosion and mechanism of corrosion. Factors affecting corrosion. Protection of corrosion and practical problems of corrosion.

UNIT V

New Materials/Nanomaterials: Nanomaterials. Properties and application of fullerenes, fullerols, carbon nanotubes andnanowires. Synthesis-top down and bottom up approaches. Nanoelectronics. Applications ofnanomaterials in catalysis, telecommunication and medicine.

Text Books

1. Jain and Jain "Engineering Chemistry",15th Edition, Dhanapat rai publishing company.
2. K.N.Jayaveera, G.V.Subba Reddy, C.Ramachandraiah."Engineering Chemistry", 1st Edition, McGraw Hill Education (India) Private Limited,2013.

Reference Books

1. Jag Mohan, "Organic Spectroscopy",2nd Edition ,Narosa Publishing house,2007.
2. V.K.Ahluwalia and Rakesh kumar Parashar."Organic Reaction Mechanisms",3rd Edition,Narosa Publishing House,2007.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M										
CO2		H	L		H							
CO3					M	H	H					
CO4			H			H	L					
CO5					H		M			H		

19CST01: PROGRAMMING FOR PROBLEM SOLVING

Credits – 3 **Sessional Marks: 30**
L:T:P::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Basic concepts of computer.
2. Variables, C-Tokens and operators, functions, arrays and strings.
3. Pointers, structures, unions and files.
4. Write algorithms for solving problems with help of C programming concepts.

Course Outcomes

After successful completion of course the student should be able to

CO1. Analyse the real time problems, develop algorithms to solve it

CO2. Use conditional branching, iteration, recursion, arrays, pointers and structures to formulate algorithms and programs in C.

CO3. Design and implement the complex problems using functions

CO4. Understanding Pointers and dynamic memory allocation

CO5. Apply the knowledge of files in different applications

UNIT I

Introduction to Problem Solving: Introduction to Computer Systems, Computer Environments, Computer Languages, Problem Solving Aspects, Top-Down Design, Bottom-Up Design, Development of Algorithms, Representation of Algorithm, Flow Chart, Pseudo Code, Coding, Testing and Debugging.

UNIT II

Introduction to C: History of C programming Language, Structure of a C program - Comments, pre-processor statements, function header statements, variable declaration statements and executable statements. C character set, C tokens-constants, identifiers, operators, punctuations and keywords. Basic data types, modifiers, identifiers, variables, C Scopes, Type qualifiers, Storage Class Specifiers, variable initializations and constants. Console I/O: Reading and writing characters, Formatted console I/O. Operators: Assignment, Arithmetic, Relational, Logical, Bitwise, Ternary, Address, Increment/Decrement, special Operators. Expressions: Precedence of operators and associativity. Category of Statements: Decision Making, Branching and Looping statements.

UNIT III

Functions: Declaration, Prototype definition, calling by value and address, Standard Library Functions, User Defined functions, Recursive Functions.

Arrays and strings: Declaration, Initialization, Reading and Writing, Accessing, and Passing as a parameter to functions, Types of arrays, String functions.

UNIT IV

Pointers: Pointer expressions, pointer and arrays, multiple indirection, initializing pointers, pointers to functions, Dynamic memory allocation functions.

Structures: Declaration, initialization, accessing, array of structures and passing structures to functions, structure pointers, arrays and structures within structures, Unions, Bit-fields, typedef, and enumerations.

UNIT V

Files: I/O and processing operations on Text and binary files, Pre-processor directives and Command Line Arguments.

Text Books

1. Brian W.Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2018.

Reference Books

1. Herbert Schildt, "C: The Complete Reference", 4th Edition, Tata McGraw-Hill, 2000.
2. E Balagurusamy, "Programming in ANSI C", 7th Edition, Tata McGraw-Hill, 2016.
3. YeswanthKanitkar, "Let us C", 9th Edition, BPB Publications, 2012.

Web References

1. https://nptel.ac.in/courses/106/105/106105171/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	-	H	H	M	-	-	-	-	-	-	-	-	H	H	-
CO2	H	M	M	-	M	-	-	-	-	-	-	-	H	H	-
CO3	-	M	H	M	M	-	-	-	-	-	-	-	H	H	-
CO4	H	L	-	-	-	-	-	-	-	-	-	-	H	L	-
CO5	H	-	-	L	M	-	-	-	-	-	-	-	H	H	-

19ECT01: BASIC ELECTRONICS ENGINEERING

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To Know the volt - Ampere characteristics of semiconductor devices.
2. To Gain knowledge on various Transistor Amplifiers.
3. To Know the principle of operation of FET biasing schemes and Amplifiers.
4. To Familiarize with negative feedback Amplifiers and oscillators.
5. To Implement different op-Amp circuits.

Course Outcomes

After successful completion of the course the student should be able to
CO1. Learn PN-Diode, Transistor, FET, Amplifiers, Oscillators, IC's.

CO2.Solve problems related to Rectifiers, Transistor Amplifiers, negative feedback amplifiers, Inverting and non-inverting Op-Amp circuits.

CO3. Classify Rectifiers, BJT and FET Amplifiers, Oscillators.

CO4. Analyze the biasing schemes of Transistors, FET's, rectifiers and Amplifiers.

CO5.Apply rectifiers, BJT Amplifiers, FET amplifier, negative Feedback Amplifiers, oscillators, OP-Amps for electronic systems.

UNIT I

PN Junction Diode: Semiconductor materials, PN junction diode, Volt-ampere characteristic and applications, half wave rectifier, Full wave rectifier, Bridge rectifier, Filters.

UNIT II

Bipolar Junction Transistor: Construction, characteristics and parameters, Transistor as amplifier, Biasing, CB, CE, CC amplifiers and their comparison.

UNIT III

Field Effect Transistor: Construction, characteristics and parameters of JFET, depletion and enhancement type MOSFETS, Biasing, JFET amplifiers, CS, CD and CG amplifiers and their comparison.

UNIT IV

Feedback Amplifiers and Oscillators: Concept of Feedback, advantages of Negative Feedback, types of feedback circuits, Barkhausen criterion, RC phase shift and Wein bridge oscillators, Hartley and Colpitts oscillators.

UNIT V

Integrated Circuit Applications: Op-Amp applications, inverting and Non-inverting amplifiers, comparator, summer, Integrator, Astable and MonostableMulti-vibrators.

Text Books

1. J.Milliman and C.C.Halkias, Satyabratajit, "Integrated Electronics", 2nd edition, TMH, 1998.
2. Allen Mottershead, "Electronic Devices and Circuits", PHI Private Limited, 1979.

Reference Books

1. Robert L.Boylestad, Louis Nashelsky- "Electronic Devices and Circuit Theory", 9th Edition, 2008.
2. S.Salivahana, N.Suresh Kumar, A.Vallavaraj- "Electronic Devices and Circuits",2nd Edition,2008,TMH.

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes(CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-										H		
CO 2		H	M	L					L	L	L		H	M	
CO 3	H	M											H		
CO 4	H	M	L	L										L	H
CO 5			H	M		M	L		L	L	L	L		L	H

19BST13: ESSENCE OF INDIAN KNOWLEDGE TRADITION

Credits – No credits
L:T:P::3:0:0

Course Objectives

1. To impart basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge systems connecting society and nature.
2. To impart holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
3. To focus on introduction to Indian knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.
4. To focuses on Indian Philosophical traditions, Indian linguistic Tradition and Indian artistic tradition.

Course Outcomes

After successful completion of course the student should be able to

CO1. The student will be able to understand, connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

UNIT I

The basic structures of Indian knowledge system: Vedas – vedangas, Upavedas – Ayurveda, Dhanurveda, Gandharvaveda, Vedic gods – Agni, Indra, Varuna, Vishnu, Importance of the study of the vedic hymns.

UNIT II

Modern sciences and Indian knowledge system: Vedic cosmology, Indian atomic theory, Matter life and Mind –Sri Aurobindo .

UNIT III

Yoga and Holistic Health Care: Mind and its Modes, Afflictions, Threefold pain, Dispositions, Levels of Attention ,

Astanga Yoga.

UNIT IV

Indian Philosophical Tradition: Asatika darshanas - Nyaya, Vaisesika, Sankhya, Yoga, Mimamsa, Vendanta. Nastika darshanas – Carvaka, Jaina Buddhism

UNIT V

Indian Linguistic and Aristic Tradition: Phonology - (sabda), Morphology (pada), syntax (vakya), Semantics,Vakhyartha, Chitrakala, Murthikala, vasthukala

Reference Books

1. S. Radha Krishna , Indian Philosophy ,Oxford Indian Paper backs, New Delhi.
2. V.SivaramaKrishnan (Ed.), Cultural Heritage of Indian - course material , Bharatiya Vidya Bhavan ,Mumbai. 5th Edition, 2014
3. Smami Jitatmanand , Modern Physics and Vedant , Bhartiya Vidya Bhavan.
4. Smami Jitatamanad , Holistic Science and Vedant , Bhartiya Vidya Bhavan.
5. Fritz of capra ,Tao of Physics.
6. Fritz of capra ,The Wave of Life
7. VN Jha(Eng. Trans.), Tarkasangraha of Annam Bhatta , International Chinmay Foundation ,Velliarnad,Arnakulam .
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata .
9. GN Jha (Eng. Trans.), Ed. RN Jha , Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan , Delhi 2016.
10. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan ,Delhi 2016
11. PB Sharma (English translation), Shodashang Hridayan .

19BSP02: ENGINEERING CHEMISTRY LAB

Credits – 1 **Sessional Mark: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objectives

1. To impart practical knowledge about some practical phenomena they have studied in the engineering Chemistry course.
2. To develop the experimental skills of the students.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the estimation of the acidity of water, Dissolved Oxygen in different water samples, estimation of chloride content of water and some ions etc.
CO2. Analyse and to measure the conductance and redox potentials of different solutions.
CO3. Develop knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixture.
CO4. Apply the knowledge of various aspects of synthesis of drug

LIST OF EXPERIMENTS

(Minimum Seven are mandatory)

1. To determine the strength of KMnO4 solution by titrating it against a standard solution of Oxalic acid.
2. Determination of hardness of water by EDTA method.
3. Estimation of acidity of Water.
4. Estimation of Dissolved oxygen in water sample.
5. Determination of Iron by using potassium dichromate.
6. Estimation of copper by EDTA method.
7. Estimation of chloride in water sample.
8. Conductometric titration of strong acid with strong base.
9. Potentiometric titration of Iron by dichrometry method.
10. Colorimetric estimation of manganese
11. Synthesis of a polymer/ drug.
12. Thin layer chromatography.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**											
CO2		**H**										
CO3					**H**							
CO4						**H**						

19CSP01: PROGRAMMING FOR PROBLEM SOLVING LAB

Credits – 2 **Sessional Marks: 30**
L:T:P::0:0:4 **University Exam Marks: 70**

List of Experiments

1. Write a C program to display "Hello Computer" on the screen.
2. Write a C program to display Your Name, Address and City in different lines.
3. Write a C program to find the area of a circle
4. Write a C program to convert centigrade into Fahrenheit. Formula: C= (F*32)/1.8.
5. Write a C program to read in a three-digit number produce following output (assuming that the input is 347) 3 hundreds 4 tens 7 units
6. Write a C program to read in two integers and display one as a percentage of the other. Typically, your output should look like 20 is 50.00% of 40 assuming that the input numbers were 20 and 40. Display the percentage correct to 2 decimal places.
7. Write a C program to swap variable values of i and j.
8. Write the program for the simple, compound interest.
9. Write a C program to find the maximum from given three nos.
10. Write a C program to find that the accepted no is Negative, Positive or Zero.
11. Write a program which reads two integer values. If the first is lesser print the message up. If the second is lesser, print the message down if they are equal, print the message equal if there is an error reading the data, print a message containing the word Error
12. Given as input three integers representing a date as day, month, year, print the number day, month and year for the next day's date. Typical input: “28 2 1992” Typical output: “Date following 28:02:1992 is 01:03:1992”
13. Write program for students marks grading.
14. Take three coefficients (a, b, and c) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots. Implement a C program to output the possible roots for a given set of coefficients with appropriate messages.
15. Implement a C program that takes an integer number as input, check whether it is PALINDROME or NOT and output the reverse of the same with suitable messages. Ex: Num: 2014, Reverse: 4102, Not a Palindrome.
16. Implement a C program to find the square root of a given number N and execute for all possible inputs with appropriate messages. Note: Don’t use library function sqrt(n).
17. Design and develop a C program to read a year as an input and find whether it is leap year or not. Also consider end of the centuries.
18. Design and develop a C function RightShift(x, n) that takes two integers x and n as input and returns value of the integer x rotated to the right by n positions. Assume the integers are unsigned. Write a C program that invokes this function with different values for x and n and tabulate the results with suitable headings.
19. Design and develop a C function isprime (num) that accepts an integer argument and returns 1 if the argument is prime, a 0 otherwise. Write a C program that invokes this function to generate prime numbers between the given range.
20. Write a C program for the problem given below: Assume that the United States of America uses the following income tax code formula for their annual income: First US$ 5000 of income: 0% tax Next US$ 10,000 of income: 10% tax Next US$ 20,000 of income: 15% tax. An amount above US$ 35,000: 20% tax. For example, somebody earning US$ 38,000 annually would owe US$ 5000 X 0.00 + 10,000 X 0.10 + 20,000 X 0.15 + 3,000 X 0.20, which comes to US$ 4600. Write a program that uses a loop to input the income and calculate and report the owed tax amount. Make sure that your calculation is mathematically accurate and that truncation errors are eliminated.
21. Write a C program to convert decimal to binary.
22. Write a C program to convert decimal to octal.
23. Write a C program to convert decimal to hexadecimal.

24. Write a C program that reads in integers until a 0 is entered. If it encounters 0 as input, then it should display:
    a. The total number of even and odd integers
    b. Average value of even integers
    c. Average value of odd integers.

    Note: Use switch statement for selection.
25. Write an interactive program to generate the divisors of a given integer.
26. Write a program to find all Armstrong number in the range of 0 and 999 Hint: An Armstrong number of three digits is an integer such that the sum of the cubes of its digits is equal to the number itself. For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371.
27. Write a program to check whether a given number is a perfect number or not. Hint: A positive integer n is called a perfect number if it is equal to the sum of all of its positive divisors, excluding n itself. For example, 6 is a perfect number, because 1, 2 and 3 are its proper positive divisors and 1 + 2 + 3 = 6. The next perfect number is 28 = 1 + 2 + 4 + 7 + 14. The next perfect numbers are 496 and 8128.
28. Write a program to check whether given two numbers are amicable numbers or not. Hint: Amicable numbers are two numbers so related that the sum of the proper divisors of the one is equal to the other, unity being considered as a proper divisor but not the number itself. Such a pair is (220,284); for the proper divisors of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110, of which the sum is 284; and the proper divisors of 284 are 1, 2, 4, 71, and 142, of which the sum is 220.
29. Write a program that will take as input a set of integers and find and display the largest and the smallest values within the input data values.
30. Write a C program that uses functions to perform the following operations: i. To insert a sub-string in to a given main string from a given position. ii. To delete n Characters from a given position in a given string.
31. Write a C program to do the following computation by providing the option using the switch statement:
    a. Add two matrices
    b. Subtract two matrices
    c. Multiply two matrices
32. Write a program to check if the given matrix is magic square or not.
33. Write a program print the upper and lower triangle of the matrix.
34. Write a program to compute transpose of a matrix.
35. Write a program to find the inverse of a matrix.
36. Using recursion, (i) Find the factorial of a number (ii) Find Greatest Common Divisor (GCD) of two numbers (iii) To generate Fibonacci sequence (iv) Reverse ‘n’ characters.
37. Write a C program to convert a Roman numeral to its decimal equivalent.
38. Write a program to convert a given lowercase string to upper case string without using the inbuilt string function.
39. Write a program to count number of vowels, consonants and spaces in a given string.
40. Define a structure that will hold the data for a complex number. Using this structure, please write a program that will input two complex numbers and output the multiple of the two complex numbers. Use double variables to represent complex number components. Note: A complex number z is a number of the form z = a + bi where a and b are real numbers. The term a is called the real part of z and b is called the imaginary part of z. The multiplication operation on complex numbers is defined as: (a + bi) * (c + di) = (ac - bd) + (ad + bc)i
41. Write a function that will return the length of a character string. You are not allowed to use the strlen C library function. Note: Use “Pointers” concept
42. Write a function that returns the minimum and the maximum value in an array of integers.
43. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)
44. Write a program that prompts the user the name of a file and then counts and displays the number of bytes in the file. And create a duplicate file with the word ‘.backup’ appended to the file name. Please check whether file was successfully opened, and display an error message, if not.
45. Write a program to create a file, open it, type-in some characters and count the number of characters in a file.
46. Write a program that will input a person's first name, last name, SSN number and age and write the information to a data file. One person's information should be in a single line. Use the function

fprintf to write to the data file. Accept the information and write the data within a loop. Your program should exit the loop when the word 'EXIT' is entered for the first name. Remember to close the file before terminating the program. Hint: Use the function strcmp() to compare two strings.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	M	H	H	L	M	-	-	L	-	-	-	-	M	H	L
CO 2	H	L	L	-	-	-	-	L	-	-	-	-	M	H	L
CO 3	M	L	-	M	L	-	-	L	-	L	-	-	M	H	L
CO 4	-	H	L	-	L	-	-	L	-	-	-	-	M	H	L
CO 5	-	-	M	-	L	-	-	L	-	-	-	-	M	H	L

19MEP01: ENGINEERING GRAPHICS
(Common to all branches)

Credits – 3 **Sessional Marks: 40**
L: T: P:: 0:0:6 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Develop the graphic skills for communication of concepts, ideas and design of engineering products.
2. Expose them to existing national standards related to technical drawings.
3. Develop skills in three-dimensional visualization of engineering component.
4. Learn sketching and taking field dimensions.
5. Take data and transform it into graphic drawings.
6. Learn basic engineering drawing formats, basic AutoCAD skills & draw 2D drawings in Auto CAD.

Course Outcomes

After successful completion of course the student should be able to

CO1. Prepare drawings as per standards.
CO2. Solve specific geometrical problems in plane geometry involving lines, plane figures and special Curves.
CO3. Produce orthographic projection of engineering components working from pictorial drawings.
CO4. Student's ability to perform basic sketching techniques will improve.
CO5. Students will be able to draw projections and sections, ability to produce engineered drawings will improve, will become familiar with Auto-CAD two-dimensional practice and standards.
CO6. Students will develop good communication skills and teamwork.

Part A

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Dimensioning principles, Conventions in Drawing.

Conics Sections: Ellipse - Eccentricity method, Arcs of circles Method, Oblong method and Four Center Method;

Parabola - Eccentricity method, Rectangular method, Tangent method.

Hyperbola - Eccentricity method, Rectangular Hyperbola.

Principles of Projections: Principles of Orthographic Projections and Conventions.

Projection of Points, Projection of Lines (first angle projection only) inclined to both planes.

Projections of Planes: Projections of regular Planes (Triangle, Square, Rectangle, Pentagon, Hexagon and Circle) in simple position, inclined to both the planes.

Part B (Using AutoCAD)

Projections of Solids: Projections of right regular solids (Cube, Prism, Pyramid) in simple position, inclined to both the planes.

Isometric Projections: Isometric projection of right regular solids (Cube, Prism, Pyramid, Sphere). Conversion of given isometric views to orthographic views of simple objects.

Text Books

1. N.D. Bhat / Charotar, "Engineering Drawing", New edition.
2. K.L. Narayana and Kannaiah, "Engineering Drawing", Scitech Publishers.

Reference Books

1. Venugopal K, “Engineering Drawing and Graphics”, New Age International.
2. P.J. Shah, “Engineering drawing’, S. Chand.
3. Johle, “Engineering Drawing’, Tata McGraw Hill.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H									M			H		
CO 2		H	L							M			H	M	
CO 3		L	M	H						M				H	
CO 4	H									M			H	M	
CO 5			M	H	L					M				M	
CO 6					L				H	M			H		

19ECP01: BASIC ELECTRONICS ENGINEERING LAB

Credits – 1 **Sessional Marks: 40**
L: T: P:: 0:0:2 **University Exam Marks:60**

Course Objectives

1. To provide Engineering skills by way of breadboard circuits with electronic devices and components.
2. To test and experimentally determine characteristics of electronic devices such as FET, PN diode, BJT & JFET.
3. To construct and measure different parameters of Rectifiers, Amplifiers and OP Amps.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Plot the characteristics of electronic devices and determine their parameters.

CO2. Construct and test amplifiers, Rectifiers and oscillators.

CO3. Operate electronic test equipment.

CO4. Verify experimentally determined values with theoretical values.

CO5. Identify the applications of different Electronic Devices.

LIST OF EXPERIMENTS

1. Study of CRO.
2. PN Junction Diode Characteristics
3. Half Wave Rectifier with and without C filter
4. Full Wave Rectifier with and without LC filter
5. Bridge Rectifier with and without π filter
6. Input and output Characteristics of BJT in CE configuration
7. CE amplifier
8. FET characteristics
9. Feedback Amplifiers
10. RC phase shift Oscillator
11. OP-Amp applications
12. OP Amp Comparator and Astable Multivibrator.

Note: A Minimum of 10 experiments have to be conducted.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	-	-	-	-	-		L	L	L		H		
CO2			H	M					L	L	L			H	L
CO3		L	H	M					L	L	L		H	M	L
CO4		M	H						L	L	L		H		M
CO5		H	M	M					L	L	L	L	L		H

B.Tech
I Year II Semester

B.Tech
I Year II Semester

S.No	Course Code	Course Title
1	19BST05	Engineering Mathematics-II
2	19BST03	Engineering Physics
3	19BST01	Functional English
4	19BST08	Economics And Accountancy
5	19BSP03	Engineering Physics Lab
6	19BSP01	Communicative English Lab
7	19MEP03	Workshop and Manufacturing Practices Lab

19BST05: ENGINEERING MATHEMATICS – II

Credits - 4 **Sessional Marks: 30**

L: T: P :: 3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. Provides an introduction to Laplace Transforms
2. To Gain knowledge of matrices in a comprehensive manner and the convergence of series.
3. To Familiarize numerical methods for solving first-order IVPs
4. To introduce partial differential equations and make the student get acquainted with the basics of PDE.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define Laplace transforms, Rank, Eigen Values and Eigen vectors, absolute and Conditional convergence

CO2. Understand Convolution theorem, Linear Dependence and Independence, Convergence and Divergence of sequences and series, Basic concepts of formation of Partial differential equations.

CO3. Apply Laplace transforms to solve ordinary differential equations and use appropriate numerical method to solve algebraic, transcendental equations, ordinary differential equations.

CO4. Determine the Laplace transforms of standard functions and evaluate a definite integral numerically and demonstrate that any square matrix satisfy its characteristic polynomial and evaluate its minimal polynomial

CO5. Derive one – dimensional wave equation, Heat equation and Laplace equation

UNIT I

Laplace Transforms: Laplace transforms of standard functions, Transform of Periodic functions, Step function, Inverse transforms of derivatives and integrals, Convolution theorem, applications to solutions of ordinary differential equations.

UNIT II

Matrices: Rank, solution of system of linear equations, Eigen values, Eigen vectors, Cayley Hamilton theorem, Quadratic forms – Diagonalization.

Sequences and Series: Convergence and Divergence, Ratio test, Comparison test, Absolute and Conditional Convergence.

UNIT III

Partial Differential Equations: Formation of PDEs by elimination of arbitrary constants and arbitrary functions, Method of separation of variables, one dimensional wave equation, heat equation, Laplace equation.

UNIT IV

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation by Gauss elimination method, Gauss matrix and Gauss – Seidal iteration method.

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae.

UNIT V

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

Numerical solution of Ordinary Differential equations

Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method, Runge-Kutta Methods, Predictor-Corrector Method-Milne's Method.

Text books

1. Grewal, B.S. Higher Engineering Mathematics, Khanna Publishers, 42nd Edition.

Reference Books

1. T.K.V.Iyengar & B.Krishna Gandhi et., "Engineering Mathematics –I, II"; S. Chand & Company.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M			L							
CO2	M	H			L							
CO3	H	L			M							
CO4	H	M			M							
CO5	M	H			L							

19BST03: ENGINEERING PHYSICS

Credits – 4 **Sessional Marks: 30**
L: T: P::3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To understand this course is at the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications.
2. To know the acquaintance of basic physics principles would help engineers to understand the vital role played by science and engineering in the development of new technologies.
3. To Familiarize basic concepts of quantum mechanics, semiconductors and superconductors will lead the students to solve some basic problems in the higher levels of their respective courses.
4. To Gain Knowledge of upcoming technologies like laser technology, fiber optics and Nanotechnology.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Explain the basic concepts of Quantum Mechanics and the band theory of solids.
CO2.Learn and to apply the basic concepts of properties of matter in day to day life.
CO3. Learn the types of Semiconductors and the role of carrier concentrations in conductivity. Understand the behaviour of materials at low temperatures and the applications of Super conductivity.
CO4. Understand the use of lasers in Engineering Science, Medicines & apply the concepts of optical fibre in communication systems.
CO5. Get a basic understanding of Nanotechnology. The course will give idea of synthesis, characterisation of Nano materials and electrical & optical properties, applications of Nano systems.

UNIT I

Quantum Mechanics and Conducting Material: Introduction-wave nature of particles-De-Broglie Hypothesis-Time dependent and independent Schrodinger wave equation-Physical signification of wave function-particle in one dimensional infinite potential well-Heisenberg Uncertainty principle-Classical free electron theory-quantum free electron theory-Fermi Dirac Distribution.

UNIT II

Properties of Matter: Elasticity– Stress-strain diagram and its uses - factors affecting elastic Modulus and tensile strength – Torsion stress and deformations– twisting couple - torsion pendulum :theory and experiment -bending of beams- bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT III

Semiconductors and Superconductors: Semiconductors: Semiconducting materials: Intrinsic and extrinsic semiconductors – carrier concentration derivation – Fermi level – variation of Fermi level with temperature in intrinsic – electrical conductivity for intrinsic semiconductor –Hall Effect.

Superconductivity: Introduction - effect of magnetic field- Meissner effect- Types of superconductors - Flux quantization - Magnetic Levitation - BCS theory - Josephson Effect - Application of superconductors.

UNIT IV

Laser& Fiber Optics: Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; Amplification of light by population inversion, different types of lasers: He-Ne Gas Laser, Ruby Laser - Coherence -applications in engineering science and medicine.

Fiber Optics: Light propagation through fibers –Acceptance angle – numerical aperture – types of fibers – step index, graded index – single mode, multimode – attenuation – dispersion– LED-Detector-application of fiber optics in communication

UNIT V

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Precipitation, Combustion Methods; Top-down Fabrication: Chemical Vapour Deposition, Physical Vapour Deposition, Pulsed Laser Vapour Deposition Methods, Characterization(TEM)-Carbon Nan tubes (OD,1D,2D and 3D) – Applications.

Text Books

1. Avadhanulu M. N., "Engineering Physics", S. Chand & Co., 2007
2. K.Thiyagarajan,"Engineering Physics" McGraw Hill Education (India) Private Limited.

Reference Books

1. Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publications, 2013.
2. R.Murugesan, Kiruthiga Sivaprasath,"Modern Physics"S.Chand&Company Pvt.Ltd, 2014.
3. Pillai, S.O., "Solid State Physics", New Age International Publication, New Delhi, Seventh Edition, 2015.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M										
CO2			H		M							
CO3			M			H	L					
CO4					H					H		
CO5				H			M				H	

19BST01: FUNCTIONAL ENGLISH

Credits – 3 **Sessional Marks: 30**
L: T: P::3: 0: 0 **University Exam Marks: 70**

Course Objectives

1. To develop the knowledge of communicative grammar, enhance lexical capabilities by extensive practice exercises, build the vocabulary, and develop skimming and scanning skills using reading materials on different topics.
2. To enhance professional competence in reading, writing, listening and speaking.
3. To switch the approach from providing information about the language to use the language.
4. To minimize the Grammar Translation Method of ELT while trying to replace it with Direct Method.
5. To introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centered learning rather than on the teacher-centered learning.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Analyze the usage of English words in different contexts and acquire considerable flair in using broad range of vocabulary.
CO2. Upgrade comprehension of technical and academic articles and recognize writings as a process rather than a product.
CO3. Identify common errors in various parts of English and give effective expression in oral and written communication.
CO4. Explore various grammatical units of English and design a language component critically and coherently to meet desired needs within the realistic constraints.

UNIT I

The Secret of Work by Swami Vivekananda: Vocabulary Building: Root words from foreign languages and their use in English;Writing: Tenses; Identifying Common Errors: Subject-Verb agreement; Reading Comprehension.

UNIT II

Reaching for the Stars: Kalpana Chawla: Vocabulary Building: Word Formation; Writing: Sentence Structures, Use of phrases and clauses in sentences; Identifying Common Errors: Noun-Pronoun Agreement; Reading Comprehension.

UNIT III

A Retrieved Reformation by O. Henry: Vocabulary Building: Acquaintance with prefix and suffix from foreign languages in English to form derivatives; Writing: Importance of proper punctuation, Creating Coherence, Describing; Identifying Common Errors: Misplaced Modifiers; Reading Comprehension.

UNIT IV

Water: The Elixir of Life by C.V. Raman: Vocabulary Building: Synonyms and antonyms; Writing: Paragraph writing, Précis Writing; Identifying Common Errors: Articles, Prepositions; Reading Comprehension.

UNIT V

The Post Office by Rabindranath Tagore: Vocabulary Building: Standard Abbreviations; Writing: Letter Writing; Identifying Common Errors: Use of Adjectives; Reading Comprehension.

Reference Books

1. Michael Swan, "Practical English Usage", OUP. 1995.
2. F.T. Wood, "Remedial English Grammar", Macmillan. 2007.
3. William Zinsser, "On Writing Well", Harper Resource Book. 2001.
4. Liz Hamp-Lyons and Ben Heasly. "Study Writing", Cambridge University Press. 2006.
5. Sanjay Kumar and PushpLata. "Communication Skills", Oxford University Press. 2011.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1		H								M		L
CO2				M						H		M
CO3									M	H		L
CO4				M						H		M

19BST08: ECONOMICS AND ACCOUNTANCY

Credits – 4 **Sessional Marks: 30**
L:T:P::3:1:0 **University Exam Marks: 70**

Course Objectives

1. To impart in-depth knowledge of the subject and highlights the role of the economics, finance & accountancy in the field of engineering.
2. To strengthen the fundamentals of demand analysis & production function.
3. To estimate demand, price-output in different market structures.
4. To select the different investment alternatives
5. To know the financial position of the companies

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define law of demand, assumption, production function & different types of costs
CO2. Apply demand forecasting techniques & BEP for estimation of demand & production
CO3. Identify the price-output in different competitions
CO4. Determine the feasible investment alternative.
CO5. Analyse the financial position of the company through ratio analysis.

UNIT I

Introduction to Economics: Economics – Micro & Macro Economics – Definitions - Significance & Limitations. Demand Analysis: Law of Demand, Demand Determinants. Elasticity of Demand: Definition, Types and Demand Forecasting methods.

UNIT II

Theory of Production: Firm and Industry – Production Function – Cobb Douglas Production function – Laws of returns – internal and external economies of scale. Break-Even Analysis: Concept of Break-even point (BEP) – Significance of BEP – Limitation - Assumptions - Break-even chart – Determination of BEP in volume and value (Simple problems).

UNIT III

Cost Analysis: Cost concepts, Fixed Vs Variable costs, explicit Vs implicit costs, Out-of-pocket costs Vs imputed costs and Opportunity cost. Introduction to Markets, Market structure, types of competition, features of Perfect competition, Monopoly, Monopolistic competition – Price output determination.

UNIT IV

Fundamentals of finance and Capital Budgeting: Capital and its significance – Types of Capital, Estimation of Fixed and Working Capital, requirements and methods of raising capital. Capital Budgeting Methods: Pay back method, Accounting Rate of Return (ARR) and Net Present Value (NPV) and IRR methods (Simple Problems).

UNIT V

Introduction to Financial Accounting and Financial Analysis: Double Entry Book Keeping – Journal, Ledger, Trial Balance, Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments. Ratio Analysis: Computation of Liquidity ratios (Current ratio and quick ratio), Activity Ratios (Inventory Turnover ratio, Debtors Turnover ratio) Capital Structure Ratios (Debt-equity Ratio and Interest Coverage ratio) and Profitability Ratios (Gross Profit ratio, Net Profit Ratio, Operating Ratio, P/E Ratio and EPS) Analysis and interpretation.

Text Books

1. Joel Dean, Managerial Economics, PHI 2001
2. James C. Van Home, Financial Management Policy
3. I.M. Pandy, Financial Management, PHI

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			**H**								**M**	**L**
CO2				**M**	**H**							**L**
CO3			**L**								**M**	
CO4				**L**	**M**						**H**	**L**
CO5				**M**							**H**	**L**

19BSP03: ENGINEERING PHYSICS LAB

Credits - 1 **Sessional Marks: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objective

1. To impart practical knowledge about some practical phenomena they have studied in the engineering physics course.
2. To develop the experimental skills of the students.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Apply knowledge of mathematics and physics fundamentals and an Instrumentation to arrive solution for various problems.
CO2. Understand the usage of basic laws and theories to determine various properties of the materials given.
CO3. Apply the theories learnt and the skills acquired to solve real time problems.
CO4. Carryout experiments to understand the laws and concepts of physics.

LIST OF EXPERIMENTS
(Minimum Six are mandatory)

1. Determination of Numerical aperture and bending losses of fibers of an optical fiber.
2. Young's modulus - non uniform bending – Pin and microscope
3. Calibration of voltmeter / ammeter using potentiometer
4. Spectrometer-Dispersive power of prism /grating.
5. Spectrometer- Determination of refractive index of given liquid using Hollow Prism.
6. Laser-Determination of wavelength.
7. Air Wedge- Determination of thickness of given thin wire.
8. V-I Characteristics of PN Junction diode.
9. Energy Gap Determination of a PN Junction Diode
10. Determination of surface tension of the given liquid-drop weight method.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2		H										
CO3			H									
CO4	H				H					H		

19BSP01: COMMUNICATIVE ENGLISH LAB

Credits -1 **Sessional Marks: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objectives

1. To enhance communicative skills of the students with emphasis on Listening, Speaking, Reading and Writing skills.
2. To develop oral communication and fluency in Group Discussions, Just a Minute and Debates.
3. To enable the student to acquire the structure of written expressions required for their profession.
4. To enable the student to communicate in English for Academic and Social purpose.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Learn English speech sounds, analyze phonetic transcriptions
CO2. Understand the stress on word accent, intonation, and rhythm to acquire better pronunciation.
CO3. Acquire fluency in spoken English and neutralize mother tongue influence.
CO4. Upgrade listening skills and receive and interpret messages in the communication process.
CO5. Become active participants in the learning process and acquire proficiency in both ways of communication

UNIT I

Phonetics

i) Phonetics: Importance ii) Speech Sounds - Vowels and Consonants
iii) Phonetic Transcriptions

UNIT II

Pronunciation:i) Word Stress and Rhythm ii) Intonation: Rising tone, Falling tone.

UNIT III

Oral Communication:i) Group Discussions ii) Just a minute (JAM) iii) Debate iv) Situational Dialoguesv) Oral Presentation s

UNIT IV

Listening Skills

` **UNIT V**

Resume Writing, Interview Skills

Reference Books

1. Nira Konar, "English Language Laboratories: A Comprehensive Manual". PHI Learning Pvt. Ltd., 2011.
2. Michael Swan, "Practical English Usage", OUP. 1995.
3. William Zinsser, "On Writing Well", Harper Resource Book. 2001.
4. Liz Hamp-Lyons and Ben Heasly. "Study Writing, Cambridge University Press. 2006.
5. Sanjay Kumar and Pushp Lata. "Communication Skills", Oxford University Press. 2011.
6. Central institute of English & Foreign Languages. "Exercises in Spoken English. Parts. I-III", Hyderabad. Oxford University Press.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		**H**		**M**						**L**		
CO2		**L**		**M**						**H**		
CO3				**M**						**H**		
CO4		**M**								**H**		
CO5				**L**						**H**		**M**

19MEP03: WORKSHOP AND MANUFACTURING PRACTICES LAB
(Common for all Branches)

Credits – 2 **Sessional Marks: 40**
L:T:P ::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Understand the basic knowledge of Workshop Practice and Safety.
2. Identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. Get hands on practice in various machining metal joining processes such as turning, facing,fitting , Soldering, etc.
4. Gain basic knowledge on Computer hardware and Software.

Course Outcomes

After successful completion of course the student should be able to

CO1. Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO2.Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and Performing Operations such as Marking, Cutting etc used in manufacturing.
CO3.Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber etc., to understand the concept of tolerances applicable in all kind of manufacturing.
CO4.Known and identify the computer hardware,assembly and disassemble the CPU.
CO5.Obtain the knowledge toinstallation of software's for different applications.

TRADE 1: CARPENTARY

Wood sizing exercise in planning, marking, sawing, chiseling and grooving to prepare

1. Cross Lap Joint.
2. Bridle Tee Joint.

TRADE 2: FITTING

Marking, cutting and filing to practice

1. Square Fitting.
2. V Fitting.

TRADE 3: ELECTRICAL & ELECTRONICS

Safety rules and practices in wiring, basic circuits common house wiring connections such as

1. Identification of basic electrical and electronic components.
2. (a) Two-switches, two-bulbsinparallel connection.
   (b)Staircase connection.
3. Soldering process.

TRADE 4: MANUFACTURING PRACTICE ON LATHE

1. Facing operation
2. Straight turning and Chamfering.

TRADE 5: INFORMATION TECHNOLOGY

1. Assembly and disassembly of CPU and component identification.
2. Software installation.

Reference Books

1. K. Venkat Reddy, Workshop Manual, BS Publications
2. P.Kannaiah, K.L.Narayana -Work shop Manual -SciTech Publishers.
3. Jeyapoovan, SaravanaPandian-Engineering Practices Lab Manual -Vikas publishers

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H				M			L		M			H	M	
CO 2	H	H	L							M			H	M	
CO 3	H					M				M		L	M	M	
CO 4	L	M			H					M			H	M	
CO 5	H				L	M				M			H	M	

B.Tech
II Year I Semester

B.Tech
II Year I Semester

S.No	Course Code	Course Title
1	19BST06	Engineering Mathematics-III
2	19MET02	Engineering Mechanics
3	19ECT04	Digital System Design
4	19EET02	Circuits & Networks-I
5	19EET08	Generation Of Electric Power
6	19BST12	Environmental Studies
7	19ECP03	Digital System Design Lab
8	19EEP02	Circuits & Networks-I Lab Lab

19BST06: ENGINEERING MATHEMATICS – III

Credits - 4 **Sessional Marks: 30**

L: T: P :: 3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To providing the student with the concepts of Fourier series, Fourier transforms which find the applications in engineering.
1. To make the student evaluate the Beta and Gamma functions, Bessel functions and Legendre polynomials that helps to solve many engineering and physical problems.
2. To Familiarize the concept of complex functions, analytic functions, harmonic functions and Cauchy – Riemann equations which play a vital role in several engineering problems.
3. To introduce the idea of poles and residues and calculation of residues at the poles; to discuss the Residue theorem and to use it to evaluate complex integrals.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Use Fourier analysis to periodic and non-periodic solutions.
CO2. Write given function in terms of sine and cosine terms in Fourier series.
CO3. Understand the statement of Fourier integral theorem and apply them in solving inverse transforms and finite Fourier transforms.
CO4. Solve improper integrals using Beta and Gamma functions.
CO5. Gain the adequate knowledge to tackle the engineering problems using the concepts analytic functions, complex functions, Cauchy – Riemann equation and also bilinear transformations.
CO6.Understand the definitions of poles, residues, singularities and apply them in solving Contour integration.

UNIT I

Fourier series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions.

.

UNIT II

Fourier Transforms: Fourier integral theorem (only statement) – Fourier sine and cosine integrals. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms - Parseval's formula.

UNIT III

Special Functions: Beta , Gamma and Bessel functions- Legendre polynomials-recurrence formulae - generating functions for $J_n(X)$ and $P_n(X)$- Rodrigue's formula-orthogonality of Legendre polynomials.

UNIT IV

Complex Functions-I: Analytical functions- Cauchy-Riemann equations-Conformal mapping-Bilinear transformations of $-e^z$, z^2 sinz and cosz.

UNIT V

Complex Analysis-II: complex integration –Evaluation of integrals-Cauchy's theorem- integral formula-Singularities-Poles –Residues-Contour Integration.

Text books

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition.

Reference Books

2. T.K.V.Iyengar & B.Krishna Gandhi et.," Engineering Mathematics – II, III"; S. Chand & Company.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M			L							
CO2	M	H			L							
CO3	H	L			M							
CO4	H	M			M							
CO5	M	H			L							

19MET02: ENGINEERING MECHANICS

Credits – 4 **Sessional Marks: 30**
L:T:P :: 3:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the basic knowledge in mechanics in the areas of applied engineering.
2. Develop the skills in the areas of forces and their effects, concept of free body diagram.
3. They will be able to analyze forces in various systems such as frames, trusses and beams.

Course Outcomes

After successful completion of course the student should be able to

CO1. Determine the resultant force and moment for a given system of forces.
CO2. Comprehend the effect of friction on general plane motion.
CO3. Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
CO4. Illustrate the laws of motion kinematics of motion and their relationship.
CO5. Determine the centroid and second moment of inertia.

UNIT I

Introduction to Engineering Mechanics – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II

Friction : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge and Screw jack

UNITIII

Centroid and Center of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids – Moment of Inertia of composite masses. (Simple problems only)

UNIT IV

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections for vertical loads, horizontal loads and inclined loads.

UNITV

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of a RigidBody – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

Text Books

1. Vijay Kumar Reddy, Suresh Kumar, Singer's, "Engineering Mechanics Statics and Dynamics", BS Publications 2015
2. B. Bhattacharyya, "Engineering Mechanics",Oxford University Publications, 2015

References Books

1. Jayakumar, "Engineering Mechanics" Kumar, PHI, 2014
2. D.S. Kumar, "Engineering Mechanics", 3rd Edition, S.K. KATARIA & SONS.
3. J L Meriam, L G Kraige, "Engineering Mechanics: Statics", 6th Edition, Wiley India Pvt. Ltd, 2010.
4. Bhavikatti.S .S,"A Textbook of Engineering Mechanics" 3rd Edition, New Age International, 2016.
5. Dr. R. K. Bansal, "Engineering Mechanics", 4th Edition, Laxmi Publications, 2011.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	L	H				L			M			H	M	
CO 2	M	H	L				M			M		L	M	H	M
CO 3	H	L	M				M			M		L	M	L	L
CO 4	M	L	M	H			L			M		L	L	H	
CO 5	M	H	L	L			M			M		L	M	H	M

19ECT04: DIGITAL SYSTEM DESIGN

Credits – 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **UniversityExamMarks: 70**

Course Objectives

1. To understand number representation and conversion between different representation in digital electronic circuits.
2. To analyze logic processes and implement logical operations using combinational logic circuits.
3. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
4. To understand characteristics of memory devices and their classification.
5. To understand concept of programmable devices, PLA, PAL, FPGA.
6. To understand the characteristics of logic families.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Develop a digital logic and apply it to solve real life problems

CO2. Analyze, design and implement combinational logic circuits.

CO3. Classify different semiconductor memories. CO4.Analyze, design and implement sequential logic circuits.

CO5.Design digital system design using PLD.

UNIT I

Number systems and codes: Review of Binary, octal decimal and hexadecimal number systems and their inter conversion. BCD, Grey, ASCII, Parity bit. Boolean Algebra and logic gates: NOT OR AND operations, Boolean theorems. De Morgan's theorem, symbols and truth tables of logic gates (NOT, OR, AND, NAND, NOR, XOR, XNOR), Universal gates.

UNIT II

Combinational logic circuits: Standard forms of logical functions, Minterm and maxterm specifications, simplification by K-maps and Tabular methods, and realization of logical functions using gates. Decoders and encoders, Multiplexers and Demultiplexers, Digital Magnitude Comparator.

UNIT III

Sequential circuits : Latches, clocked flip-flops, SR, JK, D and T flip flops, timing problems and master-slave flip – flops, shift registers, Asynchronous and synchronous counters, Ring and Johnson counters, application of counters.

UNIT IV

Arithmetic circuits: Signed binary numbers, Binary arithmetic, Binary adders and subtractors, serial and parallel adders. Integrated-circuit parallel adder and its applications.

Memory Devices: Terminology, ROM, PROM, EPROM, EEPROM, CDROM, Semiconductor RAM and its architecture.

UNITV

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like PLA,PAL, FPGA. Logic implementation using Programmable Devices.

Text Books

1. M.MorrisMano,Digital Logic and Computer Design -3rd Edition,Pearson Education/PHI

2. Ananda Kumar -Switching Theory and Logic Design –PHI, 3rd Edition, 2008

References Books

1. Ronald J. Tocci, Neal S. Widmer.” Digital Systems-Principlesand Applications”.8th Edition Pearson 2001.
2. Taub and Schilling. “ Digital Integrated Electronics.” -Mc Graw Hill Co, 1st Edition ,2008.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H	M	
CO2	M	L	H	M									M	H	
CO3	M	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

19EET02: CIRCUITS AND NETWORKS-I

Credits - 4 **Sessional Marks: 30**

L: T: P:: 3:1: **University Exam Marks: 70**

Course Objectives:

1. To explain the basic characteristics of R, L, C parameters, their Voltage and Current Relations and various combinations of these parameters.
2. To familiarize with the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
3. To learn about Series and parallel resonances, bandwidth, current locus diagrams.
4. To introduce Network theorems and their applications.
5. To study about Network Topology and Coupled circuits.

Course Outcomes:

After completion of the course the student will able to

CO1. Understand various basic definitions and concepts of Network Topology and Coupled circuits.
CO2. Calculate the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across any element.
CO3. Describe the concepts of AC circuits and determine the real power, reactive power, power factor etc.
CO4. Analyze the series, parallel resonant circuit and locus diagrams.
CO5. Apply theorems for finding the solutions of network problems.

UNIT I

Basic Network Concepts:

Introduction –Resistance, Inductance, Capacitance, sources –dependent and independent, classification of elements, basic laws-ohm`s law, KVL, KCL, source transformation ,network reduction techniques-series parallel combination of R,L,C, mesh analysis, nodal analysis, star-delta transformation, concept of super mesh and super node analysis.

UNIT II

Single Phase A.C Circuits:

Periodic waveforms – Average and effective values of different waveforms – Form factor and crest factor. Phase and phase difference – Phasor notation – Concept of reactance, impedance, susceptance, and admittance – Active and reactive power – Power factor – Power triangle. Response of R, L, and C elements for sinusoidal excitation Steady state analysis of RL, RC and RLC circuits for sinusoidal excitation – Phasor diagrams. Steady state analysis of ac circuits including coupled circuits using mesh and nodal analysis.

UNIT III

Resonance and Locus Diagram:

Series and parallel resonance – Half power frequencies, bandwidth, Q factor and relations between them. Impedance and admittance locus diagrams of RL and RC series circuits and two branch parallel circuits.

UNIT IV

D.C and A.C Network Theorems

Network theorems – Superposition – Thevenin's and Norton's theorems – Millman's theorem – Reciprocity theorem – Tellegan's theorem – Compensation theorem and application of the theorems for dc circuits and sinusoidal steady state circuits – Maximum power transfer theorems for dc and ac circuits

UNIT V

Network Topology & Coupled Circuits

Introduction**,** Elements of network topology – Graph, tree, incidence matrix, and tie set and cut set matrices – formulation of equilibrium equations based on graph theory. Coupled circuits-introduction, concepts of self and mutual inductance, concept of coupling and Dot notation, Duality and dual circuits.

Text Books

1. Ravish R Singh," Network Analysis and Synthesis" 2nd Edition, Mc Graw Hill, 2016.
2. Hayt, Kimberly and Durbin "Engineering Circuit Analysis", 8th Edition, TATA Mc Graw Hill, 2017.
3. Charles K.Alexander& N.O Sadiku,"Fundametals of Electric Circuits" 6th Edition, Mc Graw Hill, 2013.

Reference Books

1. M.E.Van Valkenburg,"Network Analysis", 3rd Edition, PHI Publications, 2014.
2. Roy Choudary,"Network Analysis" 2nd Edition, New Age International, 2013.
3. A. Bruce Carlson (Thomoson), "Circuit: Engineering Concepts and Analysis of Linear Electric Circuits", 1st Edition, 2012.
4. Sudhakar and Shyammohan "Circuits And Networks", 3rd Edition, Tata Mcgraw-Hill, 2018.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**L**	**M**	**-**
CO 2	**L**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**M**	**-**
CO 3	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**M**	**-**
CO 4	**L**	**H**	**M**	**-**	**H**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**M**	**-**
CO 5	**H**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**M**	**H**

19EET08: GENERATION OF ELECTRIC POWER

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives:
1. This course is a beginners fundamental of Power system course.
2. To Learn about Renewable sources of Electrical Energy.
3. To Impart knowledge on Conventional sources of Electrical energy.
4. To Study about different components in Thermal, Hydel and Nuclear plants.

Course Outcomes:
After completion of the course the student will be able to
CO1. Understand the Layout of various generating power stations.
CO2. Design Electrical layout of various generating stations.
CO3. Ability to discuss about various power sources for generation of power merit/Demerit.
CO4. Describe about various methods of production and to classify the electrical energy from economic point of view.
CO5. Discuss the energy resources and energy conversion methods available for the production of electric power in India.

UNIT I

Thermal Power Generating Systems:
Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers.

UNIT II

Hydro & Nuclear Power Generating Systems:
Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT III

Solar Power Generating Systems:
Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

UNIT IV

Wind Power Generating Systems:

Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills- Performance Characteristics- Power- Speed & Torque- Speed Characteristics-Pitch & Yaw Controls – Power Electronics Application – Economic Aspects.

UNIT V

Biogas & Geothermal Power Generating Systems:

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.

Geothermal and Ocean Power Generation: Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants- Economic Aspects.

Text Books:

1. G.D. Rai,"Non Conventional Energy Sources", Khanna Publishers, 2004.
2. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, "A Text Book on Power System Engineering", Dhanpat Rai & Co. Pvt. Ltd., 2016.
3. C.L Wadhwa,"Generation Distribution and Utilization of Electrical energy",4th edition, New Age International (P) Ltd., 2017.

Reference Books:

1. John Twidell and Tony Weir,"Renewable Energy Resources" , 3rd Edition, Routedge, 2015.
2. S.N.Singh, "Electrical Power Generation, Transmission and Distribution", PHI, 2008.
3. V.K Mehta and Rohit Mehta, "Principles of Power Systems"**,** Revised Edition**,** S.Chand& Company Ltd., New Delhi 2005.
4. S. N. Bhadra, D. Kastha & S. Banerjee,"Wind Electrical Systems" Oxford University Press, 2013.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**L**	**-**
CO 2	**-**	**M**	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**-**
CO 3	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**M**
CO 4	**-**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**
CO 5	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**M**	**M**

19BST12: ENVIRONMENTAL STUDIES

Credits – No credits
L:T:P::3:0:0

Course Objectives

1. To reflect on how the natural and built environments shape and are shaped by multiple socio-cultural and political factors.
2. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
3. To live responsibly and appreciate the environmental and cultural histories of the places they inhabit.
4. To nurture knowledge, respect, and love for the natural and human communities of central Maine, the place where they spend four formative years of their lives.
5. To develop skills of analysis and communication, bearing in mind disciplinary traditions and diverse publics.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

CO2. Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.

CO3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

CO4. Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

CO5. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I

Environmental studies and Natural resources-Definition of environment, scope and importance of environment, environmental studies, need for public awareness.

Renewable and **Non Renewable Resources and associated problems and case studies-** Uses, consequences of exploitation and remedies- (i) Water resources,(ii) Forest resources, (iii) Land resources, (iv) Mineral resources, (v) Food resources, (vi) Energy resources. Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles.

UNIT II

Environmental Pollution and Global Effects - Definition, Causes, Effects and Control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution and Noise pollution . Case studies. Role of an individual in prevention of pollution.

Solid waste Management- Causes, effects, disposal methods, and control of urban and industrial wastes.

Climate change- Global warming, Acid rain and Ozone layer depletion, Nuclear accidents and holocaust-case studies.

UNIT III

Disaster Management – Floods, earth quake, cyclone, avalanches, landslides and Tsunami.

Environment and Human health – Epidemic diseases, and pathology of Hepatitis –b, HIV/AIDs Malaria, Typhoid, Chikungunya, Avian flu and anthrax *etc.* Role of information technology in environment and human health, Case studies

Water conservation- Rain water harvesting – Water shed management.

Waste land reclamation

UNIT IV

Ecosystem- Concept of an ecosystem, Structure and functions of an ecosystem; types of ecosystems, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Types of ecosystems- characteristic feature, structure and functions.

Biodivesity and its conservation –Introduction; Definition; genetic, species and ecosystem diversity; Endangered and endemic species of India; Value of biodiversity- consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national and local level; Importance of biodiversity; Biodiversity hot-spots; India as a mega-diversity nation. Threats to biodiversity: habitats loss, poaching of wild life man wild life conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT V

Human population and the environment-Population growth and variation among nations, Population explosion - Family welfare program in specific to women and child, Human rights, Value education.

Environment Impact Assessment; Environmental risk assessment (ERA); Clean production and Life cycle assessment.

Environmental Legislation - Forest Act, Water Act, Air act, Wild life protection Act, Environmental protection Act. Issues involved in enforcement of environmental legislation and public awareness.

Reference Books

1. Kaushik & Kaushik, Environmental Studies, New age international Publishers, 4th Edition,
2. B.R. Shah and Snehal Popli, Environmental Studies, Mahajan Publishing House. 9th Edition,
3. C.S.Rao,Environmental Pollution Control Engineering, 2nd Edition,New age International Publishers.
4. Canter, L.W., Handbook of Environmental Impact Assessment, Vol. I and II', The World Bank, Washington, 1991.
5. Pelczer, Jr., M.J., Chan, E.C.S., Krieg, R. Noel., and Pelczer Maerna Foss, 'Microbiology'. 5th Edition Tata Mc Graw Hill Publishing Company Limited, New Delhi-1996.
6. Metcalf & Eddy, Inc. "Wastewater Engineering Treatment Disposal and Reuse", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi-1995.
7. Casey.I.J., 'Unit Treatment processes in Waste water engineering', John Wiley & Sons England, 1993.
8. Erach Bharucha, "Text book of Environmental Studies, UGC
9. DD Mishra,"Fundamental concepts in Environmental Studies", S Chand & Co Ltd

19ECP03: DIGITAL SYSTEM DESIGN LAB

Credits - 1 **Sessional Mark: 40**
L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To know about the behavior of digital logic.
2. To understand combinational logic circuits and sequential logic circuits.

Course Outcomes

After successful completion of the course the student should be able to
CO1. Construct and experiment different logic gates.
CO2. Measure Test combinational logic circuits.
CO3. Usage different adders and Subtractor.
CO4. Verify experimentally sequential logic circuits.
CO5. Identify the applications of decoders and display.

LIST OF EXPERIMENTS

1. Testing of Logic gates and simulation of gates using universal gates
2. Decoders
3. Encoders
4. Multiplexers
5. Demultiplexers
6. Flip –Flops
7. MOD-10 Counter
8. Shift register
9. Johnson counter
10. Half adder, Full adder and 4-bit parallel adder
11. Half Subtractor & Full Subtractor
12. Seven Segment Decoder and display

Note: A minimum of 10 experiments have to be conducted.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M	H	H	L					L	M	L		H		
CO2	L	L	H	M					L	L	M			H	M
CO3	M	H											H	M	
CO4	H	L												H	M
CO5		L	L	M	**H**									M	H

19EEP02: CIRCUITS AND NETWORKS – I LABORATORY

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

1. To provide hands on experience to the students so that they are able to put theoretical Concepts to practice.
2. To find the circuit response using KVL, KCL and various network theorems.
3. To study and determine the resonance characteristics of series and parallel RLC circuits.
4. To draw current locus diagrams.

Course Outcomes:

After completion of the course the student will able to

CO1. Apply suitable theorems for circuit analysis and verify the results theoretically.
CO2. Experimentally determine the self inductance, mutual inductance and coefficient of coupling
CO3. Calculate Resonant Frequency, Bandwidth, Quality factor for a series and parallel RLC circuit.
CO4. Verify KVL and KCL in a series and parallel resistive network.
CO5. Draw current locus diagrams

LIST OF EXPERIMENTS

1. Verification of KVL and KCL in a series and parallel resistive network.
2. Determination of coefficient of coupling of a coupled circuit.
3. Current Locus diagram of a series RL and RC circuits with R varying and C varying.
4. Determination of Resonant Frequency, Bandwidth, Quality factor for a series RLC circuit.
5. Determination of Resonant Frequency, Bandwidth, Quality factor for a Parallel RLC circuit.
6. Verification of Superposition Theorem and Reciprocity Theorem.
7. Determination of Thevenin's and Norton's equivalent circuits.
8. Verification of Maximum power transfer theorem with DC and AC sources.
9. Verification of Millman's Theorem
10. Verification of Compensation Theorem

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	H	M	-	-	-	-	-	-	M	-	-	-	M	-
CO 2	M	H	M	M	-	-	-	-	-	M	-	-	-	M	-
CO 3	M	H	M	M	-	-	-	-	-	M	-	-	-	M	-
CO 4	H	M	M	M	-	-	-	-	-	M	-	-	-	M	-
CO 5	H	M	M	-	L	-	-	-	-	M	-	-	-	M	-

B.Tech
II Year II Semester

B.Tech
II Year II Semester

S.No	Course Code	Course Title
1	19ECT05	Signals & Systems
2	19ECT29	Electronic Circuits
3	19EET03	Circuits & Networks-II
4	19EET05	Electromagnetic Fields
5	19EET06	Power Systems-I
6	19EET04	Electrical Machines-I
7	19ECP11	Electronic Circuits Lab
8	19EEP04	Circuits & Networks-II Lab
9	19EEP03	Electrical Machines-I Lab

19ECT05 -SIGNALS AND SYSTEMS

Credits – 4 **Sessional Marks: 30**

L: T: P:: 3:1:0 **UniversityExam. Marks: 70**

Course Objectives

1. Tounderstand the fundamental characteristics of signals and systems.
2. To understand the concepts of vector space, inner product space and orthogonal series.
3. To understand signals and systems in terms of both time and transform domains.
4. To develop the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the mathematical description and representation of continuous anddiscrete signals and systems

CO2.Develop input output relationship for LTI system and understand theconvolution operator for continuous and discrete time systems

CO3.Understand and resolve the signals in frequency domain using Fourier series andtransforms. CO4.Understand the limitations of Fourier transform and need for Laplace transform and develop mathematical models.

CO5.The ability to analyze the system in S-domain

UNIT I

Signal Analysis & Fourier Series: Exponential and Sinusoidal Signals, Continuous and Discrete Time Signals, Discrete Time Signal representation using Complex Exponential and Sinusoidal Components Periodicity of Discrete Time using Complex Exponential Signal, Concepts of Impulse Function, Unit Step Function, Signum Function. Properties of Fourier Transforms Involving Impulse Function and Signum Function. Introduction to Hilbert Transform. Representation of Fourier series.

UNIT II

Signal Transmission through Linear Systems: Discrete Time Signals and Sequences, Linear Shift Invariant Systems (LTI), Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems Linear System, Impulse Response, Response of Linear System, Linear Time Variant (LTV) system, Transfer function of a LTI system. Filter Characteristics of Linear Systems. Distortion less Transmission through a system, Signal Bandwidth, System Bandwidth, Ideal LPF, HPF AND BPF Characteristics, Causality and Poly- Wiener Criterion for Physical Realization, Relationship between Bandwidth and Rise Time.

UNIT III

Convolution and Correlation of Signals: Concept of Convolution in Time Domain and Frequency Domain, Graphical Representation of Convolution, Convolution Property of Fourier Transforms. Cross Correlation and Auto Correlation of Functions, Properties of Correlation Function, Energy Density Spectrum, Parseval's Theorem, Power Density Spectrum, Relation between Auto Correlation Function and Energy/Power Spectral Density Function. Relation between Convolution and Correlation, Detection of Periodic Signals in the Presence of Noise by Correlation, Extraction of signal from Noise by Filtering.

UNIT IV

Laplace Transforms: Review of Laplace Transforms, Partial Fraction Expansion, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various Classes of Signals, Properties of L.T's. Laplace transform of Certain Signals using Waveform Synthesis.

State –space analysis and multi input&multi output representation: Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling

UNIT V

Z-Transform: Concept of Z-Transform of a Discrete Sequence.Region of Convergence in Z- Transform, Constraints on ROC for Various Classes of Signals, Inverse Z- Transform, Properties of Z-Transforms. Transfer Function-BIBO Stability-System Response to Standard Signals-Solution of Difference Equations with Initial Conditions.

Text Books

1. B.P. Lathi–" Signals, Systems and Communications" - BS Publications, 2003.
2. A. V. Oppenheim, A.S. Willsky and S. H. Nawab – "Signals and Systems" PHI, 2 nd Edition.

Reference Books

1. Simon Haykin and Van Veen, Wiley –"Signals & Systems" – 2 nd Edition.
2. Michel J. Robert – "Fundamentals of Signals and Systems", MGH International Edition, 2008.
3. C. L. Philips, J. M. Parr and Eve A. Riskin,-" Signals, Systems and Transforms " Pearson Education, 3 rd Edition, 2004.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	
CO2			H	M	M				M	L	L		L	L	M
CO3		H	H	M	L				L	M			M	L	
CO4		H	H	M	L				L	M			L	M	
CO5		M	H	H									M	L	H

19ECT29: ELECTRONIC CIRCUITS

Credits – 3 **Sessional Marks: 30**
L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To analyse the diode clipper and clamper circuits.
2. To explain biasing schemes of BJT and FET amplifiers.
3. To Analyse Small signal performance of amplifiers.
4. To classify different types of coupling and feedback Amplifiers

Course Outcomes

After successful completion of the course the student should be able to
CO1.Understand the characteristics of diodes and transistors.

CO2.Design and analyze various rectifier and amplifier circuits.

CO3.Design and analyse various FET biasing circuits.

CO4.Design and analyse the methods of Multistage Amplifiers.

CO5.Design sinusoidal RC and LC oscillators.

UNIT I

Diode Circuits: Diode equivalent circuits, Analysis of diode circuits, Diode clippers, Diode clampers. **General Amplifiers:** Concept of Amplifier, Voltage gain, Current gain, Power gain, Input and Output resistances, conversion efficiency, Frequency response, Bandwidth, distortion, Classification of amplifiers.

UNIT II

BJT Amplifiers: BJT biasing schemes, Bias stability, Hybrid model, Small signal analysis of single stage BJT amplifiers, Comparison of CE,CB and CC amplifiers, approximate model analysis, Effect of coupling and bypass capacitors on low frequency response, Hybrid π model at high frequencies, Parameters f_B and f_T**.**

UNIT III

FET Amplifiers: FET biasing schemes, Small signal model, Analysis of CS, CD and CG amplifiers. High frequency analysis of FET Amplifier.

UNIT IV

Multistage Amplifiers: Types of Coupling, choice of Amplifier configuration, overall voltage gain and Bandwidth of n stage amplifier.

Power Amplifiers: Class-A large signal amplifiers, Transformer coupled audio power amplifiers, Push pull amplifiers, Class B amplifiers, Class AB operation Complementary symmetry power amplifier.

UNIT V

Feedback Amplifiers: Feedback concept, classification, Effects of negative feedback on gain, Stability, Noise, Distortion, Bandwidth, Input and Output resistances, Different types of feedback circuits without analysis, voltage amplifiers, current amplifiers, Trans-resistance amplifier, Trans–conductance amplifier.

Sinusoidal oscillators: Barkhausen criterion, RC Phase shift, Wein Bridge, Hartley and Colpitts oscillators , crystal oscillator.

Text Books

1. Milliman and Halkias," Integrated Electronics", Mc Graw Hill &Co.
2. Moottershed," Electronic Devices and Circuits", PHI.

References

1. R.L. Boylestad&LouisNashelay " Electronic Devices and Circuits", pearsonedition.
2. Salivahana ," Electronic Devices and circuits, "2nd Edition ,2008,TMH.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L						L	L	L		H		
CO2	L	M	H	L					L	L	L		H	M	
CO3	L	M	H	L					L	L	L		H	M	
CO4	L	M	H	L					L	L	L		H	M	
CO5	L	M	H	L					L	L	L		H	M	L

19EET03: CIRCUITS AND NETWORKS – II

Credits - 4 **Sessional Marks: 30**

L: T: P:: 3:1:0 **University Exam Marks: 70**

Course Objectives:

1. To make the students capable of analyzing any given electrical network.
2. To learn about how to synthesize an electrical network from a given Impedance/ admittance function.
3. To study about the Laplace transforms for circuit analysis.
4. To familiarize with the analysis of three phase balanced and unbalanced circuits and to Measure active and reactive powers in three phase circuits
5. To explain the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C Excitations

Course Outcomes:

After completion of the course the student will be able to

CO1. Explain the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits
CO2. Analyze the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C Excitations
CO3. Understand about the network functions and Laplace transforms for circuit analysis
CO4. Evaluate two-port network parameters
CO5. Synthesize one port network using Foster and Cauer Forms.

UNIT I

Three Phase Circuits: Advantages of three phase systems – Phase sequence – Balanced and Unbalanced systems – Magnitude and phase relationships between line and phase voltages and currents in balanced star and delta circuits – Analysis of balanced and unbalanced three phase circuits with star and delta connected loads – Neutral displacement voltage – Analysis by star-delta conversion.
Measurement of three phase power by two-wattmeter methods – Measurement of three phase reactive power by single wattmeter

UNIT II

Transient Analysis: Solution of first and second order differential equations for series R-L,R-C,R-L-C Circuits, initial and final conditions in network elements ,forced and free response ,time constants, steady state and transient state response.

UNIT III

Electrical Circuit Analysis Using Laplace Transforms
Review of Laplace transform , analysis of electrical circuits using Laplace transform for standard inputs ,inverse Laplace transform ,transformed network –R-L,R-C,R-L-C circuits with initial conditions, initial and final value theorems.
Network Functions: One-port and Two-port networks – Driving point and transfer function of networks

UNIT IV

Two-Port Parameters : Open circuit impedance and short circuit admittance parameters – Hybrid and Transmission parameters – Inter relationships between parameter sets – Series, Parallel, and Cascade connection of two-ports – Conditions for reciprocity and symmetry of two-port networks in terms of different parameters – Terminated two-port networks.

UNIT V

Filters & Fourier Circuit Analysis

Passive Filters –low pass, high pass, band pass, and band stop filters.

Fourier Circuit Analysis - Introduction**,** Trigonometric Form and Exponential Form of Fourier Series – Conditions of Symmetry- Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

Text Books:

1. Ravish R Singh," Network Analysis and Synthesis" 2nd Edition, Mc Graw Hill, 2016.
2. Hayt, Kimmerly and Durbin "Engineering Circuit Analysis", 8th Edition, TATA Mc Graw Hill, 2017.
3. Charles K.Alexander& N.O Sadiku,"Fundametals Of Electric Circuits" 6th Edition,Mc Graw Hill,2013.

Reference Books:

1. M.E.Van Valkenburg,"Network Analysis", 3rd Edition, PHI Publications, 2014.
2. Roy Choudary,"Network Analysis" 2nd Edition, New Age International, 2013.
3. A. Bruce Carlson (Thomoson), "Circuit: Engineering Concepts and Analysis of Linear Electric Circuits", 1st Edition, 2012.
4. Sudhakar and Shyammohan "Circuits And Networks", 3rd Edition, Tata Mcgraw-Hill, 2018.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	-	-	-	-	-	-	M	-	-	-	M	H
CO 2	M	H	M	-	-	-	-	-	-	M	-	-	-	H	-
CO 3	H	L	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 4	M	H	H	-	-	-	-	-	-	M	-	-	-	H	-
CO 5	M	-	H	-	M	L	-	-	-	M	-	-	-	H	-

19EET05: ELECTROMAGNETIC FIELDS

Credits – 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives:

1. To introduce the concepts of electrostatic and magneto static fields and their applications.
2. To impart knowledge about the concept of conductors, dielectrics and capacitances.
3. To learn about all electromagnetic field laws which are used in electrostatics and magnetostatics.
4. To familiarize the concept of time varying fields and electromagnetic wave propagation and its significance.

Course Outcomes:

After completion of this course the student will be able to:

CO1. Understand vector algebra, and static electric fields due to electric charges.

CO2. Acquire knowledge on basic principles, concepts and use of fundamental laws to find electric field intensities for different charge distributions.

CO3. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of Electromagnetic fields in different media using the fundamental laws.

CO4. Determine the behaviour of magnetic fields in the presence of dielectric and magnetic materials and Describe/analyze the force and inductance of magnetic fields.

CO5. Derive electromagnetic wave equations and analyze Maxwell's equations for both time variant and time invariant fields.

UNIT I

Vector Calculus:

Vector Algebra- Addition, Subtraction, Multiplication- Triple Products-Cartesian, cylindrical & Spherical co-ordinate systems-DEL operator.

Electrostatic Field:

Introduction - Coulomb's law – Electric field intensity – electric fields due to point, line, surface and volume charge distributions – Electric flux density – Gauss law – Electric potential – potential gradient – Divergence and divergence theorem.

UNIT - II

Electrostatic Applications:

Field due to dipoles – dipole moment – Current and current density – Conductors and Dielectrics - Boundary conditions – capacitance – Dielectric interface – Capacitance of system of conductors – Dielectric const & Dielectric strength -Energy stored in capacitor – Energy density– Poisson's and Laplace equations.

UNIT III

Steady Electro-Magnetic Fields:

Introduction – Biot - Savart Law – Ampere's Circuital Law – Applications – Curl – Stoke's theorem – Magnetic flux – Magnetic flux density – The Scalar and Vector magnetic potentials – Force on a moving charge and current elements – Force and Torque on closed circuit.

UNIT IV

Magnetostatics and Applications:

Introduction to magnetic materials – Magnetization and Permeability – Magnetic boundary Conditions – Magnetic circuit – Potential energy and forces on Magnetic materials – Inductance and mutual inductance – Inductance of solenoids, toroids, and transmission lines.

UNIT V

Electromagnetic Fields and Wave Propagation:

Faraday's Law – Time varying magnetic field, Conduction current and Displacement current – Maxwell's equation in point and integral forms – Wave propagation in free space – Wave propagation in Dielectrics – Power and the Pointing Vector – Propagation in good conductors – Wave polarization.

Text Books:

1. A.V.Bakshi U.A.Bakshi,"Electromagnetic Field Theory", Technical Publications Pune.
2 .K.A.Gangadhar, "Field theory", Khanna publishers, New Delhi, 15th edition, 2004.
3. M.N.O. Sadiku,"Elements of Electromanetics" Oxford University Publication, 2014.

Reference Books:

1. G. S. N. Raju, "Electromagnetic Field Theory and Transmission Lines"
2. John D. Kraus, "Electromagnetics", 5th Edition, McGraw Hill, 1999.
3. N. Narayana Rao, "Elements of Engg. Electro Magnetics", 6th Edition, PHI, 2008.
4. William Hayt," Engineering Electromagnetics", 7th edition, McGraw Hill, New York., 2005.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 3	M	H	L	-	-	-	-	-	-	M	-	-	M	H	-
CO 4	M	H	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	M	H	M	-	-	-	-	-	-	M	-	-	-	H	-

19EET06: POWER SYSTEMS –I

Credits – 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To gain Knowledge on Transmission line parameters.
2. It deals with Distribution of Electrical power.
3. Also this course gives emphasis on the Economic aspects of Power stations.
4. To familiarize with the basic concepts of Under Ground Cables.
5. To Impart Knowledge about Insulators and corona.

Course Outcomes

After completion of the course the student will be able to

CO1. Understand basic transmission line parameters.
CO2. Determine design parameters required for Distribution systems.
CO3. Analyze the operation of underground cables.
CO4. Formulate the Transmission line sag Tension, corona.
CO5. Apply Knowledge on Economic Aspects.

UNIT I

Transmission Line Parameters:

Line Conductors-Resistance-Inductance and Capacitance of Single Phase And Three Phase Lines With Symmetrical And Unsymmetrical Spacing – Composite Conductors Transposition -Bundled Conductors-Effect Of Earth On Capacitance.

UNIT II

Distribution Systems:

Dc Distribution:

Introduction, D.C Distributors for the Following Cases: Distributor Fed at One End (Concentrated and Uniform Loading), Fed at Both Ends (Concentrated and Uniform Loading) and Ring Main Distributor.

Ac Distribution:

Design Considerations Of Distribution Feeders: Radial And Loop Types Of Primary Feeders, Voltage Levels, Feeder Loading-Basic Design Practice Of The Secondary Distribution System-Ac Distributors For The Following Cases: Power Factors Referred To The Receiving End Voltage And With Respect To Respective Load Voltages.

UNIT III

Under Ground Cables:

Introduction –Insulation Types – Insulating Materials For EHV Cables-Classification Of Cables-Parameters Of Single Core Cable-Grading Of Cables-Capacitance Of Three Core Belted Cable- Break Down Of Cables-Heating Of Cables-Dielectric Loss And Sheath Losses-Current Ratings Of Cables.

UNIT IV

Insulators and Corona:

Insulators: Introduction-Types of Insulators-Potential Distribution over a String of Insulators-Methods Of Equalizing The Potential, String Efficiency-Testing Of Insulators. The Catenary Curve- Sag Tension Calculations-Support at Different Levels-Stringing Chart-Sag Template-Equivalent Span.

Corona: Introduction-Disruptive Critical Voltages- Factors Affecting Corona Loss-Methods Of Reducing Corona Loss-Disadvantages Of Corona-Interference Between Power And Communication Lines.

UNIT V

Economic Aspects of Power Stations:

Types of Loads-Load Curve, Load Duration and Integrated Load Duration Curves-Load Factor-Demand Factor-Diversity Factor-Capacity Factor-Utilization and Plant Use Factors -Costs of Electrical Energy-Types of Tariffs. Power Factor Correction Methods.

Text Books

1. V.K.Mehta and Rohit Mehta," Principles of Power Systems", Revised Edition, S.Chand &Company Ltd., New Delhi 2005.
2. C.L.Wadhwa,"Electrical Power Systems",7 Th Editions, New Age International, 2016.

Reference Books

1. C.L.Wadhawa, "Generation Distribution and Utilization of Electrical Energy",4th Edition New Age Publication, 2017.
2. J.B.Gupta," A Course in Power Systems", Katson and Sons Publications, 2013.
3. D. P. Kothari, I. J. Nagrath," Power System Engineering",3rd Edition, Tata Mcgraw-Hill**,**

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	H	M	L
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 3	M	H	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 4	M	H	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	H	L	M

19EET04: ELECTRICAL MACHINES-I

Credits - 4 **Sessional Marks: 30**
L: T: P:: 3:1:0 **University Exam Marks: 70**

Course Objectives:

1. To Import Knowledge on constructional features of DC machines and different types of windings Employed in DC Machines.
2. To study about the characteristics of generators and speed control of DC motors and applications of DC Motors.
3. To get knowledge on various types of losses that occurs in DC machines and how to calculate efficiency and Testing of DC motors.
4. To familiarize the predetermination of regulation and efficiency of transformer from OC and SC test results
5. To know about the parallel operation of transformers

Course Outcomes:

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

CO1. Understand principles of DC machines, Singly Excited and Multi Excited Magnetic Systems.
CO2. Apply knowledge to solve problems relating to DC machines and Transformers.
CO3. Compute system losses and their components/factors and their reduction.
CO4. Analyse performance of DC machines and Transformers from the results of experiments.
CO5. Describe the Testing of DC machines.

UNIT I

Magnetic Circuits:

Electromechanical Energy Conversion – Forces and Torque In Magnetic Field Systems – Energy Balance– Energy and Force in A Singly Excited Magnetic Field System, Determination of Magnetic Force - Co-Energy – Multi Excited Magnetic Field Systems.

UNIT II

D.C. Generators:

D.C. Generators – Principle of Operation – Constructional Features – Armature Windings – Lap and Wave Windings – Simplex and Multiple-Windings –E.M.F Equation–Numerical Problems – Parallel Paths-Armature Reaction –Commutation –Types- Reactance Voltage – Methods of Improving Commutation. Methods of Excitation –Building up of E.M.F – Critical Field Resistance and Critical Speed - Causes for Failure to Self Excite and Remedial Measures-Load Characteristics of Shunt, Series and Compound Generators – Parallel Operation of D.C Series Generators – Use of Equalizer Bar and Cross Connection of Field Windings – Load Sharing.

UNIT III

D.C. Motors:

D.C Motors – Principle of Operation – Back E.M.F. – Circuit Model – Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors –Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Ward-Leonard System–Braking of D.C Motors – Permanent Magnet D.C Motor (PMDC). Motor Starters (3 Point and 4 Point Starters) – Protective Devices-Calculation of Starters Steps for D.C Shunt Motors.

UNIT IV

Testing Of Dc Machines:

Losses – Constant & Variable Losses – Calculation of Efficiency – Condition for Maximum Efficiency. Methods of Testing – Direct, Indirect – Brake Test – Swinburne's Test – Hopkinson's Test – Field's Test – Retardation Test.

UNIT V

Transformers:

Single phase transformers-types - constructional details-Principle- minimization of hysteresis and eddy current losses-emf equation - operation on no load and on load - phasor diagrams-Equivalent circuit - losses and efficiency-regulation- All day efficiency - effect of variations of frequency & supply voltage on iron losses. OC and SC tests - Sumpner's test - predetermination of efficiency and regulation-separation of losses test-parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Three Phase Transformers-construction and types of connection-Scott connection, Tap Changing Transformers- No Load and On Load Tap Changing of Transformers, Cooling of Transformers.

Text Books:

1. I.J. Nagrath & D.P. Kothari," Electric Machines", 4th Edition, Tata Mc Graw – Hill Publishers, 2016.
2. Stephen J Chapman, "Electrical Machinery Fundamentals", 4th Edition, Mc Graw Hills, 2017.

Reference Books:

1. Ashfaq Hussain, Haroon Hussian,"Electrical Machines", 3rd Edition, Dhanpat Rai& Co. (P), 2017.
2. S.K. Battacharya,"Electrical Machines ",4th Edition, Tata Mcgraw-Hill, 2017.
3. P.S. Bimbhra,"Electrical Machines ",7th Edition, Khanna Publishers, 2011.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 3	L	H	-	-	-	H	-	-	-	M	M	-	-	H	-
CO 4	L	H	M	H	-	-	-	-	-	M	-	-	-	H	-
CO 5	-	-	-	-	-	-	-	-	-	M	-	-	-	-	-

19ECP11 -ELECTRONIC CIRCUITS LAB

Credits – 1 **Sessional Marks: 40**

L: T: P:: 0:0:2 **University Exam Marks: 60**

Course Objectives

1. To Generate and measure sinusoidalsignals.
2. To test different Amplifier circuits.
3. To construct experimentally determine the characteristics of amplifiers, oscillators.

Course Outcomes

After successful completion of the course the student should be able to CO1.Construct and experiment amplifiers, oscillators, Diode circuits, JFET's.

CO2. Measure different parameters & waveforms.

CO3. Use different Electronic equipment.

CO4. Verify experimentally determined parameters with theoretical values.

CO5. Identify the applications of different Electronic circuits.

LIST OF EXPERIMENTS

1. Diode clipper circuits
2. Diode clamper circuits
3. Common-Emitter amplifier.
4. Common-Base amplifier.
5. Emitter follower and Boot strapping
6. Two stage RC coupled amplifier.
7. Feedback amplifiers
8. Power amplifier.
9. RC Phase shift oscillator.
10. Wein Bridge Oscillator
11. Colpitts or Hartley oscillator.
12. JFET common-source amplifier.

Note: A minimum of 10 experiments have to be conducted.

Course Outcomes-Program Outcomes - Program Specific Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M		H	M					L	L	L		H		L
CO2	H					M	L		L	L	L		M	H	L
CO3	L	H	M						L	L	L			H	L
CO4		M	H						L	L	L		L		H
CO5		H	M	M					L	L	L	L	L		H

19EEP04: CIRCUITS AND NETWORKS – II LABORATORY

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

1. To provide hands on experience to the students so that they are able to put theoretical concepts To practice.
2. To find three phase power and reactive power by using two wattmeter and single wattmeter Method.
3. To determine Hybrid parameters and Transmission parameters of Two Port network.
4. To measure three phase power by using three wattmeter methods.
5. To analyze impedance and admittance parameters of a two port network.

Course Outcomes:

After completion of the course the student will be able to

CO1. Interpret system functions through transient response of series RL and RC circuits
CO2. Analyze the concepts of impedance and admittance parameters of a two port network
CO3. Determination of Hybrid parameters, transmission of a two port network.
CO4. Calculate impedance and admittance of two port network
CO5. Find the reactive and 3 phase power by using two watt meter.

LIST OF EXPERIMENTS

1. Measurement of three phase power by using two wattmeter methods.
2. Measurement of reactive power by using single wattmeter.
3. Determination of Impedance parameters of a two port network.
4. Determination of Admittance parameters of a two port network.
5. Determination of Hybrid parameters of a two port network.
6. Determination of Transmission parameters of a two port network.
7. Determination of DC transient response of series RL and RC circuits.
8. Determination of AC transient response of series RL and RC circuits.
9. Measurement of active power for star and delta connected balanced loads.
10. Measurement of three phase power by using three wattmeter methods.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	H	L	L	-	-	-	-	-	M	-	-	H	M	-
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 3	M	H	M	L	-	-	-	-	-	M	-	-	H	M	-
CO 4	M	H	-	L	-	-	-	-	-	M	-	-	M	H	-
CO 5	M	H	-	L	-	-	-	-	-	M	-	-	M	H	-

19EEP03- ELECTRICAL MACHINES-I LABORATORY

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

1. The constructional features of DC machines and different types of windings employed in DC Machines.
2. Characteristics of generators and speed control of DC motors and applications of DC motors
3. Various types of losses that occur in DC machines and how to calculate efficiency and Testing Of DC motors.
4. Predetermination of regulation and efficiency of transformer from OC and SC test results
5. Parallel operation of transformers

Course Outcomes:

After completion of the course the student will be able to

CO1. Determine the performance of a single phase transformer by conducting Open Circuit (O.C) and Short Circuit (SC) tests and Sumpner's test.

CO2. Understand 3-phase to 2-phase transformation using the Scott connection and determine the Different losses of the transformers.

CO3. Test the performance characteristics of DC shunt and DC compound generators by conducting load tests.

CO4. Implement the speed control techniques for a separately excited DC motor

CO5. Draw the performance characteristics of DC machine by conducting direct and indirect tests.

LIST OF EXPERIMENTS

1. Magnetizing Characteristics Of Separately Excited DC Generator
2. Load Test On A DC Shunt Generator
3. Hopkinson's Test On DC Machines
4. Swinburne's Test On DC Shunt Machine
5. Speed Control Of DC Shunt Motor
6. Brake Test On DC Shunt Motor
7. Separation Of Losses Test
8. Internal And External Characteristics Of DC Compound Generator
9. Parallel Operation Of Single Phase Transformer
10. O.C & S.C Test On A 1-Φ Transformer
11. Load test on single phase transformer

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	H	-	-	-	-	-	M	-	-	M	H	-
CO 2	H	M	-	H	-	-	-	-	-	M	-	-	M	H	-
CO 3	H	M	-	H	-	-	-	-	-	M	-	-	H	M	-
CO 4	H	M	-	H	-	-	-	-	-	M	-	-	M	H	-
CO 5	H	M	-	H	-	-	-	-	-	M	-	-	H	M	-

B.Tech
III Year I Semester

B.Tech
III Year I Semester

S.No	Course Code	Course Title
1	19ECT09	Micro Processors & Micro Controllers
2	19EET07	Electrical Machines-II
3	19EET09	Power Systems-II
4	19EET10	Control Systems
5	19BST09	Industrial Management
6	Elective-I	
19ECT30		Electro Magnetic Waves
19ECT31		Analog & Digital IC Applications
19EET14		Renewable Energy Sources
19EET15		Electrical Machine Design
7	19ECP05	Micro Processors & Micro Controllers Lab
8	19EEP06	Control Systems Lab
9	19EEP05	Electrical Machines-II Lab

19ECT09: MICROPROCESSORS AND MICROCONTROLLERS

Credits – 3 **Sessional Marks: 30**
L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To design and implement programs on 8085, 8086,8051 Microcontroller
2. To design I/O circuits.
3. The program prepares students to successfully analyse electronic equipment of modern usage.
4. To design Memory Interfacing circuits.
5. To design and implement 8051 microcontroller based systems.

Course Outcomes

After successful completion of the course the student should be able to
CO1.Assess and solve basic binary math operations using the microprocessor.

CO2.Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of microprocessors and microcontrollers.

CO3.Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements.

CO4.Select appropriate assemblers of a microprocessor and microcontroller.

CO5.Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.

CO6.Evaluate assembly language programs and downloads the machine code that will provide solutions in real-world control problems.

UNITI

8086Architecture: Introduction to 8085 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086-common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086.

UNIT II

Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

UNITIII

I/OInterface:8255 PPI various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter.Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing.RS- 232.IEEE-4-88, Prototyping and trouble shooting.

UNITIV

IntroductiontoMicrocontrollers: Overview of 8051 microcontroller. Architecture.I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple programs Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming8051timersandcounters

UNIT V

8051 Interrupts: 8051 Real Time Control Interrupts, Timer/ Counter And Serial Communication, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming The Serial Communication Interrupts, Programming 8051 Timers And Counters

TextBooks

1. D. V.Hall. Microprocessors and Interfacing, TMH. 2nd edition 2006.
2. Kenneth. J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010

ReferenceBooks

1. K. Ray and K.M. Bhurchandani,-" Advanced Microprocessors and Peripherals" TMH, 2nd edition2006.
2. K.Uma Rao, AndhePallavi,- "The 8051 Microcontrollers, Architecture and programming and Applications " Pearson,2009.
3. Ajay. V. Deshmukh, - "Microcontrollers and application "TMH, 2005

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H		
CO2	H	M	L	L									H	M	
CO3			L	H		M	L							L	M
CO4		L	L	M	H									L	M
CO5			H	M	M	L					M		H	L	M
CO6			H	M	M	L					M		H	L	M

19EET07: ELECTRICAL MACHINES-II

Credits - 4 **Sessional Marks: 30**

L: T: P:: 3:1:0 **University Exam Marks: 70**

Course Objectives

1. To impart the knowledge on fundamentals of AC Rotating Machines.
2. To Familiarize the constructional details, principle of operation of three phase alternator and Synchronous Motor.
3. To get the Knowledge on Constructional details, principle of operation, Performance, stator, Speed Control and breaking of three phase induction Motor.
4. To Study the constructional details, principle of operation, type of single phase Induction Motor and Special Machines.

Course Outcomes

After completion of the course the student will able to

CO1. Understand the principles of AC Machines
CO2. Apply knowledge to solve problems relating AC Machines
CO3. Compute system losses and their components/factors and their reduction.
CO4. Analyse performance of AC machines from the results of experiments.

UNIT- I

Induction Machines:

Poly-phase Induction Motors-Construction Details of Cage and Wound Rotor Machines-Production of Rotating Magnetic Field - Principle of Operation - Rotor parameters Standstill and During Operation. Inter Relationship of Rotor Power Input, Rotor Copper Loss and Mechanical Power Developed Torque Equation-Deduction From Torque Equation - Expressions for Maximum Torque and Starting Torque - Torque Slip Characteristic-Equivalent Circuit - Phasor Diagram, No Load and Blocked Rotor.

UNIT II

Starting and Speed Control Of Induction Motors:

Starting Methods and Starting Current and Torque Calculations, Speed Control–Double Cage - Crawling and Cogging -Change of Frequency; Pole Changing and Methods of Consequent Poles; Cascade Connection. Injection of an EMF; Circle Diagram, generator operation: self excitation, doubly –fed induction machines

UNIT III

Single Phase Induction Motors:

Single Phase Induction Motor - Constructional Features – Double Revolving Field Theory-equivalent circuit, determination of parameters – Split Phase starting methods and applications. Universal Motor.

UNIT IV

Synchronous Machines:

Armature Windings– Concentrated and Distributed Windings – Integral Slot and Fractional Slot Windings – Pitch, Distribution, Winding Factors. Principle And Constructional Features of Salient Pole and Round Rotor Machines E.M.F Equation- Harmonics in Generated E.M.F – Elimination of Harmonics- Armature Reaction – Load Characteristics – Phasor Diagram .Regulation of Salient Pole Alternator – Voltage Regulation Methods – E.M.F Method- MMF Method – ZPF Method – – Short Circuit Ratio (SCR) – Two Reaction Theory –Determination of X_d and X_q (Slip Test) – Phasor Diagrams.

UNIT V

Parallel Operation of Alternators & Synchronous Motors

Power Flow Equation in Alternator (Cylindrical and Salient Pole Machine) – Synchronizing Power and Torque – Parallel Operation and Load Sharing – Effect of Change of Excitation and Mechanical Power Input – Synchronizing Alternators with Infinite Bus Bars - Determination of Sub-Transient, Transient and Steady State Reactance

Synchronous Motor:

Theory of Operation – Phasor Diagram – Power Flow Equations in Synchronous Motors- Variation of Current and Power Factor with Excitation – V and Inverted V Curves – Synchronous Condenser – Hunting and Methods to Eliminate Hunting – Starting Methods of Synchronous Motor

Text Books

1. I.J. Nagrath & D.P. Kothari," Electric Machines" ,4th Edition ,Tata Mc Graw – Hill Publishers, 2016.
2. Stephen J Chapman, "Electrical Machinery Fundamentals", 4th Edition, Mc Graw Hills, 2017.

Reference Books

1. M..SAY, "Performance and Design of A.C Machines", CBS Publishers, 2005.
2. Ashfaq Hussain, Haroon Hussian,"Electrical Machines", 3rd Edition, Dhanpat Rai& Co. (P), 2017.
3. S.K. Battacharya,"Electrical Machines ",4th Edition, Tata Mcgraw-Hill, 2017.
4. P.S. Bimbhra,"Electrical Machines ",7th Edition, Khanna Publishers, 2011.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 2	M	H	-	-	-	-	-	-	-	M	-	L	M	H	L
CO 3	M	H	M	-	-	-	-	-	-	M	-	-	M	H	L
CO 4	-	H	-	-	-	-	-	-	-	M	-	-	M	H	M

19EET09: POWER SYSTEMS-II

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course objectives

1. To Gain knowledge on the performance of short, medium & long transmission lines.
2. To analyse the transients of power system.
3. To solve the problems related to the economic dispatch of power, plant scheduling, unit Commitment and formulate strategies to minimize transmission line losses and penalties Imbibed.
4. To know the importance of compensation in power system and study the different Compensating techniques.

Course out comes

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

CO1. Have Knowledge on Performance of short, medium & long transmission lines.
CO2. Do calculation of power system Transients.
CO3. Explain methods for economic load dispatch and unit commitment.
CO4. Design the mathematical models of the mechanical and electrical components involved in the operation of power systems with the voltage and frequency control of single area or interconnected multi area power systems.
CO5. Explore the methods for active and reactive power control.

UNIT I

Performance of Transmission Lines:

Representation of lines-Short transmission lines-Medium transmission lines-Nominal pie and T representation of long lines by distributed parameters-Equivalent T and Pie representation of long transmission lines - Evaluation of ABCD parameters of long lines-Ferranti effect-Power flows through a transmission line

UNIT II

Power System Transients:

Introduction-Circuit closing transients-Sudden symmetrical short circuit analysis of alternator- Travelling waves on transmission line –Surge impedance and wave velocity-Specification of travelling waves-Reflections and refractions of waves-Different types of terminations-Forked line-Successive reflections-Beweleys Lattice diagram-Attenuation and Distortion

UNIT III

Economic Load Dispatch and Unit Commitment:

Economic Load Dispatch: Incremental cost curve, co-ordination equations with losses neglected - solution by iteration; co-ordination equations with loss included (No derivation of B_{mn} co-efficient); solution of co-ordination equations using B_{mn} co-efficient by iteration method.,

Unit commitment: Introduction to unit commitment constraints on unit commitment, unit commitment using priority ordering load dispatching and dynamic programming method.

UNIT IV

Load Frequency Control:

mathematical model of speed governing mechanism, speed load characteristics of governing mechanism; Regulation of two generators in parallel; Division of power system into control areas; LFC control of a single area; static and dynamic analysis of uncontrolled system; proportional plus integral control of a single area; LFC control of two area system - uncontrolled case, static and dynamic response

UNIT V

Voltage Control:

Fundamental characteristics of excitation system; Block diagram model of exciter system; Generation and absorption of reactive power; methods of voltage control; Series capacitors - static shunt capacitor/inductor, -Synchronous compensation, tap changing transformer; comparisons of different types of compensating equipment for transmission systems.

Text Books

1. V.K.Mehta and Rohit Mehta," Principles of Power Systems", Revised Edition, S.Chand &Company Ltd., New Delhi 2005.
2. C.L.Wadhwa,"Electrical power systems"7 th edition New age International, 2016.

Reference Books

1. C.L.Wadhawa, "Generation Distribution And Utilization of Electrical energy",4th edition, New age Publication, 2017.
2. J.B.Gupta," A course in Power Systems", Katson and sons publications, 2013.
3. D. P. Kothari, I. J. Nagrath," Power System Engineering",3rd edition, Tata Mcgraw-Hill**,**

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 2	L	H	M	-	-	-	-	-	-	M	-	-	H	L	-
CO 3	H	-	-	-	-	-	M	-	-	M	-	-	-	-	H
CO 4	L	M	H	M	-	-	-	-	-	M	-	-	L	H	-
CO 5	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H

19EET10: CONTROL SYSTEMS

Credits – 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives:

1 Make the students learn about the mathematical modelling, feedback control System.
2. Impart Knowledge on State Space Analysis.
3. Familiarized the Concepts of stability analysis in Time and Frequency domains.
4. Study about Different types of Controllers.

Course Outcomes:

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

CO1. Demonstrate knowledge on the concepts of open and closed loop control systems.
CO2. Understand the Concepts of stability analysis in Time Domain.
CO3. Analyze the Stability analysis in Frequency Domain.
CO4. Explore different types of controllers.
CO5. Develop and analyze state space models for electrical and mechanical systems.

UNIT I

Introduction:

Introduction to control systems – Control theory concepts - Open loop and feedback control systems – Mathematical modelling of control systems – Analysis of control systems using Laplace transforms – Block diagram reduction techniques – Signal flow graphs.

UNIT II

Time Response Analysis:

Time Response Analysis - Analysis of transient and steady state behaviour of control systems. Standard test signals – Time response of first order and higher order systems, design specification of second-order system based on time response. Steady state errors – Error criterion.

UNIT III

System Stability and Root – Locus:

Stability concepts – Conditions for stability – Routh- Hurwitz stability criteria - Root locus concepts - Construction of root loci, Root contours, Compensation design of P, PI, PD & PID controllers, Lead and Lag Compensators.

UNIT IV

Frequency Response Analysis:

Frequency response specification – Time and frequency response correlation – Bode plot – Gain margin – Phase margin -polar plot -All pass minimum phase and non-minimum phase systems–. Nyquist stability criterion

UNIT V

State Space Analysis of Linear Continuous Systems:

Introduction - State space representation using physical variables – Phase variables and canonical variables – Derivation of transfer function from state model – Solving the time invariant state equation – State transition Matrix – Its properties and computation. Concept of controllability and Observability.

Text Books:

1. I.J.Nagrath and M.Gopal ,"Control Systems Engineering",5th edition, New Age International (P) Limited, New Delhi, 2007.
2. K. Ogata,"Modern control engineering", 4th edition, Pearson Education, 2004.

Reference Books:

1. Norman S. Nise, "Control System Engineering", 4th edition, Wiley Student Edition, 2008.
2. B.C.Kuo, "Automatic control systems", 8th edition, Wiley Student Edition, 2008.
3. Ashfaq Husain, haroon Ashfaq," Control Systems", 1st edition, Dhanpat Rai&Co, 2011.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 2	H	M	-	-	-	-	M	-	-	M	-	-	-	-	H
CO 3	L	H	M	-	-	-	-	-	-	M	-	-	L	H	-
CO 4	H	H	L	-	-	-	-	-	-	M	-	-	-	-	H
CO 5	M	M	H	-	-	-	-	-	-	M	-	-	L	H	-

19BST09: INDUSTRIAL MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To impact in-depth knowledge of the subject and highlights the role of the management in the field of engineering.
2. To strengthen the fundamentals of management functions and organisation structures.
3. To select the suitable type of organisation
4. To know the feasible location for the plant & layout
5. To understand the role of human resource management in organisations.
6. To select suitable marketing mix, channels of distribution for the organisation

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define the function of management, organisation, material management & HRM
CO2. Evaluate the thoughts of management, performance of employees & job evaluation.
CO3. Identify the type & location of organisation.
CO4. Understand the functions of HRM
CO5.Determine the marketing mix, channels of distribution and PLC

UNIT I

Introduction to Management: Concept of Management - Functions of Management – Evaluation of Management Thought: Taylor's Scientific Management, Fayol's principles of Management, Douglas MC Gregor's theory X and Y, Maslow's Hierarchy of human needs.

UNIT II

Organisation: Concept - Principles of organisation. Organisational Structure: Line Organisation, Functional Organisation and Line and Staff Organisation. Types of Business Organisations: Features, Merits and Demerits of Sole trading Proprietorship, Partnership, Joint stock Companies.

UNIT III

Introduction to Operations Management: Plant location and Layout, Methods of Production. Work-study: Method study- Procedure and charts. Work measurement – procedure & work sampling. Materials Management: objectives of inventory control - EOQ & ABC analysis.

UNIT IV

Introduction to Human Resource Management: The concept of HRM. Functions of the HR manager - Manpower planning, Recruitment, Selection, Training and Development, Performance Appraisal and Job evaluation.

UNIT V

Marketing: Marketing – Definition – Marketing concepts – Marketing Environment - Marketing Mix, Marketing Vs Selling, Stages in Product Life Cycle, Channels of Distribution.

Text Book

1. A.R. Aryasri , Management Science for JNTU (B.Tech), TMH, 2002

Reference Books

1. Koontz and O'Donnel, Principles of Management, MC Graw Hill, 2001
2. Phillip Kotler, Marketing Management (11th Ed 2002) Prentice Hall of India.
3. Gary Dessler, Human Resource Management, Pearson Education, Asis, 2002
4. O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai 1999
5. Chandra Bose, Management and Administration, Prentice Hall, 2002
6. W. Glueck & L.R. Jauch, Business Policy and Strategic Management, MC Graw Hill,

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								**H**				
CO2					**M**				**H**			**L**
CO3									**H**		**M**	
CO4					**L**				**H**		**M**	**L**
CO5									**H**		**M**	**L**

19ECP05: MICROPROCESSORS AND MICROCONTROLLERS LAB

Credits - 1 **Sessional Marks: 40**

L: T: P:: 0:0:2 **University Exam Marks: 60**

Course Objectives

1. Study the Architecture of 8086 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study the Architecture of 8051 microcontroller

Course Outcomes

After successful completion of the course the student should be able to CO1.Design and implement programs on 8086 microprocessor.

CO2.Design interfacing circuits with 8086.

CO3.Design and implement 8051 microcontroller-based systems CO4.To understand the concepts related to I/O and memory interfacing CO5.Design interfacing circuits with 8051 microcontroller

LIST OF EXPERIMENTS

8086 Microprocessor:

1. Arithmetic operations (Addition, subtraction, multiplication, division) using 8086 microprocessor
2. Sorting the n numbers in ascending & descending order.
3. Moving the block of string from one segment to another segment.
4. Sorting of string in ascending order
5. Sorting of string in descending order
6. Length of string
7. Reverse of string
8. Interface of ADC converter.
9. Interfacing of DAC converterStepper motor control using microprocessor.
10. Interfacing Keyboard/Display controller.
11. Microprocessor based traffic controller

8051 Microcontroller:

12. Programming using arithmetic, logical and bit manipulation instructions of 8051
13. Counter Design Display digits starting from 00 up to 99, incremented every second
14. Lamp Controller Switch ON a lamp through a relay and switch it OFF after say 2 minutes under p program control
15. Water Level Indicator Sense the presence or absence of water and switch ON or OFF an LED
16. DAC Interface Interface DAC to the microcontroller to generate a saw-tooth, square and triangular waveform
17. ADC Interface Interface to ADC and display the input analogue voltage to digital display of 8 LEDs
18. STEPPER MOTOR Interface to a Stepper motor to rotate

LCD Interface Interfacean 16 x 2 LCD display Serial Communication

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1		L	H	M					M	M	M		H	L		
CO2		L	H	M					M	M	M		H	L		
CO3		L	H	M					M	M	L	L	H	M		
CO4	H	L	M						M	L	M	L	M	H		
CO5									H		M	L				

19EEP06 –CONTROL SYSTEMS LAB

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

1 Make the students learn about the mathematical modelling, feedback control System.
2. Impart Knowledge on State Space Analysis.
3. Familiarized the Concepts of stability analysis in Time and Frequency domains.
4. Study about Different types of Controllers.

Course Outcomes:

After completion of the course the student will be able to
CO1. Analyze Different types of Controllers
CO2. Obtain the transfer function and time response of second order system.
CO3. Also to set up a closed loop position control system and study the system Performance
CO4. Design a Lead, lag and Lag-Lead compensator
CO5. Develop the Root Locus, Bode Plot & Nyquist Plot using MATLAB

LIST OF EXPERIMENTS

1. Linear System Simulator (Time response of second order system)
2. Synchro Transmitter Receiver Pair
3. Study of AC Servo Position Control System (closed loop)
4. Lead and Lag Compensator (Magnitude and phase plot)
5. Transfer function of DC Motor
6. Effect of P, PI, and PID controller on a second order system
7. Temperature Controller using PID (analog)
8. Temperature controller using PID (microcontroller based)
9. Transfer function of DC Servo motor
10. Root Locus, Bode Plot & Nyquist Plot using MATLAB
11. Simulation of State space model using MATLAB

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	L	M	-	-	-	-	-	M	-	-	-	H	M
CO 2	M	H	-	H	-	-	-	-	-	M	-	-	-	H	M
CO 3	M	M	-	H	-	-	-	-	-	M	-	-	M	H	L
CO 4	-	M	H	H	-	-	-	-	-	M	-	-	-	H	H
CO 5	L	M	H	H	H	-	-	-	-	M	-	-	-	H	H

19EEP05-ELECTRICAL MACHINES-II LABORATORY

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

. **Course Objectives:**

1. To impart the Knowledge on fundamental of AC Rotating Machine.
2. To Familiarize the constructional details, principle of operation of three phase alternator and Synchronous Motor.
3. To get the Knowledge on Constructional details, principle of operation, Performance, stator, Speed Control and breaking of three phase induction Motor.
4. To Study the constructional details, principle of operation, type of single phase Induction Motor and special Machines.

Course Outcomes:

After completion of the course the student will be able to

CO1. Identify relevant information to supplement to the Electric Machines-II course.
CO2. Set up testing strategies and select proper instruments to evaluate performance characteristics of electrical machines.
CO3. Analyze the machines operation under different loading conditions.
CO4. Prepare professional quality textual and graphical presentations of laboratory data and computational results.
CO5. Primarily via team based laboratory activities, students will demonstrate the ability to interact effectively on a social and interpersonal level

LIST OF EXPERIMENTS

1. Sumpner's Test on a Pair of Single Phase Transformer
2. Scott Connection of Transformers
3. No-load And Blocked Rotor Test on Three Phase Induction Motor
4. Load Test on Three Phase Squirrel Cage Induction Motor
5. No Load and Blocked Rotor Test on Single phase Induction Motor
6. EMF Method of a Three Phase Alternator
7. ZPF Method of a Three Phase Alternator
8. Determination of X_d and X_q of a Salient Pole Machine
9. 'V' And Inverted 'V' Curves of a Synchronous Motor
10. Speed Control of Universal Motor

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**M**	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**M**	**-**
CO 2	**-**	**M**	**M**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**H**	**-**
CO 3	**-**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**H**	**-**
CO 4	**-**	**M**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**M**	**-**
CO 5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**H**	**M**	**-**	**-**	**-**	**-**	**H**

SYLLABUS FOR COURSES IN ELECTIVE-I

19ECT30: ELECTRO MAGNETIC WAVES

Credits – 3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.

Course Outcomes

After successful completion of the course the student should be able to

CO1.Solve Maxwell’s equations using vector calculus in three standard coordinate systems

CO2.Study EM wave propagation in free space in dielectric medium

CO3. Analyze electromagnetic wave propagation in guiding structures under various matching conditions

CO4. Understand the power flow mechanism in guiding structures and in unbounded medium

UNIT I

Static Electric Field: Introduction, Coulomb's law of forces, Principle of Superposition of fields, Electric scalar potential, Relation of Electric field lines and equi-potential contours,The electric dipole and dipole moment, Gauss's law, Characteristics of dielectrics. Boundary relations, Capacitance, Divergence of flux density, Divergence Theorem, Poisson's and Laplace Equations, Joule's law, Ohm's law at a point, Kirchoff's laws, Current and field at boundaries.

UNIT II

Static Magnetic Field: Magnetic field of current carrying element - BiotSavart law, Force between two parallel linear conductors, Magnetic flux and flux density, Magnetic field relations, Torque of a loop, Energy stored in a magnetic field, Inductance, Ampere's law, Maxwell's First curl equation, Comparison of divergence and curl, The vector potential, permeability, Analogies between electric and magnetic fields.

Maxwell's Equations: The equation of continuity for time varying fields, Maxwell's equations, Conditions at a boundary surface, Applications of circuit and field theory, Comparison of field and circuit theory, Maxwell's equations as generalization of circuit equations.

UNIT III

Electromagnetic Waves: Plane waves: Wave equations, plane waves in dielectric media, Plane waves in conducting media, polarization, skin effect and surface impedance, direction cosines, reflection of plane

waves: Reflection of normally and oblique plane waves from conductors and dielectrics, total reflection.

UNIT IV

Poynting Vector And The Flow Of Power: Poynting theorem, power flow for a plane wave and power loss in a plane conductor, GUIDED WAVES: Waves between parallel planes, TE and TM waves, Characteristics of TE and TM waves, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance, Electric field and current flow within the conductor.

UNIT V

Wave Guides: Rectangular wave-guides, TE and TM modes in wave-guides, Velocity, wavelength, impedance and attenuation in rectangular waveguides.

Text Books

1. E.C.Jordan and K.G.Balmain, Electromagnetic waves and Radiating Systems, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1968.
2. John D.Kraus, Electromagnetics, McGraw Hill Book Co., 1973.

Reference Books

1. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed.,2008
2. E.C. Jorden and K.G. Balmain, "Electromagnetic Waves and Radiating Systems " PHI, 2nd ed., 2000

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO1 0	PO11	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**L**	**L**	**L**				**L**			**H**	**H**	**M**	
CO 2	**H**	**H**	**M**	**H**	**L**							**L**	**L**	**H**	
CO 3	**L**	**H**	**M**									**L**	**H**		
CO 4	**H**	**L**		**M**	**M**		**L**			**M**		**M**	**H**		

19ECT31: ANALOG AND DIGITAL IC APPLICATIONS

Credits – 3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To make the student understand the basic concepts in the design of electronic circuits using linear integrated circuits and their applications.
2. To introduce some special function ICs.
3. To be able to use computer-aided design tools for development of complex digital logic circuits
4. To be able to design tests for digital logic circuits, and design for testability

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the basic building blocks of linear integrated circuits and its characteristics. CO2. Analyze the linear, non-linear and specialized applications of operational amplifiers.

CO3. Understand the theory of ADC and DAC.

CO4. Able to use computer-aided design tools for development of complex digital logic circuits. CO5. Able to design tests for digital logic circuits, and design for testability.

UNIT I

OP-AMP Characteristics: ideal and practical Op-amp, DC and AC characteristics, 741 Op-amp and its features, inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, Differentiator and Integrator, Comparators and Schmitt trigger.

UNIT II

Timers & D-A AND A-D Converters: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications. Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs –parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC.

UNIT III

Active Filters: Introduction, 1storder LPF, HPF filters, Band pass, Band reject and all pass filters.

Voltgae Regulators: Series Op-amp regulator, IC voltage regulators, Fixed voltage regulators.

UNIT IV

Digital Integrated Circuits: Classification of Integrated Circuits, CMOS Transmission Gate, IC interfacing.

Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, LED & LCD Decoders with Drivers, Priority Generators/Checkers.

UNIT V

Sequential Logic ICS: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Text Books

D.Roy Chowdhury, Linear Integrated Circuits, 2nd Ed., New Age International (p) Ltd, 2003

1. John F. Wakerly, Digital Design Principles & Practices, 3rd Ed., PHI/ Pearson Education Asia, 2005.

Reference Books

1. Ramakanth A.Gayakwad, Op-amps & Linear ICs, PHI, 1987.
2. Sergio Franco, Design with Operational amplifiers & Analog Integrated circuits 3rd Ed., Mc Graw Hill, 2002.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	H	L											H		
CO 2	L	H	M											L	H
CO 3	M	H	L											H	L
CO 4	M	L	L	M	H									M	H
CO 5		L	H	M										M	H

19EET14:RENEWABLE ENERGY SOURCES

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives:

1. Understand the various forms of Renewable energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics And Industrial application
5. Analyse the environmental aspects of renewable energy resources.

Course Outcomes:

At the end of this course, students will be able to

CO1. Understand the energy scenario and the consequent growth of the power generation from Renewable energy sources.

CO2. Explain the basic concepts of solar power generation and the performance characteristics.

CO3. Describe the methods of Solar power Storage and understand the applications of Solar Energy.

CO4. illustrate the basic physics of Biomass power generation and the performance analysis and Testing

CO5. Analyze the basic physics of Wind power generation and the performance analysis and Control Strategies.

UNIT I

Introduction to Energy Sources:

Energy sources and their availability, Non-renewable reserves and resources; renewable resources, Transformation of Energy, Energy scenario in India.

UNIT II

Solar Energy:

Basic characteristics of sunlight – solar energy resource – Solar processes and spectral composition of solar radiation; Radiation flux at the Earth's surface. Solar collectors, Types and performance characteristics.

UNIT III

Solar Energy Storage:

Solar energy storage systems and Solar pond.

Applications of Solar Energy:

Photovoltaic cell-characteristics - equivalent circuit- Photovoltaic effect – photo voltaic for battery charging-applications.

UNIT IV

Biomass Energy Systems:

Biomass sources-production processes- Gasification, Anaerobic Digestion, Pyrolysis, Biogas-Performance analysis and testing

UNIT V

Wind Energy

Wind Distribution – principles of wind energy conversion –basic components of wind energy conversion- advantages and disadvantages- Principles of Operation of wind turbines, types of wind turbines and characteristics, Generators for Wind Turbines, Control strategies.

Text Books

1. G.D.Rai "Non Conventional Energy sources", Khanna Publishers, Newdelhi, 1999.
2. G.N.Tiwari and M.K.Ghosal, "Renewable energy resources, Basic Principles and Applications", Narosa Publishing house, Newdelhi.

Reference Books

1. S.N.Badra, D.Kastha and S.Banerjee "Wind electrical Systems", Oxford university press, Newdelhi.
2. M.V.R.koteswara Rao "Energy resources Conventional & Non conventional" BS publications- Hyderabad, 2004.
3. Gilbert M.Masters "Renewable and Efficient electric power systems" Wiley interscience Publications, 2004.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	M	-	-	M	-	-	H	-	-
CO 2	-	-	-	-	-	-	M	-	-	M	-	-	H	-	-
CO 3	H	L	L	-	-	-	-	-	-	M	-	-	H	-	-
CO 4	H	M	-	-	-	-	-	-	-	M	-	-	H	-	-
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	H	-	-

19EET15: ELECTRICAL MACHINE DESIGN

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. Understanding about the construction and design of the electrical machines.
2. To get Knowledge on innovative tools and techniques will be used for Industrial and Automotive applications
3. The course provides to the students the basis and the methodologies to a correct design of The electrical machines (transformers, rotating AC machines and DC machines).
4. To Study about heating and cooling of electrical machines.
5. To Design traditional electrical machines for standard applications (Three phase Transformers, induction motors

Course Outcomes

At the end of this course, students will be able to

CO1. Explain the construction and performance characteristics of electrical machines.

CO2. Describe the various factors which influence the design: electrical, magnetic and thermal loading Of electrical machines

CO3. Understand the principles of electrical machine design and carry out a basic design of an ac machine. Use software tools to do design calculations.

CO4. Approach the problem linked to design of electrical machines.

CO5. Analyze the heating and cooling of electrical machines.

UNIT I

The Design Problem:

Basic considerations, design specifications, IS specifications, design constraints, design specifications for transformers and rotating machines.

Design of Transformers:

Types of core constructions, output equation, principles of design of core, windings, yoke, estimation of main dimensions (H & W) for single phase shell type , core type and 3-phase core type transformers. Estimation of no load current from design data

UNIT II

General Concepts for design of rotating machines: Output equation of DC machines and AC Machines, separation of D and L, Choice of specific loadings

Design of Dc Machines:

Choice of number of poles, selection of number of armature slots, choice of armature winding, design of armature, design of commutator.

Design of Field System:

Tentative design of field system, estimation of filed current.

UNIT III

Design of 3-Phase Induction Motor:
Separation of D and L, ranges of specific loadings Stator Design: selection of number of slots, estimation of turns per phase, design of conductor cross section. Rotor design: Selection of number of rotor slots, principles of design of squirrel cage and slip ring rotor

UNIT IV

Design of Synchronous Machines:
Choice of armature windings, types of armature windings, separation of D and L. Design of armature, choice of number of slots, estimation of turns per phase, conductor cross section, field system design for salient pole and cylindrical pole rotor machines.

UNIT V

Heating and Cooling Of Electrical Machines:
Estimation of temperature rise, heating time constant, cooling time constant, heating and cooling time curves, and volume of coolant required. Design of transformer tank with tubes: estimation of temperature rise, design of transformer tank.

Text Books

1. A.K.Sawhney, "Electrical Machine Design", Dhanpatrai& Co, 2016.
2. V. Rajini, V.S.Nagrajan "Electrical Machine Design", Pearson Publishers, 2018.

Reference Books

1. Sen., S.K.,'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing co. pvt.Ltd, New Delhi, 1987.
2. A.Shanmugasundaram, G.Gangadharan, R.Palani' Electrical Machine Design Data Book ', New Age International Pvt. Ltd., Reprint 2007.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 2	H	-	-	M	-	-	-	-	-	M	-	-	H	M	-
CO 3	-	-	H	-	M	-	-	-	-	M	-	-	H	M	-
CO 4	L	-	H	M	M	-	-	-	-	M	-	-	H	M	-
CO 5	M	H	-	L	-	-	-	-	-	M	-	-	M	H	-

B.Tech
III Year II Semester

B.Tech
III Year II Semester

S.No	Course Code	Course Title
1	19EET11	Power Electronics
2	19EET12	Electrical &Electronics Measurements
3	19BST10	Entrepreneurship &Project Management
4	Elective-II	
19ECT04		Digital Signal Processing
19EET16		Switch gear & protection
19EET17		Modern Control Theory
19EET18		Special Machines
5	Open Elective-II	
6	19BST11	Constitution Of India
6	19EEP07	Electrical &Electronics Measurements Lab
7	19EEP08	Power Electronics Lab

19EET11: POWER ELECTRONICS

Credits – 4 **Sessional Marks: 30**
L: T: P:: 3:1:0 **University Exam Marks: 70**

Course objectives

1. To study the characteristics of various power semiconductor devices and to design firing circuits for SCR.
2. To learn the operation of single phase and three phase controlled rectifiers with R, RL, RLE loads and effect of source inductance and freewheeling diode on converter performance.
3. To know about control strategies of Choppers and their performance
4. To impart knowledge on line commutated converters, Cycloconverter and ac voltage regulators.

Course outcomes

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

CO1. Describe the characteristics of various power semiconductor devices and analyze the Static and dynamic characteristics of SCR's and Design firing circuits for SCR
CO2. Understand the operation of single phase and three phase converters.
CO3. Analyze the operation of different types of DC-DC converters and control strategies.
CO4. Explain the operation of single and three phase inverters and application of PWM techniques for voltage Control.
CO5. Discuss about the operation of AC voltage controllers and Cyclo-converters.

UNIT I

Power semi conductor devices:

Diode , Thyristor, MOSFET, IGBT : V-I characteristics; dynamic characteristics of SCR, Firing circuit for Thyristor– Series and parallel operation of SCR's, Need for Equalizing Network and Equalizing Network design – Protection circuits – Design of Snubber circuit – Class A,B,C,D,E types of commutation circuits.

UNIT II

Phase controlled Rectifiers:

Principles of phase control – Half-wave and full- wave controlled rectifiers with resistive, inductive load – Freewheeling diode operation – Bridge rectifiers – Single phase and three phase Rectifiers with inductive load – Half and fully controlled rectifiers – freewheeling diode operation – Effect of source inductance –Dual converter – circulating and non-circulating current mode of operation.

UNIT III

Choppers:

Principles of operation – Principles of operation – control strategies, constant and variable frequency system, current limit control – Types of chopper circuits – Type-A, Type B and Type E chopper circuits Morgan chopper Jone's chopper – step-up and multiphase chopper circuits – load commutated chopper.

UNIT IV

Inverters: Classification – series and parallel inverters improved series inverters – Bridge inverters – Commutation circuits – current and voltage commutation circuits – single phase and three phase inverters – output waveform control – Mc Murray Inverter – Introduction to current source inverters.

UNIT V

Cyclo-converters: Principle of operation – single phase step-up and step down cyclo converters – Three-phase half-wave Cyclo converters – output voltage equation – circulation and non-circulating current mode of operation – Load commutated Cyclo converter. Introduction to AC voltage controller.

Text Books

1. Dr.P.S.Bimbhra, "Power Electronics", 2nd edition, Khanna publishers, 2006.
2. M.D.Singh and K.B.Khanchandani,"Power Electronics", 2nd edition, Tata McGraw Hill publishers, 2017.

References Books

1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices, and Applications", 4th edition Pearson education, 2017.
2. V. Subrahmanyam," A Text book of Power Electronics Power Electronics: Devices, Converters, Application**"** New age Publication, 2018.
3. P C Sen,"Power Electronics", Tata McGraw Hill publishers, 2017.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**H**
CO 2	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**H**
CO 3	**-**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**L**	**H**	**-**
CO 4	**H**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**H**
CO 5	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**H**

19EET12: ELECTRICAL & ELECTRONICS MEASUREMENTS

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To study the basic principles of different types of electrical instruments for the Measurement of voltage, current, power factor, power and energy.
2. To get knowledge on measurement of R, L, and C parameters using DC and AC bridge circuits.
3. To know about the principles of Instrument Transformers, PF meters, Watt-meters and Energy meters.
4. To import knowledge on working of CRO and its applications along with Electronic instruments like Digital Voltmeters and Multimeters.

Course Outcomes

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

CO1. Understand the basic principles of different types of electrical instruments for the Measurement of voltage, current, Resistance, Extend the range of ammeters and voltmeters and analyse the Errors in them.
CO2. Analyze DC bridges for measurement of Resistance, Inductance and Capacitance, and also use potentiometers.
CO3. Explore about AC bridges and the use of Current Transformers& Potential Transformers.
CO4. Discuss about the operation of Watt-meters, PF meters, and energy meters.
CO5. Explain the working of electronic instruments and display devices, different characteristic features of periodic and aperiodic signals using CRO.

UNIT I

Introduction:
Accuracy – Precision – Types of errors, Error Analysis – General theory of instruments. Deflecting, control, and damping torques in instruments – PMMC type of instrument – Extension of range – Ohmmeter – Multimeter – Megger. Moving iron, rectifier, and dynamometer type instruments.

UNIT II

DC Bridges:
Circuits for D.C. measurements – Measurement of potential difference, current, and resistance – Carey-Foster Bridge – Kelvin double bridge. Fundamentals of A.C. measurements – A.C. potentiometers.

UNIT III

AC Bridges:
Principle of bridge measurements - Measurement of inductance, capacitance, and resistance using different AC bridges. Potential and current transformers – Ratio and phase angle errors.

UNIT IV

Measurement of power and Energy:
Electro-dynamic instruments, Single, Double and Triple Watt-Meter Methods. Measurement of energy – Single phase and three phase energy meters. Power factor meters.

UNIT V

Cathode ray oscilloscope (CRO):

Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.

Electronic Instruments:

Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter and Digital Energy meter.

Text Books

1. A.K.Shawney,"Electrical and Electronics Measurements and Instrumentation ", Dhanpat Rai&Co, 2015.
2. U A Bakshi,'' Electrical Measurements and Instrumentation'', Technical Publications, 2014.

Reference Books

1. C.T.Baldwin, "Fundamentals of Electrical Measurements", George G.Harrap & Co Ltd.
2. Prithwiraj Purkait, Budhaditya Biswas,"Electrical and Electronics Measurements and Instrumentation'' Tata Mc.Graw Hill publishers, 2017.
3. Rajput R.K," Electrical Measurements and Measuring Instruments"Revised Edition, S Chand, 2007

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	H	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 2	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 3	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 4	H	-	-	-	-	-	-	-	-	M	-	-	-	-	H
CO 5	H	H	-	-	-	-	-	-	-	M	-	-	-	-	H

19BST10: ENTREPRENEURSHIP & PROJECT MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand the principles & phases of projects
2. To identify the resources of the project & duration.
3. To know the role entrepreneurship in economic development
4. To understand the problems of SSE
5. To learn the design & preparation of business plan.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define the concepts of project, engineering project design, and prototyping and feasibility study
CO2. Evaluate product duration, cost & quality control charts
CO3. Identify the ways to enhance economic development
CO4. Capable to maintain the problems of SSE and SWOT analysis
CO5. Design the business plan

UNIT I

Project Management: Concept of project - Project Life Cycle Phases – Human centred Engineering Project Design – Design thinking – Principles – Preliminary project specification – Feasibility Study – Detailed Project Design - Prototyping Methods – Validation of project with users.

UNIT II

Project Evaluation Techniques: PERT - CPM - Statistical Quality Control: X & R charts, P & C charts - Report preparation - Incubation – Concept – Support System.

UNIT III

Introduction to Entrepreneurship: Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs Manager, Entrepreneur vs Entrepreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development – Problems faced by women entrepreneurs – Support System for entrepreneurs.

UNIT IV

Small Scale Enterprise: Definition, Characteristics, Role of Small Enterprise in Economic Development, Problems of SSE, and Steps involved to start SSE, Package for promotion of Small Scale Enterprise, SWOT Analysis.

UNIT V

Business Model Design: Innovation readiness to commercialisation – Business Plan Preparation - Venture capital support system – Start-up support system and Review of Indian start-up business models.

Reference Books

1 L.S. Srinath, PERT/CPM, Affiliated East-West Press, New Delhi , 2002

2 S. Choudary, Project Management, McGraw Hill Education (India) Private Limited, New Delhi.

3 S.S.Khanka, Entrepreneurial Development, S Chand & Company Ltd., New Delhi.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					**M**		**L**					
CO2					**M**						**H**	**L**
CO3									**L**			
CO4				**M**					**M**			**L**
CO5					**H**				**M**		**H**	**L**

19BST11: CONSTITUTION OF INDIA

Credits – No credits
L:T: P::3:0:0

Course Objectives

1. To learn basic concepts of Indian Constitution.
2. To understand Fundamental Rights, Fundamental Duties and its implications.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire the knowledge of Indian constitution.

CO2. Understand the Fundamental Rights, Directive Principles of State Policies and Fundamental Duties.

UNIT I

Constitution-structure and principles: Meaning and importance of Constitution, making of Indian Constitution, salient features of Indian constitution.

UNIT II

Fundamental Rights and Directive Principles of State Policy: Fundamental Rights , Fundamental Duties, Directive Principles.

UNIT III

Government of the Union: President of India – election, powers and functions, Prime Minister and Council of Ministers, Loksabha - composition and powers, Rajyasabha -composition and powers.

UNIT IV

Government of states: Governor - powers and functions, Chief Minister and Council of Ministers, Legislative Assembly and Legislative Council.

UNIT V

Judiciary: Features of Judicial System in India, Supreme Court, High court- structure and Jurisdiction.

Administrative Organizations and Construction: Federalism in India, local government –panchayat, election commission, citizen oriented measures - RTI and PIL significance and provisions.

Text Books

1. HM Seervai ,"Constitutional Law of India",Universal Law Publishing Co Ltd
2. Parvinrai Mulwantrai Bakshi, Constitution of India, LexisNexis,2019.

Reference Books

1. Dr.J.N.Pandey," Constitutional Law Of India", Central Law Agency,Allahabad, 2019
2. Durga Das Basu, Shorter Constitution of India, LexisNexis, 2019.

SYLLABUS FOR COUSES IN

ELECTIVE-II

19ECT04: DIGITAL SYSTEM DESIGN

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **UniversityExamMarks: 70**

Course Objectives

7. To understand number representation and conversion between different representation in digital electronic circuits.
8. To analyze logic processes and implement logical operations using combinational logic circuits.
9. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
10. To understand characteristics of memory devices and their classification.
11. To understand concept of programmable devices, PLA, PAL, FPGA.
12. To understand the characteristics of logic families.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Develop a digital logic and apply it to solve real life problems

CO2. Analyze, design and implement combinational logic circuits.

CO3. Classify different semiconductor memories.

CO4.Analyze, design and implement sequential logic circuits.

CO5.Design digital system design using PLD.

UNIT I

Number systems and codes: Review of Binary, octal decimal and hexadecimal number systems and their inter conversion. BCD, Grey, ASCII, Parity bit. Boolean Algebra and logic gates : NOT OR AND operations, Boolean theorems. De Morgan's theorem, symbols and truth tables of logic gates (NOT, OR, AND,NAND, NOR, XOR, XNOR), Universal gates

UNIT II

Combinational logic circuits: Standard forms of logical functions, minterm and maxterm specifications, simplification by K-maps and Tabular methods, and realization of logical functions using gates. Decoders and encoders, Multiplexers and demultiplexers, Digital Magnitude Comparator.

UNIT III

Sequential circuits : Latches, clocked flip-flops, SR, JK, D and T flip flops, timing problems and master-slave flip – flops, shift registers, Asynchronous and synchronous counters, Ring and Johnson counters, application of counters.

UNIT IV

Arithmetic circuits: Signed binary numbers, Binary arithmetic, Binary adders and subtractors, serial and parallel adders. Integrated-circuit parallel adder and its applications.

Memory Devices: Terminology, ROM, PROM, EPROM, EEPROM, CDROM, Semiconductor RAM and its architecture.

UNITV

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin,Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing,Memory elements, Conceptof Programmable logic devices like PLA,PAL, FPGA. Logic implementation using Programmable Devices.

Text Books

3. M.MorrisMano,Digital Logic and Computer Design -3rdEdition,Pearson Education/PHI

4. nanda Kumar -Switching Theory and Logic Design –PHI, 3rdEdition, 2008

References Books

3. Ronald J. Tocci, Neal S. Widmer." Digital Systems-Principlesand Applications".8th Edition Pearson 2001.
4. Taub and Schilling. " Digital Integrated Electronics." -Mc Graw Hill Co, 1st Edition ,2008.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H	M	
CO2	M	L	H	M									M	H	
CO3	M	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

19EET16: SWITCH GEAR AND PROTECTION

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To introduce students to power system protection and switchgear.
2. To discuss the causes of abnormal operating conditions (faults, lightning and switching Surges) of the apparatus and system.
3. To study of different Types of Circuit Breakers and Relays.
4. To Import Knowledge on protection of Generators and Transformers.
5. To Make the Students Learn About the protection of various feeders, bus bars from Abnormal conditions and over voltages & importance on Neutral grounding for overall Protection.

Course Outcomes

After completion of the course student will be able to

CO1. Analyse the operation of different Types of Protective Relays.
CO2. Explain different types of relays which are used in real time power system operation.
CO3. Explore the protection of different power system components such as generators, Transformer, Transmission lines and feeders against over voltages and short circuits.
CO4. Illustrate the operation of different Types of Circuit Breakers.

UNIT I

Protective Relays:

Introduction – Need for protective systems in a power system –Zones of protection - Primary and backup protection – definition and functional characteristics of a protective relay – operating principles of electromagnetic relays - torque production in an induction relay – induction disc and induction cup structure relays – different types of over current relays – time current characteristics and current setting of over current relays – directional over current relays – operating characteristics of a directional over current relay – applications of over current relays.

UNIT II

Distance Relays:

The universal torque equation – principle of distance protection – operating characteristics of impedance , reactance and mho relays- structures of reactance and mho relays – effects of arc resistance, type of fault, power swings on the performance of distance relays – principles and operation of differential relays – construction and operating characteristics of simple and percentage differential relays – carrier pilot protective relaying .

Static Relays:

Amplitude and phase comparators, Analysis of duality, Static amplitude comparators, integrating and instantaneous comparators, Static phase comparators. Coincidence type, Static over-current relays, Static directional relay, Static differential relay, Static distance relays, Impedance, Reactance & mho relays.

UNIT III

System Protection:

Protective schemes for different types of feeders and transmission lines by over Current, distance and pilot relaying methods. Generator protection: Protection for stator faults, rotor faults and protection for abnormal conditions of a generator. Transformer protection: protection against short circuits by differential protection schemes –construction and working of Buchholz relay. Bus bar protection schemes – frame leakage protection scheme.

UNIT IV

Circuit Breakers:

Arcs in air and oil – initiation of the arc-deionization of the arc-arc interruption theories, Restriking voltages, Recovery voltages, and rate of rise of restriking voltages- Current chopping- Resistance switching

Classification of circuit breakers: Types of Oil circuit breakers- Air break circuit breaker -Air blast circuit breaker-- SF6 circuit breaker-Vacuum circuit breaker-High voltage D.C.Circuit breakers, Testing of circuit breakers-rating of circuit breakers- Selection of circuit breakers-auto reclosing methods .Fuses – Introduction, Definitions, Fuse characteristics, Type of fuses, Application of HRC fuses, Discrimination.

UNIT V

Protection Against Over Voltages:

Causes of over voltages-over voltages due to lightning – Rod gaps-Horn gaps-Expulsion type and valve type lightning arresters-lightning arrester calculations-ground wires-counter poises-surge absorbers and surge diverters- surge protection of rotating machines

Insulation coordination: volt-time curve-basic impulse insulation levels of different equipment-insulation coordination of transformers & lightning arresters-insulation coordination of bus bars –transmission lines and other equipment in a power system.

Text Books

1. BadriRam & D.N.Vishwakarma,''Power system protection and switch gear'',2nd Edition, Tata McGraw Hill Education, 2017.
2. Paithankar Y.G ,"Fundamentals of Power System Protection" 2nd Edition, PHI Publications, 2010.

Reference Books

1. A. Wright , C. Christopoulos,"Electrical Power System Protection" 2nd Edition, Kluwer Academic Publications, 1999.
2. B.Ravindranath&M.Chander,"power system protection & switch gear", 2nd Edition. New Age International, 2011.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	H	L	-	-	-	-	-	-	M	-	-	M	H	-
CO 2	H	-	-	-	M	-	-	-	-	M	-	-	H	M	L
CO 3	M	H	L	-	-	-	-	-	-	M	-	-	H	M	-
CO 4	M	H	L	-	-	-	-	-	-	M	-	-	M	H	L

19EET17: MODERN CONTROL THEORY

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To develop the ability to determine various properties of these systems including Controllability, Observability, and stability.
2. To Design feedback controllers for specified Eigen values based on state space methods.
3. To formulate the state observers based on state-space methods and other methods.
4. To Generate state space models for dynamic systems.
5. To Impart Knowledge on Non Linear Systems

Course Outcomes

At the end of this course, students will be able to

CO1. Design of pole assignment and observer using state feedback.
CO2. Identify and analyze non-linear systems using describing function analysis
CO3. Analyze linear and non-linear systems using Lyapunov function and design Lyapunov function for Stable systems
CO4. Formulate an optimal control problem and design optimal control signal.
CO5. Generate state space models for dynamic systems.

UNIT I

Controllability and Observability:

Review of State Space Analysis, Tests for Controllability and Observability for Continuous Time Systems – Principle of Duality, Controllability and Observability of State Models in Jordan Canonical Form and Other Canonical Forms. Effect of State Feedback on Controllability and Observability.

UNIT II

Analysis Of Non Linear Systems-I:

Introduction to Nonlinear Systems, Types of Nonlinearities, Concepts of Describing Functions, Derivation of Describing Functions for Dead Zone, Saturation, Backlash, Relay With Dead Zone and Hysteresis - Jump Resonance.

UNIT III

Analysis of Non Linear Systems-II:

Introduction to Phase-Plane Analysis, Method of Isoclines for Constructing Trajectories, Singular Points, Phase-Plane Analysis of Nonlinear Control Systems.

UNIT IV

Stability Analysis:

Stability in the Sense of Lyapunov. Lyapunov Stability and Lyapunov Instability Theorems. Direct Method of Lyapunov for the Linear and Nonlinear Continuous Time Autonomous Systems.

UNIT V

Controllers and Observers Design:
Design of State Feedback Control through Pole Placement. Full Order Observer and Reduced Order Observer. State Estimation through Kalman Filters.

Text Books
1. M. Gopal, "Modern Control System Theory", 2nd edition, New Age International Publishers, 1996.
2. Stainslaw H. Zak, "Systems and Control", Oxford Press, 2003.

Reference Books
1. K. Ogata, "Modern Control Engineering", 3rd edition, Prentice Hall of India, 1998.
2. I.J. Nagrath and M.Gopal, "Control Systems Engineering" New Age International (P) Ltd. 2007.
3. M. Gopal,"Digital Control and State Variable Methods", Tata Mc Graw-Hill Companies, 1997.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	L	M	H	M	-	-	-	-	-	M	-	-	M	H	M
CO 2	L	H	M	-	-	-	-	-	-	M	-	-	-	H	M
CO 3	-	M	H	-	-	-	-	-	-	M	-	-	M	H	H
CO 4	L	H	H	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	-	M	H	-	-	-	-	-	-	M	-	-	-	H	M

19EET18: SPECIAL MACHINES

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives:

1. To impart knowledge on the theory of travelling magnetic field and applications of linear Motors
2. to study the performance and control of stepper motors, and their applications.
3. To learn about brush less dc motor.
4. To know the theory of operation and control of switched reluctance motor.

Course outcomes:

At the end of this course, students will be able to

CO1. Explain the theory of travelling magnetic field and applications of linear motors.
CO2. Understand the basic theories of stepper motors.
CO3. Analyze the performance and control of stepper motors, and their applications.
CO4. Describe about Brushless DC motor and Permanent magnet motor performance.
CO5. Discuss the Switched mode reluctance motor operation and characteristics.

UNIT I

Field Aspects of Electrical Machines:

Review of Maxwell's equations and solution of Laplace's and Poisson's equations, Concept of magnetic vector potential. Eddy current braking. Linear motors: Basic principle of operation and types. End effects & transverse edge effects. Field analysis & Propulsion force; equivalent circuit.

UNIT II

Stepper Motors:

Construction and operation of Stepper Motors: variable reluctance, permanent magnet, hybrid stepper motors, characteristics of stepper motors. Drive Circuits for Stepper motors: Block diagram of stepper motor controller, logic sequence generator, power drivers, current suppression circuits, acceleration and deceleration circuits

UNIT III

Microprocessor Control of Stepper Motors:

Microprocessor based stepper motor controller, PC based stepper motor controller. Micro-stepping Control of Stepper motors: the micro-stepping principle, advantages of micro stepping, design of basic micro-stepping controller. Applications of stepper motor.

UNIT IV

Brushless Dc Motor:
Principle of operation of BLDC motor, square wave permanent magnet brushless motor drives, sine wave permanent magnet Brushless DC motor drives, Phasor diagram, torque speed characteristics, controllers for BLDC motors, alternating current drives with PM and synchronous reluctance hybrid motors.

UNIT V

Switched Reluctance Motor Drives:
Types of SR motors, principle of operation, static torque production, energy conversion loop, and dynamic torque production. Converter Circuits, Control of SR motors: current regulation, commutation, torque speed characteristics, shaft position sensing.

Text Books:

1. VV Athani, "Stepper Motors Fundamentals, Applications, and Design", New Age International, 1997.
2. TJE Miller, "Brushless Permanent-Magnet and Reluctance Motor Drives" Clarendon Press, Oxford, 2010.
3. R.Krishnan,"Switched Reluctance Motor Drives" CRC Press, 2001.

Reference Books:

1. K.Venkata rathnam,"Special electrical machines", University press, New Delhi 2009.
2. E.G.janardhan,"Special electrical machines", PHI learning private limited, 2014

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 2	H	H	M	-	-	-	-	-	-	M	-	-	-	H	M
CO 3	M	H	-	H	-	-	-	-	-	M	-	-	L	H	M
CO 4	H	H	M	-	-	-	-	-	-	M	-	-	M	H	M
CO 5	L	H	M	-	-	-	-	-	-	M	-	-	-	H	M

OPEN ELECTIVE-I

REFERRED TO CONCERNED DEPARTMENT

19EEP07 – ELECTRICAL& ELECTRONIC MEASUREMENTS LAB

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

1. The basic principles of different types of electrical instruments for the Measurement of Voltage, current, power factor, power and energy.
2. The measurement of R, L, and C parameters using DC and AC bridge circuits.
3. The principles of Instrument Transformers, pf meters, Watt-meters and Energy meters.
4. The principle of working of CRO and its applications along with Electronic instruments like Digital Voltmeters and Multimeters.

Course Outcomes:

After completion of the course the student will be able to

CO1. Acquire hand on experience about different measurement devices and its working principles.
CO2. Determine the unknown parameters by using Kelvin's double bridge and wheat stone's Bridge, AC bridges, slide wire potentiometer. CT/PT,
CO3. Test single – phase energy meter, concept of direct loading and phantom loading, 3-phase Energy meter using standard wattmeter, AC potentiometer
CO4. Analyze the principle of calibration of a measuring instrument and plotting of curves
CO5. Apply appropriate technique to find temperature.

LIST OF EXPERIMENTS

1. Measurement of parameters of a choke coil using 3 voltmeter and 3 ammeter methods
2. Calibration of Dynamometer Type Power Factor Meter
3. Measurement of % ratio error and phase angle of given C.T.
4. Calibration of LPF wattmeter- by Phantom testing
5. Crompton D.C Potentiometer- Calibration of PMMC ammeter and PMMC voltmeter
6. Kelvin's double Bridge- Measurement of resistance- Determination of Tolerance
7. Schering Bridge
8. Anderson Bridge
9. Measurement of Resistance by Wheat Stone Bridge
10 Measurement of Temperature using RTD
11. Study of various DC / AC bridges with built-in necessary components, meter/s, connecting wires and detailed manual**.**

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	L	-	-	-	-	-	M	-	-	M	H	-
CO 2	M	H	L	-	-	-	-	-	-	M	-	-	M	H	-
CO 3	M	-	-	H	-	-	-	-	-	M	-	-	M	H	L
CO 4	H	M	L	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	H	H	L

19EEP08 –POWER ELECTRONICS LAB

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course objectives:

1. To study the characteristics of various power semiconductor devices and to design firing Circuits for SCR.
2. To learn the operation of single phase and three phase controlled rectifiers with R, RL, and RLE Loads and effect of source inductance and freewheeling diode on converter performance.
3. To know about control strategies of Choppers and their performance
4. To impart knowledge on line commutated converters, Cycloconverter and ac voltage Regulators.

Course Outcomes:

After completion of the course the student will be able to

CO1. Explain the significance of switching devices and its application to power converters and Demonstrate the triggering circuit and Snubber circuits.
CO2. compare the operation of two, three Pulse Converters and draw output waveforms with And without source and load inductance.
CO3. Classify the operation of Choppers and outline the application of SMPS.
CO4. Analyze the operation of single phase and three phase Inverters with and without PWM Techniques.
CO5. Illustrate the operation of AC voltage controller and Cycloconverter and its application.

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET, TRIAC, DIAC, IGBT Characteristics
2. Study of SCR gate firing circuits
3. Single phase AC voltage controller with R and RL loads
4. Study of single phase fully controlled bridge converters with R and RL Loads
5. DC Jones Chopper with R & RL Loads and DC Motor Load
6. IGBT based Single Phase Bridge Inverter with R & RL load
7. Study of single phase half controlled bridge converters with R and RL Loads
8. Single phase series inverter with R & RL loads
9. Forced Commutations circuits Study Unit
10 Single phase parallel inverter with R & RL loads

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**
CO 2	**M**	**-**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**
CO 3	**M**	**-**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**
CO 4	**M**	**H**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**
CO 5	**M**	**M**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**M**	**H**	**-**

B.Tech
IV Year I Semester

B.Tech
IV Year I Semester

S.No	Course Code	Course Title
1	19EET13	Power System Analysis
2	Elective-III(MOOCS	
3	Elective-IV	
	19EET19	Power Quality & FACTS
	19EET20	High Voltage Engineering
	19EET21	Neural Network & Fuzzy Logic
	19EET22	Industrial Electrical Systems
4	Open Elective-II	
5	19EEP09	Power systems simulation lab
6	19EEI01	Internship
7	19EES01	Technical Seminar
8	19EEJ01	Project Work Phase-I

19EET13: POWER SYSTEM ANALYSIS

Credits - 4 **Sessional Marks: 30**

L: T: P:: 3:1:0 **University Exam Marks: 70**

Course Objectives:

To make the student learn about

1: per unit quantities and the concept of the Z_{bus} building algorithm.

2: modelling of various power system components, Short circuit analysis of power systems.

3: Power flow studies by various methods.

4: Study the stability of power systems

Course Outcomes:

At the end of the course the student will be able to:

CO1. Design mathematical models for power system components
CO2. Determine the fault currents for symmetrical and unbalanced faults
CO3. Generate input data suitable for load flow, fault calculations and state estimation.
CO4. Analyze the steady state, transient and dynamic stability concepts of a power system
CO5. Solve the swing equation and its solution, Equal area criterion and its applications

UNIT I

Fault studies: Per unit system-Introduction to symmetrical fault analysis-Short circuit capacity of a bus-The short circuit currents and the reactance of synchronous machines-Internal voltages of loaded machines under transient conditions-Expressions for fault MVA in terms of per unit and percentage quantities-Need for current limiting reactors and their location-The selection of circuit breakers. Z_{bus} building algorithm-addition of link-addition of branch

UNIT II

Introduction to unsymmetrical faults-Symmetrical components- phase shift of symmetrical components in Star-Delta transformer banks-Power in terms of symmetrical components-Unsymmetrical series impedances- sequence impedances and sequence networks-Sequence Networks of unloaded generators-Sequence impedances of transmission lines-Sequence impedances of transformers - Zero sequence networks of 3 phase loads and 3 phase transformer banks-Unsymmetrical fault analysis on unloaded generator and on power systems with and without fault impedances.

UNIT III

Load flow studies: Need for load flow studies in a power system-Incidence matrix -Formation of Bus admittance matrix by direct and singular transformation methods- -Classification of types of buses in a power system-Formulation of load flow equations-Gauss-Seidel, iterative method for load flow studies-Treatment of PV bus-Acceleration factors-Newton Raphson method for load flow solution with rectangular and polar coordinates- formulation of load flow equations-Decoupled and fast decoupled load flow

UNIT IV

Stability studies: Classification of stability studies-The power flow equations of round rotor and salient pole synchronous machine connected to infinite bus through a transmission system under steady state and transient state - Power flow equations of a two machine system - Power flow equations in terms of ABCD constants-Power angle diagrams-Derivation of swing equation, Inertia constant. steady state stability analysis: Steady state stability and steady state stability limits.

UNIT V

Transient stability analysis: General considerations and assumptions-Transient stability and stability limits-Reduction of two finite machine system to one machine system-Solution of swing equation of one machine system by point by point method-Digital solution by numerical methods-Equal area criterion-Limitations of equal area criterion- Determination of critical clearing angle. Methods for improving power system stability.

Text Books:

1. C.L.Wadhwa, "Electrical power systems",7th Edition, New Age International publications,2016.
2. D.P. Kothari and IJ Nagrath,''Modern Power System Analysis'', 4th edition, Tata McGraw Hill Publishers, 2011.

Reference Books:

1. William .D. Stevenson Jr "Elements of power system analysis ", 4th edition, Tata Mcgraw Hill Publishers, 2017.
2. Hadi Saadat, "Power system analysis", Tata McGraw Hill Publishers, 2002.
3. AR Bergen and Vijay Vittal, "Power system analysis", 2th edition, Pearson education Asia, 2001.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	M	H	-	-	-	-	-	-	M	-	-	H	M	-
CO 2	M	H	-	M	-	-	-	-	-	M	-	-	H	M	-
CO 3	M	H	-	M	-	-	-	-	-	M	-	-	M	H	-
CO 4	M	H	M	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	M	H	-	-	M	-	-	-	-	M	-	-	M	H	-

ELECTIVE-III (MOOCS)

SYLLABUS FOR COURSES IN ELECTIVE-IV

OPEN ELECTIVE-II

REFERRED TO CONCERNED DEPARTMENT

19EET19: POWER QUALITY & FACTS

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1 To introduce the basic concepts of power quality and its issues.
2. Analysis and mitigation of power quality issues.
3. Study of basic concepts, different types, and applications of FACTS controllers in power system.

Course Outcomes

After completion of the course the student will be able to

CO1. Understand the power quality issues.
CO2. Analyze the voltage disturbances and suggest suitable mitigating techniques.
CO3. Explain the working principles of FACTS devices and their operating characteristics
CO4. Estimate the effect of shunt and series reactive compensation.
CO5. Apply the concepts in solving problems of simple power systems with FACTS Controllers.

UNIT I

Introduction:

Introduction – Characterization of Electric Power Quality: Transients, short duration and long duration voltage variations, Voltage imbalance, waveform distortion, Voltage fluctuations, Power frequency variation, Power acceptability curves – power quality problems: poor load power factor, Non linear and unbalanced loads, DC offset in loads, Notching in load voltage, Disturbance in supply voltage – Power quality standards.

UNIT II

Analysis and Conventional Mitigation Methods:

Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detroit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load Balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

UNIT III

Reactive Power Compensation:

Basic concepts of reactive power compensation, Types of compensation, Static VAR compensation, Resonance damper, Thyristor controlled series capacitor (TCSC), Static condenser, Phase angle regulator and other controllers.

UNIT IV

Series Compensation Technique:

Sub-Synchronous resonance, Tensional interaction, Modelling and control of Thyristor controlled series compensators. Static VAR Compensation – Basic concepts, Thyristor controlled reactor (TCR), Thyristor switched reactor (TSR), and Thyristor switched capacitor (TSC), saturated reactor (SR) and fixed capacitor (FC).

UNIT V

Facts Controllers & Statcom:
Variable structure FACTS controllers for Power system transient stability, Non linear variable structure control, Unified power flow, Unified power flow control – Introduction, Implementation of power flow control using conventional thyristors, concept, Implementation of unified power flow controller. Basics of STATCOM and its applications.

Text Books

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.

Reference Books

1. T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
2. R. C. Dugan, "Electrical Power Systems Quality", Tata McGraw Hill Education, 2012.
3.G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**H**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**H**
CO 2	**-**	**H**	**H**	**-**	**M**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**H**
CO 3	**H**	**M**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**H**
CO 4	**-**	**H**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**H**
CO 5	**-**	**H**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**-**	**H**	**-**	**H**

19EET20: HIGH VOLTAGE ENGINEERING

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

Upon completion of this course, the student will be able

1 To understand the principle of theory of High Voltage Generation and Measurements.

2. To Impart Knowledge on the operation of high voltage power supplies for AC, DC and Impulse voltages.

3. To get familiar with various applications where high voltage field is used.

4. To Study about breakdown of HV insulation (solid, liquid & gas).

5. To Gain Knowledge on lightening phenomena and HV insulation environmental pollution.

Course Outcomes

After completion of the course the student will be able to

CO1. Discuss about the basic physics related to various breakdown processes in solid, Liquid and gaseous insulating materials.

CO2. Explain the basic concepts of generation and measurement of D. C., A.C., & Impulse Voltages.

CO3. Perform test on H. V. equipment and on insulating materials, as per the standards.

CO4. Describe how over-voltages arise in a power system, and protection against these over-Voltages.

CO5. Analyse the breakdown of HV insulation (solid, liquid & gas).

UNIT I

Generation of high D.C. and A.C. voltages: – Introduction, Half wave rectifier circuit, Cockcroft-Walton voltage multiplier circuit, Electrostatic generator, Generation of high a.c. voltages by cascaded transformers, Series resonant circuit.

Generation of impulse voltages and currents: – Definitions, Impulse generator circuits, Analysis of circuit 'a' and Analysis of circuit 'b', Multistage impulse generator circuits, Triggering of impulse generator, Impulse current generation.

UNIT II

Measurement of high voltages and currents: – Introduction, Sphere gap, uniform field spark gap, Rod gap, Electrostatic voltmeter, Generating voltmeter, Chubb-Fortescue method, Impulse voltage measurement using voltage dividers, Measurement of high d.c., a.c. and impulse currents.

UNIT III

High voltage testing of electrical equipment: – Testing of overhead line insulators, Testing of cables, Testing of bushings, Testing of power capacitor, Testing of power transformers, Testing of circuit breakers.

UNIT IV

Non-Destructive Insulation Techniques: – Measurement of resistivity, Measurement of dielectric constant and loss factor, High voltage Schering bridge measurement of large capacitances, Partial discharges.

UNIT V

Break Down Mechanism Of Gases, Liquid and Solid Insulating Materials: – Introduction, Mechanism of breakdown of gases, Townsend's first ionization coefficient, Cathode processes secondary effects, Townsend's second ionization coefficient, Townsend breakdown mechanism, Paschen's law, Principles of breakdown of solid and liquid dielectrics.

Text Book

1. C.L.Wadhwa,"High voltage Engineering",3rd Edition, New Age International Publisher,2012.
2. M. S.Naidu & Kamaraju,"High voltage engineering fundamentals",5th Edition, Tata McGraw Hill Education,2017.

Reference Books

1. Kuffel & Zaengle," High voltage engineering fundamentals", 2th Edition, Newnes.
2. Ravindra Arora, Bharat Singh Rajpurohit, "fundamentals of High voltage engineering",Wiley, 2019.
3. Dieter Kind," An introduction to high voltage experimental technique", vieweg.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	-	M	-
CO 2	H	M	-	-	-	-	-	-	-	M	-	-	-	H	-
CO 3	-	M	-	H	-	-	-	-	-	M	-	-	-	-	H
CO 4	H	M	-	-	-	-	-	-	-	M	-	-	H	-	H
CO 5	M	H	-	-	-	-	-	-	-	M	-	-	H	-	-

19EET21: NEURAL NETWORKS AND FUZZY LOGIC

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To know the Importance of AI techniques in engineering applications
2. To familiarize with the concepts of Artificial Neural networks and Biological Neural Network.
3. To study the ANN approach in various Electrical Engineering problems.
4. To impart knowledge on Fuzzy Logic and Its use in various Electrical Engineering Applications

Course Outcomes

At the end of this course, students will be able to

CO1. Discuss the concepts of Artificial Neural networks
CO2. Acquire the adequate knowledge about feedback networks.
CO3. Explain the learning rules and control applications of Neural Networks.
CO4. understand the concept of fuzziness, fuzzy set theory and gain the comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic
CO5. Design of fuzzy systems for real time applications.

UNIT I

Artificial Neural Networks:

Introduction to neural networks, biological neurons, artificial neurons, McCulloch-Pitt's neuron model, neuron modelling for artificial neural systems, feed forward network, Perceptron network, Supervised and un-supervised learning

Learning Rules:

Hebbian learning Rule, Perceptron learning Rule, Delta learning Rule, Winner-take-all learning rule, Out-star learning rule

UNIT II

Supervised Learning:

Perceptron, exclusive OR problem, single layer Perceptron network, multi-layer feed forward networks: linearly non separable patter classification, delta learning rule for multi Perceptron layer, error back propagation algorithm, training errors , ADALINE, introduction to Radial Basis Function Networks(RBFN).

UNIT III

Un-Supervised Learning:

Hamming net, Maxnet, Winner –take –all learning, counter propagation network, and feature mapping, self-organising feature maps

Applications of neural Algorithms: elementary aspects of applications of character recognition

Neural Network control applications: Process identification, Basic dynamic learning control architecture

UNIT IV

Fundamentals of Fuzzy Logic and Fuzzy Sets:

Definition of fuzzy set, α-level fuzzy set , cardinality, operations on fuzzy sets: union, intersection, complement, Cartesian product, algebraic sum, definition of fuzzy relation, properties of fuzzy relations, fuzzy composition

UNIT V

Design of Fuzzy Systems:

Components of fuzzy systems, functions of fuzzification, Rule base patterns, Inference mechanisms, methods of de-fuzzification: COG, COA, MOM, Weighted average, height methods. Design of Fuzzy Systems for temperature setting of water heater, fuzzy system for control of air conditioner.

Text Books

1. Jacek M Jurada, "Introduction to artificial Neural Systems", Jaico Publications.
2. S.Rajashekaran, G.A.Vijaya Lakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications'', PHI, 2013.

Reference Books

1. Hans-Jurgen Zimmermann,"Fuzzy Set Theory and its Applications" ,4th,Kluwer Academic Publishers, 2006.
2. S.N. Sivanandam & S.N. Deepa ,"Principles of soft Computing", 3rd Edition, Wiley India Pvt.Ltd, 2018.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 2	H	M	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 3	H	M	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 4	M	H	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 5	M	-	H	-	-	-	-	-	-	M	-	-	-	H	M

19EET22: INDUSTRIAL ELECTRICAL SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To import knowledge on electrical wiring systems for residential, commercial and industrial Consumers, representing the systems with standard symbols and drawings, SLD.
2. To study various components of industrial electrical systems.
3. To select the proper size of various electrical system components.

Course Outcomes

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

CO1. Describe the tariff structure and various protection components.
CO2. Design aspects of lightning and sizing of wiring systems.
CO3. Estimate the illumination levels produced by various sources and to design different Lighting systems by taking inputs and constraints in view.
CO4. Calculate different compensation techniques and lightning protection.
CO5. Know the functioning and applications of DG systems, UPS and Battery banks.

UNIT I

Electrical System Components:

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

UNIT II

Residential and Commercial Electrical Systems:

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices,

Earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III

Illumination Systems:

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

UNIT IV

Industrial Electrical Systems I :

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V

Industrial Electrical Systems II:

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Text Books

1. S.L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & costing", Khanna publishers, 2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
   Web site for IS Standards.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	-	-	-	-	-	-	-	-	M	-	-	-	-	-
CO 2	-	M	H	-	-	-	-	-	-	M	-	-	-	H	-
CO 3	-	H	M	-	-	-	-	-	-	M	-	-	-	H	-
CO 4	M	H		-	-	-	-	-	-	M	-	-	-	M	-
CO 5	H	-	-	-	-	-	M	-	-	M	-	-	-	H	M

OPEN ELECTIVE-II

REFERRED TO CONCERNED DEPARTMENT

19EEP09 – POWER SYSTEMS & SIMULATION LABORATORY

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:

To make the student learn about

1. Per unit quantities and the concept of the Zbus building algorithm.
2. Model various power system components Short circuit analysis of power systems.
3. Power flow studies by various methods.
4. Study the stability of power systems

Course Outcomes:

After completion of the course the student will be able to

CO1. Draw the sequence network for L-G, L-L and L-L-G fault of the power system and Determine the Fault current in case of L-G, L-L and D-L-G fault
CO2. determine Sub-Transient reactance of a salient pole synchronous machine
CO3. Explain the Performance Characteristics of Relays
CO4. Analyze Y-Bus & Z-Bus, Gauss –Seidel, Fast decoupled analysis using MATLAB
CO5. Develop a Simulink model for a single area load frequency problem and simulate the Same.

LIST OF EXPERIMENTS

1. Performance Characteristics of Over Current Relay
2. Performance Characteristics of Directional over Current Relay
3. Performance Characteristics of Percentage Differential Relay
4. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
5. Fault Analysis – I (LG Fault, LL Fault)
6. Fault Analysis – II (LLG Fault, LLLG Fault)
7. Determination of Sub-Transient reactance of a salient pole synchronous machine
8. Y-Bus & Z-Bus formation using MATLAB
9. Gauss -Seidel load flow analysis using MATLAB
10. Fast decoupled load flow analysis using MATLAB
11. Develop a Simulink model for a single area load frequency problem and simulate the same.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	L	H	M	H	-	-	-	-	-	M	-	-	M	-	-
CO 2	L	H	-	M	-	-	-	-	-	M	-	-	M	-	-
CO 3	H	-	-	-	-	-	-	-	-	M	-	-	M	-	-
CO 4	L	M	-	M	H	-	-	-	-	M	-	-	M	-	-
CO 5	L	-	H	M	-	-	-	-	-	M	-	-	M	-	-

19EEI01: INTERNSHIP

Credits – 2 **Sessional Marks: 100**

Course Objectives

To expose the students to the following:

1. To expose technical students to the industrial environment, which cannot be simulated in the class room and creating competent professionals for the industry.
2. To provide possible opportunities to learn understand and sharpen the real time technical/managerial skills require at the job.
3. To exposure to the current technological developments relevant to the subject area of training.
4. Experienced gained from the "industrial internship" in class room will be used in class room discussions.
5. To create conditions conductive to quest for knowledge and its applicability on the job.

Course Outcomes

After successful completion of course the student should be able to

CO1. An opportunity to get hired by the industry/organization.
CO2. Practical experience in industry.
CO3. Excellent opportunity to see how the theoretical assepts learned in classes are integrated in the Practical world.
CO4. Opportunity to learn new skills and supplement knowledge.
CO5. Opportunity to practice communication and teamwork skills.
CO6. Opportunity to learn strategies like time management, multi tasking in an industrial setup.
CO7. Enhance their candidacy for higher education
CO8. Creating network and social circle and developing relationships with the industry people.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	-	-	-	-	H	-	M	H
CO 2	-	H	-	-	-	-	-	-	M	-	-	M	-	M	H
CO 3	M	-	-	-	-	H	M	-	-	-	-	-	H	M	-
CO 4	-	-	-	-	H	-	-	-	-	-	-	M	M	H	-
CO 5	M	M	-	-	-	-	-	-	-	H	-	-	-	-	H
CO 6	-	-	-	-	-	-	-	-	M	M	H	-	-	-	H
CO 7	-	-	-	-	-	-	-	-	-	-	-	H	-	-	H
CO 8	-	-	-	-	-	H	-	-	-	-	-	M	-	-	M

19EES01: TECHANICAL SEMINAR

Credits – 1
L: T: P: 0:0:2 **Sessional Marks: 100**

Course Objectives

To expose the students to the following:

1. Identify, understand and discuss current, real-time issues.
2. Improve oral and written communication skills.
3. Explore an appreciation of the self in relation to its larger diverse social and academic contexts.
4. Apply principles of ethics and respect in interaction with others.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the chosen seminar topic.
CO2. Analyse critically the chosen seminar topic for arriving at conclusions.
CO3. Understand the impact of seminar output in the context of environmental sustainability.
CO4. Develop communication skills for preparing and presenting seminar report.
CO5. Develop skills for continuous learning to improve knowledge and competence in the chosen field of Seminar.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**H**	**M**	**-**
CO 2	**-**	**H**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**H**	**-**
CO 3	**-**	**-**	**-**	**-**	**-**	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**L**	**-**	**-**
CO 4	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**-**	**-**	**H**	**-**	**-**	**-**	**M**	**H**
CO 5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**H**	**-**	**-**	**H**

19EEJ01: PROJECT WORK PHASE -I

Credits – 2 **Sessional Marks: 40**
L: T: P:: 0:0:4 **University Exam Marks : 60**

Course Objectives

To expose the students to the following:

1. To understand and analyse the problems associate with energy conservation, environmental protection and society and to find suitable solution.
2. To create a optimal solution and/or a workable prototype for the problems.
3. To introduce students to the vast array of literature available for various research challenges in the field of Electrical Engineering.
4. To create awareness among the students about the characteristics of several domain areas where Electrical Engineering can be effectively used.
5. To enable students to use concepts of Electrical Engineering in creating a solution for practical problems.
6. To improve the team building, communication and management skills of the students.

Course Outcomes

After successful completion of course the student should will be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Critically analyze the chosen topic for arriving at conclusions.
CO3. Develop and design feasible solutions for the problem proposed in the project.
CO4. Undertake research and solve real world problems in the project domain.
CO5. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO6. Use project results for sustainable development of the society.
CO7. Understand the impact of project results in the context of environmental sustainability.
CO8. Understand professional and ethical responsibilities for sustainable development of society in the chosen field of project.
CO9. Function effectively as individual and a member in the project team.
CO10. Develop communication skills, both oral and written for preparing and presenting project report.
CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.
CO12. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	H	M	-	M	-	-	-	-	-	-	-	-	H	M	-
CO2	-	H	M	-	M	-	-	-	-	-	-	-	M	H	-
CO3	-	M	H	-	M	-	-	-	-	-	-	-	H	M	-
CO4	-	-	-	H	-	M	-	-	-	M	-	-	-	M	H
CO5	-	-	M	-	H	-	-	-	-	M	-	-	-	H	-
CO6	-	-	-	-	-	H	M	-	-	-	-	-	-	-	H
CO7	-	-	-	-	-	M	H	-	-	-	-	-	-	-	H
CO8	-	-	-	-	-	-	M	H	-	-	-	-	-	-	H
CO9	-	-	-	-	-	-	-	-	H	M	M	-	-	-	H
CO10	-	-	-	-	-	-	-	M	-	H	M	-	-	-	H
CO11	-	-	-	-	-	-	-	-	M	-	H	-	-	-	H
CO12	M	M	-	-	-	-	-	-	-	-	-	H	-	-	H

B.Tech
IV Year II Semester

B.Tech
IV Year II Semester

S.No	Course Code	Course Title
1	Elective-V	
	19EET23	Electrical Distribution Systems
	19EET24	Electrical Drives
	19EET25	Control System Design
	19EET26	PLCs & applications
2	Elective-VI	
	19EET27	Smart Electrical Grids
	19EET28	HVDC Transmission Systems
	19EET29	Digital Control Systems
	19EET30	Utilization of Electrical Energy
3	Open Elective-III	
4	19EEJ02	Project Work Phase-II

SYLLABUS FOR COUSES IN

ELECTIVE-V

19EET23: ELECTRICAL DISTRIBUTION SYSTEMS

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To know how a distribution system is planned.
2. To learn about different types of power distribution systems and their usage in today's life.
3. To familiarize with protection and co-ordination of protective devices in distribution systems.
4. To understand how power factor can be improved and need for its improvement.
5. To provide information on voltage control and how to achieve it.

Course Outcomes

At the end of this course, students will be able to

CO1. Understand the necessity of distribution system planning.Necessity of planning of Sub Transmission, distribution substations for future load requirements and different Substation schemes.
CO2. Design considerations of primary & secondary systems.
CO3. Explain the co-ordination of protective devices in distribution system.
CO4. Explain the application of capacitors to distribution systems.
CO5. Illustrate the voltage control and how to achieve it.

UNIT I

Distribution System Planning and Automation:

Introduction, distribution system planning, factors affecting system planning, present techniques, planning models, planning in the future-role of computers in distribution system, system automation. Load Characteristics, basic definitions, loss factor, classification of loads (Residential, commercial, agricultural, Industrial) and their characteristics

UNIT II

Substations:

Application of distribution transformers, types, regulation and efficiency. Design of sub transmission lines and Distribution substations: Sub-transmission, distribution substations, substation schemes, location, rating of distribution substation, substation service area with n primary feeders, comparison of four and six feeder patterns, derivation of constant K.

UNIT III

Design Considerations of Primary Systems:

Introductory aspects, Radial and loop types of primary feeders, primary network, voltage levels, feeder loading, tie-lines. Distribution feeder exit, rectangular radial type development, radial feeder with uniformly and no-uniformly distributed load-application of the ABCD general circuit constants to radial feeders.

Design Considerations of Secondary Systems:

Introductory aspects, secondary voltage levels, the present design practice, secondary banking, secondary networks, high voltage and low voltage distribution systems and their salient features, different types of HVDS

UNIT IV

Protective Devices and Co-Ordination:

Objectives of distribution system protection, types of common faults and procedure for fault calculations, protective devices, principles of operation of fuses, circuit breakers, consideration of protective devices, general co-ordination procedure, fault current calculations.

UNIT V

Application of Capacitors to Distribution Systems:

Basic definitions, power capacitor , effect of shunt capacitors(fixed and switched) , power factor correction, capacitor allocation , capacitor installation types, economic justification, procedure to determine the best capacitor location, mathematical procedure to determine the optimum capacitor location, equipment for voltage control ,effect of series capacitor, effect of AVB/AVR , line drop compensation, voltage fluctuations

Text Books

1. Turan Gonen, "Electric Power Distribution System Engineering" 3rd Edition, CRC Press, 2014.
2. A S Pabla, "Electrical Power Distribution", 5th Edition, Tata McGraw Hill, 2000.

Reference Books

1. Dale R.Patrick and Stephen W.fardo,"Electrical distribution system",2nd Edition,CRC press.
2. V.Kamaraju, "Electric power distribution" Right publishers, 2017.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	H	-	-
CO 2	-	H	M	-	-	-	-	-	-	M	-	-	H	-	-
CO 3	H	-	-	-	-	-	-	-	-	M	-	-	H	-	-
CO 4	M	H	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-

19EET24: ELECTRICAL DRIVES

Credits - 3 **Sessional Marks: 30**

L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To get knowledge on advantages of electrical drives in a power transmission and choice of Electrical drives
2. To study of speed control of DC motor by using chopper fed DC drive
3. To Learn about Braking and motoring mode by using multi quadrant chopper
4. To Familiarize with the design of controller for a DC drive
5. To Understand about performance analysis of Induction Motor by using VSI or AC drive
6. To Intend Knowledge on Torque Speed characteristics of slip ring Induction Motor by Using PE Equipment

Course Outcomes

At the end of this course, students will be able to

CO1. Understand the operation of Different types of Electrical Drives
CO2. Describe about the speed control of DC Motor by using Power Electronic Equipment
CO3. Explain about various types of operation of DC drive
CO4. Analyze the operation of Current Controller and Speed Controller
CO5. Illustrate the performance of Induction Motor by using VSI

UNIT I

Electrical Drives:

An introduction – Electrical Drives, Advantages of Electrical Drives, parts of electrical drives – Electrical motor, power modulators, sources, control unit, choice of electrical drives.

Controlling of Dc Motor Drive: DC motor drives fed from controlled rectifiers

UNIT II

Chopper Fed Dc Drive:

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.

Multi-Quadrant Dc Drive:

Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four- quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

UNIT III

Closed-Loop Control of Dc Drive:

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions, modelling of chopper as gain with switching delay, plant transfer function, for controller design, current controller specification and design, speed controller specification and design.

UNIT IV

Scalar Control or Constant V/F Control of Induction Motor:

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

UNIT V

Control of Slip Ring Induction Motor:

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

Text Books

1. G. K. Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.
2. W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.

Reference Books

1. G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. R. Krishnan, "Electric Motor Drives: Modelling, Analysis and Control", Prentice Hall, 2001.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	-	H	-
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	-	H	-
CO 3	H	M	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 4	M	H	-	-	-	-	-	-	-	M	-	-	-	H	M
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	-	M	M

19EET25: CONTROL SYSTEMS DESIGN

Credits - 3 **Sessional Marks: 30**

L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To make students understand the concept of state space analysis
2. To familiarize the Design Concepts of compensator in time and frequency domain,
3. To Impart Knowledge on Design of the PID compensator.

Course Outcomes

At the end of this course, students will be able to

CO1. Understand various design specifications.
CO2. Analyse the Concepts of compensator in time and frequency domain
CO3. Describe the Concepts of compensator in time and frequency domain
CO4. Design controllers to satisfy the desired design specifications using simple controller Structures (P, PI, PID, compensators).
CO5. Interpret the controllers using state-space approach.

UNIT I

Design Specifications:

Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

UNIT II

Design of Classical Control System in the Time Domain:

Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT III

Design of Classical Control System in Frequency Domain:

Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

UNIT IV

Design of PID Controllers:

Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT V

Control System Design in State Space:

Review of state space representation. Concept of controllability & Observability, effect of pole zero cancellation on the controllability & Observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle.

Text Books

1. I. J. Nagrath and M. Gopal, “Control system engineering”, Wiley, 2000.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

Reference Books

1. K.K. Aggarwal ,”Control System Analysis and Design” Khanna Publisher, 2004.
2. N. Nise, “Control system Engineering”, John Wiley, 2000.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	-	L	-	-	-	-	M	-	-	H	M	-
CO 2	M	H	L	-	M	-	-	-	-	M	-	-	M	H	L
CO 3	H	M	M	M	L	-	-	-	-	M	-	-	H	M	-
CO 4	M	M	H	M	M	-	-	-	-	M	-	-	M	H	L
CO 5	H	M	M	-	-	-	-	-	-	M	-	-	H	M	L

19EET26: PROGRAMMABLE LOGIC CONTROLLER AND ITS APPLICATIONS

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

The objectives of the course are to make the students learn about:

1. PLC and its basics, architecture, connecting devices and programming
2. Implementation of Ladder logic for various Industrial applications
3. Designing of control circuits for various applications
4. PLC logic and arithmetic operations

Course Outcomes

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

CO1. Know the architecture, connecting devices and programming of PLC
CO2. Design logic circuits to perform industrial control functions of medium complexity
CO3. Demonstrate the correct operation of logic circuits by programming them into the Programmable logic controller.
CO4. Develop coded programs for the programmable logic controller.
CO5. use the programmable controller for troubleshooting

UNIT I

PLC Basics:

PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules. PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

UNIT II

Digital Logic Gates: Programming in the Boolean Algebra System, Conversion Examples. Ladder Diagrams for Process Control: Ladder Diagrams & Sequence Listings, Ladder Diagram Construction and Flowchart for Spray Process System.

UNIT III

PLC Registers:

Characteristics of Registers, Module Addressing, Holding Registers, Input Registers, Output Registers. PLC Functions: Timer Functions & Industrial Applications, Counter Function & Industrial Applications, Arithmetic Functions, Number Comparison Functions, Number Conversion Functions

UNIT IV

Data Handling Functions:

SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS, CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit Shift Register, Sequence Functions and Applications, Controlling of Two-Axis & Three Axis Robots With PLC, Matrix Functions.

UNIT V

Analog PLC Operation: Types of PLC Analog Modules and Systems, PLC Analog Signal Processing, BCD or Multibit data Processing, Analog output application examples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation, Troubleshooting and Maintenance.

Text Books

1. Hackworth, "Programmable Logic Controllers: Programming Methods and Applications", 1st Edition, Pearson, 2003
2. Frank.D, petruzella,"Programmable Logic Controllers",5th Edition: McGraw Hill Publishers.

Reference Books

1. Lin S.C. Jonathon," Programmable Logic Controllers", Industrial Press Inc., U.S.
2. Bolton William,"Programmable Logic Controllers", 6th Edition, Elsevier Science & Technology Publishers

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	L	-	-	-	-	-	-	M	-	L	M	H	-
CO 2	M	M	H	M	M	-	-	-	-	M	-	L	H	M	L
CO 3	H	L	M	M	M	-	-	-	-	M	-	-	M	H	-
CO 4	M	M	H	M	M	M	-	L	-	M	-	L	L	H	L
CO 5	M	M	H	L	M	-	-	-	-	M	-	-	-	H	M

SYLLABUS FOR COUSES IN

ELECTIVE-VI

19EET27: SMART ELECTRICAL GRIDS

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To Impart Knowledge on Basic definitions, aims and main functions of Smart Grids.
2. To identify the main characteristics, structures and functions of power systems and electricity market.
3. To Learn about the role of actors in electricity distribution and electricity Market.
4. To summarize the main point of distributed energy resources from network point of view and ICT solutions for Smart Grids.

Course Outcomes

At the end of this course, students will be able to
CO1. Understand the challenging issues and architecture of smart grid.
CO2. Explain the communication and wide area monitoring in smart grid.
CO3. Analyse rudimentary management issues in smart grid.
CO4. Acquire the knowledge in computational intelligence and security issues in smart grids.
CO5. Describe the role of power electronics and energy storage in smart grid.

UNIT I

The Smart Grid:

Introduction, Ageing Assets and Lack of Circuit Capacity, Thermal Constraints, Operational Constraints, Security of Supply, National Initiatives, Early Smart Grid Initiatives, Active Distribution Networks, Virtual Power Plant, Other Initiatives and Demonstrations, Overview of The Technologies Required for The Smart Grid.

UNIT II

Communication Technologies:

Data Communications: Introduction, Dedicated and Shared Communication Channels, Switching Techniques, Circuit Switching, Message Switching, Packet Switching, Communication Channels, Wired Communication, Optical Fibre, Radio Communication, Cellular Mobile Communication, Layered Architecture and Protocols, The ISO/OSI Model, TCP/IP

Communication Technologies: IEEE 802 Series, Mobile Communications, Multi Protocol Label Switching, Power line Communication, Standards for Information Exchange, Standards For Smart Metering, Modbus, DNP3, IEC61850

UNIT III

Information Security for the Smart Grid:

Introduction, Encryption and Decryption, Symmetric Key Encryption, Public Key Encryption, Authentication, Authentication Based on Shared Secret Key, Authentication Based on Key Distribution Center, Digital Signatures, Secret Key Signature, Public Key Signature, Message Digest, Cyber Security Standards, IEEE 1686: IEEE Standard for Substation Intelligent Electronic Devices (IEDs) Cyber Security Capabilities, IEC 62351: Power Systems Management And Association Information Exchange – Data and Communication Security.

UNIT IV

Smart Metering And Demand Side Integration:

Introduction, smart metering – evolution of electricity metering, key components of smart metering, smart meters: an overview of the hardware used – signal acquisition, signal conditioning, analogue to digital conversion, computation, input/output, and communication. Communication infrastructure and protocols for smart metering- Home area network, Neighbourhood Area Network, Data Concentrator, meter data management system, Protocols for communication. Demand Side Integration- Services Provided by DSI, Implementation of DSI, Hardware Support, Flexibility Delivered by Prosumers from the Demand Side, System Support from DSI.

UNIT V

Transmission and Distribution Management Systems:

Data Sources, Energy Management System, Wide Area Applications, Visualization Techniques, Data Sources and Associated External Systems, SCADA, Customer Information System, Modelling and Analysis Tools, Distribution System Modelling, Topology Analysis, Load Forecasting, Power Flow Analysis, Fault Calculations, State Estimation, Applications, System Monitoring, Operation, Management, Outage Management System, Energy Storage Technologies, Batteries, Flow Battery, Fuel Cell and Hydrogen Electrolyser, Flywheels, Superconducting Magnetic Energy Storage Systems, Super-capacitors.

Text Book

1. Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins,"Smart Grid", Student Edition, Wiley Publications, 2012.
2. James Momoh, "Smart Grid: Fundamentals of Design and Analysis", Wiley, IEEE Press., 2012.

Reference Books

1. A.B.M.Shawkat Ali,"Smart Grid", Springer London Ltd.
2. M.D. Fadlullah Zubair,"Evalution of Smart Grid", Springer International Publishing AG.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	-	-	-	M	-	-	H	M	L
CO 2	H	-	-	-	-	-	-	-	-	M	-	-	M	H	-
CO 3	H	M	-	-	-	-	-	-	-	M	-	-	H	M	-
CO 4	H	-	M	-	-	-	-	-	-	M	-	L	M	H	L
CO 5	M	H	-	M	-	-	M	-	-	M	-	L	H	M	-

19EET28: HIGH VOLTAGE DIRECT CURRENT TRANSMISSION

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To introduce the Technical and economic aspects of HVAC and HVDC transmission and Their Comparison.
2. To impart knowledge on HVDC converters.
3. To study the Control strategies of HVDC converter systems
4. To know the occurrence of faults, and transients in HVDC system and their protection.
5. To familiarize with the Origin, effects, classification and elimination of harmonics and Design of filters.

Course Outcomes

At the end of this course, students will be able to

CO1. Compare dc transmission over ac transmission.
CO2. Describe the operation of Line Commutated Converters and Voltage Source Converters.
CO3. Explain the control strategies used in HVDC transmission system and understand the Improvement of power system stability using an HVDC system
CO4. Understand the occurrence of faults, and transients in HVDC system and their protection.
CO5. Suppress / eliminate harmonics and Design HVDC Filters.

UNIT I

Dc Power Transmission Technology:

Introduction, Comparison of AC DC transmission, Converter station, Description of DC Transmission systems, Choice of voltage level, Modern trends in DC transmission

UNIT II

Analysis of HVDC Converters:

Pulse number, Choice of converter configuration, valve rating. Transformer, simplified analysis of graetz circuit with and without overlap, rectifier and inverter waveforms, converter bridge characteristics

UNIT III

Converter and HVDC System Control:

Principle of DC Link control, Converter control characteristics, system and control hierarchy, firing angle control, converter and excitation angle control, starting and stopping of DC Link, Power control , higher level controllers

UNIT IV

Converter Faults:

Protection against over currents, over voltages in converter station, surge arresters, protection against over voltages

Smoothing reactor, DC Line, Transient over-voltages in DC line, protection of DC line, DC breakers

UNIT V

Reactive Power Requirements in Steady State:
Sources of reactive power, static VAR systems, generation of Harmonics, Design of AC Filters, Dc Filters, Carrier frequency and RI noise.

Text Books

1. K R Padiyar, "HVDC Transmission Systems", 3rd Edition, New Age International Publishers, 2017.
2. S. Rao, "EHV AC and HVDC Transmission engineering and Practice" Khanna Publishers ,1993.

Reference Books

1. Kamakshaiah S and Kamaraju,"HVDC Transmission", Tata MC-Graw hill, 2017.
2. Jos Arrillaga ,Y. H. Liu ,Neville R. Watson," Flexible Power Transmission: The HVDC Options", Wiley, 2007.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	-	-	-	-	-	-	M	-	-	H	M	-
CO 2	M	H	-	M	-	-	-	-	-	M	-	-	H	M	-
CO 3	M	H	L	-	-	-	-	-	-	M	-	L	M	H	L
CO 4	H	M	M	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	M	M	H	M	-	-	-	-	-	M	-	-	H	M	-

19EET29: DIGITAL CONTROL SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To equip the students with the basic knowledge of discretization.
2. To impart knowledge on Z-Transforms for Discrete system analysis.
3. To learn the stability analysis of digital control system.
4. To familiarize the design concepts of the controller and observer for digital control systems.

Course Outcomes

At the end of this course, students will be able to
CO1. Obtain discrete representation of LTI systems.
CO2. Illustrate the Z-Transforms in discrete time analysis.
CO3. Explain stability of open loop and closed loop discrete-time systems.
CO4. Describe and analyze digital controllers.
CO5. Design state feedback and output feedback controllers.

UNIT I

Discrete Representation of Continuous Systems:

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

UNIT II

Discrete System Analysis:

Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

UNIT III

Stability of Discrete Time System:

Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT IV

State Space Approach for Discrete Time Systems:

State space models of discrete systems, State space analysis. Controllability, reach-ability, Reconstructibility and Observability analysis. Effect of pole zero cancellation on the controllability & Observability. Lyapunov Stability.

UNIT V

Design of Digital Control System:

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of Discrete Observer for LTI System. Design of Discrete compensator. Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

Text Books

1. K. Ogata, “Digital Control Engineering”, Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.

Reference Books

1. G. F. Franklin, J. D. Powell and M. L. Workman, “Digital Control of Dynamic Systems”, Addison-Wesley, 1998.
2. B.C. Kuo, “Digital Control System”, Holt, Rinehart and Winston, 1980

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	M	H	M	L	-	-	-	-	-	M	-	-	M	H	L
CO 2	M	H	-	-	-	-	-	-	-	M	-	-	M	H	L
CO 3	L	H	M	-	-	-	-	-	-	M	-	-	H	M	L
CO 4	M	H	H	-	-	-	-	-	-	M	-	-	H	M	L
CO 5	L	M	H		H	-	-	-	-	M	-	-	H	M	L

19EET30: UTILIZATION OF ELECTRICAL ENERGY

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To provide the students the fundamental concepts of drives and types of drives used in Traction.
2. To train the students with a good engineering breadth so as to analyze the accessing Techniques for braking system implementation in traction.
3. To comprehend the different issues related to heating, welding and illumination.
4. To Familiarize about the Trouble shoot various lamps and fittings.
5. To Impart Knowledge on different schemes of traction schemes and its main components.

Course Outcomes

On completion of this course the student will be able to

CO1. Maintain electric drives used in an industries
CO2. Identify a heating/ welding scheme for a given application
CO3. Describe how to use Trouble shoot various lamps and fittings.
CO4. Design the different schemes of traction schemes and its main components
CO5. Explain the suitable scheme of speed control for the traction systems

UNIT I

Illumination:

Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination, CFL, LED lamps, Street Lighting and Factory Lighting– Numerical Problems.

UNIT II

Electric Heating & Welding:

Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Induction and Dielectric Heating.

Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Electrodes of Various Metals, Defects in Welding. Electrolysis - Faraday's Laws, Applications of Electrolysis, Power Supply for Electrolysis.

UNIT III

Electric Traction-I:

Introduction – Systems of Electric Traction. Comparison Between A. C And D. C Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Breaking with DC Motors and with AC Motors – Control Gear – Auxiliary Equipment – Track Equipment and Collector Gear – Conductor-Rail Equipment – Overhead Equipment – Calculation of Sags and Tensions – Collector Gear for Overhead Equipment.

UNIT IV

Electric Traction – II:

Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral, Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, and Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

UNIT V

Economic Aspects of Utilizing Electrical Energy:

Power Factor Improvement, Improvement of Load Factor, Off Peak Loads- Use of Exhaust Steam, Heat Stations, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply-Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage, Cost of Renewals.

Text Books

1. C.L. Wadhwa,"Generation Distribution and Utilization of Electrical Energy", 4th Edition, New Age International Publishers, 2017.

2. H. Partab," Art & Science of Utilization of electrical Energy", Dhanpat Rai & Co., 2017.

Reference Books

1. Er. R.K. Rajput," Utilisation of Electrical Power",2nd Edition, 2016.

2. J.B. Gupta,"Utilization of Electric Power & Electric Traction", Katson Books, 2013.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	-	-	-	-	M	-	-	M	-	-	H	M	-
CO 2	L	H	M	-	-	-	-	-	-	M	-	-	M	H	-
CO 3	M	M	H	-	-	-	-	-	-	M	-	-	H	M	L
CO 4	M	M	H	-	-	-	-	-	-	M	-	-	M	H	-
CO 5	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-

OPEN ELECTIVE-III

REFERRED TO CONCERNED DEPARTMENT

LIST OF OPEN ELECTIVES SYLLABUS OFFERED BY EEE DEAPRTMENT

OPEN ELECTIVE-I

19EET31: ELECTRICAL ENGINEERING MATERIAL

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objective

1. To understand the importance of various materials used in electrical engineering and Obtain a qualitative analysis of their behaviour and applications.
2. To learn about types of magnetic materials and their magnetization properties.
3. To use semiconductor materials in designing VLSI circuits.
4. To know about electrical applications for various materials.
5. To acquire knowledge on special purpose materials.

Course Outcomes

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

CO1. Understand Various Types Of Dielectric Materials, Their Properties In Various Conditions.
CO2. Evaluate Magnetic Materials And Their Behaviour.
CO3. Explore About Semiconductor Materials And Technologies.
CO4. Describe the Materials Used in Electrical Engineering and Applications.
CO5. Analyze the Basic Concepts of Special Purpose Materials

UNIT- I

Dielectric Materials:

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II

Magnetic Materials:

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermets permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis

UNIT III

Semiconductor Materials:

Properties of semiconductors, Silicon wafers, integration Techniques, Large and very large scale integration techniques (VLSI)

UNIT IV

Materials For Electrical Applications:

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V

Special Purpose Materials:

Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI

Text Books

1. "R K Rajput", "A course in Electrical Engineering Materials", Laxmi Publications, 2009.
2. "T K Basak", "A course in Electrical Engineering Materials", New Age Science Publications, 2009.

Reference Books

1. J.B. Gupta," Electrical and Electronics Engineering Materials ", Katson Books, 2013.
2. AdrianusJ.Dekker," Electrical Engineering Materials", PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	-	M	-	-	-	-	-	M	-	-	H	M	-
CO2	H	M	-	-	-	-	-	-	-	M	-	-	M	H	-
CO3	H	M	M	-	-	-	-	-	-	M	-	-	-	H	-
CO4	H	M	-	-	-	-	-	-	-	M	-	-	H	M	-
CO5	H	H	-	-	-	-	M	-	-	M	-	-	H	-	-

19EET32: ENERGY AUDITING & DEMAND SIDE MANAGEMENT

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course objectives

1. To learn about energy consumption and situation in India
2 To express about Energy auditing.
3 To aware of Energy Measuring Instruments.
4 To understand the Demand Side Management.

Course Outcomes

After completion of the course the student will be able to

CO1. Explore the current energy scenario and importance of energy conservation.
CO2. Illustrate the methods of improving energy efficient motors.
CO3. Analyze the methods of improving power factor.
CO4. Understand the concepts of different energy efficient devices.
CO5. Explain about Energy Economic analysis and Demand side management.

UNIT I

Energy Auditing:

Energy Situation – World and India, Energy Consumption, Conservation, Codes, Standards and Legislation. Energy Audit- Definitions, Concept, Types of Audit, Energy Index, Cost Index, Pie Charts, Sankey Diagrams, Load Profiles, Energy Conservation Schemes. Measurements in Energy Audits, Presentation of Energy Audit Results.

UNIT II

Energy Efficient Motors:

Energy Efficient Motors , Factors Affecting Efficiency, Loss Distribution , Constructional Details , Characteristics - Variable Speed , Variable Duty Cycle Systems, RMS Hp- Voltage Variation-Voltage Unbalance- Over Motoring- Motor Energy Audit.

UNIT III

Power Factor Improvement:

Power Factor – Methods of Improvement, Location of Capacitors, Power Factor with Non Linear Loads, Effect of Harmonics on Power Factor and Power Factor Motor Controllers.

UNIT IV

Lighting and Energy Instruments:

Good Lighting System Design and Practice, Lighting Control ,Lighting Energy Audit – Energy Instruments- Watt Meter, Data Loggers, Thermocouples, Pyrometers, Lux Meters, Tongue Testers ,Application of PLCs

UNIT V

Energy Economic Analysis & Demand Side Management:
The Time Value of Money Concept, Developing Cash Flow Models, Payback Analysis, Depreciation, Taxes and Tax Credit – Numerical Problems. Introduction to DSM, Concept of DSM, Benefits of DSM, Different Techniques of DSM – Time of Day Pricing, Multi-Utility Power Exchange Model, Time of Day Models for Planning. Load Management, Load Priority Technique, Peak Clipping, Peak Shifting, Valley Filling, Strategic Conservation, Energy Efficient Equipment. Management and Organization of Energy Conservation Awareness Programs.

Text Books

1. Arry C. White, Philip S. Schmidt, David R. Brown," Industrial Energy Management Systems", Hemisphere Publishing Corporation, New York, 1994.
2. A S. Pabla, "Electrical Power distribution", 5th edition, Tata McGraw Hill Education, 2004
3. Jyothi Prakash,"Demand Side Management", Tata McGraw Hill Education, 2004.

Reference Books

1. W.R. Murphy & G. McKay Butter worth, "Energy management", Heinemann publications, 2007.
2. Paul o" Callaghan, Energy management, 1st edition, Mc-graw Hill Book Company, 1998
3. John .C. Andreas,"Energy efficient electric motors" 2nd edition, Marcel Dekker Inc Ltd, 1995.
4. W.C.Turner, John wiley and sons "Energy management hand book", 1986.
5. Energy management and good lighting practice: fuel efficiency- booklet12-EEO, 1993.
6. D.P.Sen, K.R.Padiyar, "Recent Advances in Control and Management of Energy Systems", Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
7. Ashok V. Desai, "Energy Demand – Analysis, Management and Conservation", Wiley Eastern, 2005.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	-	-	-	-	M	-	-	M	-	-	M	H	-
CO2	M	H	M	-	-	-	M	-	-	M	-	-	H	H	-
CO3	M	H	H	-	-	-	M	-	-	M	-	-	H	M	-
CO4	H	H	M	-	-	-	M	-	-	M	-	-	H	M	-
CO5	M	H	H	-	-	-	M	-	-	M	-	-	M	-	-

OPEN ELECTIVE-II

19EET33: ARTIFICIAL NEURAL NETWORKS

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To know the concept of different neural networks of various architectures both feed forward and feed Backward and understand various learning rules.
2. To study the biological neural network and to model equivalent neuron models.
3. To obtain the knowledge of their importance and applications in various fields.
4. To learn Limitations of Back Propagation
5. To acquire knowledge about Dynamical Systems, Stability of Equilibrium States and Hopfield Models

Course Outcomes

By completing this course the student will be able to:

CO1. Design different neural networks of various architectures both feed forward and feed Backward and understand various learning rules.
CO2. Implement Single Layer and Multilayer Perceptron algorithms.
CO3. Perform the testing of neural networks and analysis of these networks For various pattern recognition applications.
CO4. Model the Self-Organization Maps using SOM algorithms.
CO5. Explain the Neuro Dynamical Models.

UNIT I

Introduction:

A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process:

Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

UNIT II

Single Layer Perceptron:

Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron – Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment

Multilayer Perceptron:

Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection

UNIT III

Back Propagation:

Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT IV

Self-Organization Maps (SOM):

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification

UNIT V

Neuro Dynamics:

Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm, Hopfield Models

Text Books

1. Simon Haykin," Neural Networks a Comprehensive Foundation", 2nd Edition, Pearson, 1997.
2. Jacek M. Zurada, "Introduction to Artificial Neural Systems", JAICO Publishing House Ed. 2006.

Reference Books

1. B. Yegnanarayana,"Artificial Neural Networks" Prentice Hall of India P Ltd, 2005.
2. Li Min Fu,"Neural Networks in Computer Inteligance", TMH, 2003.
3. James A Freeman David M S Kapura," Neural Networks", Pearson Education, 2004.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	H	M	-	-	-	-	-	M	-	-	L	H	-
CO2	M	M	H	M	-	-	-	-	-	M	-	-	H	-	-
CO3	L	H	H	M	L	-	-	-	L	M	-	-	-	H	-
CO4	L	M	H	M	L	L	-	-	-	M	-	-	-	M	-
CO5	H	L	L	-	-	-	-	-	-	M	-	-	-	M	-

19EET34: ENERGY STORAGE SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objective

1. To know the concept of energy storage.
2. To study the working of energy storage and various devices used for the purpose.
3. To obtain the knowledge of their importance and applications in various fields.
4. To learn real time applications.
5. To acquire knowledge on Features of Energy Storage Systems**.**

Course Outcomes

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

CO1. Understand the basic concepts of energy storage.
CO2. Illustrate various types of energy storage and various devices used for the purpose
CO3. Identify various real time applications.
CO4. Analyze the characteristics of energy from various sources and need for storage
CO5. Describe the Features of Energy Storage Systems.

UNIT I

Electrical Energy Storage Technologies:

Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

UNIT II

Needs for Electrical Energy Storage:

Emerging needs for EES, More renewable energy, less fossil fuel, Smart Grid uses, the roles of electrical energy storage technologies, the roles from the viewpoint of a utility, the roles from the viewpoint of consumers, the roles from the viewpoint of generators of renewable energy.

UNIT III

Features of Energy Storage Systems:

Classification of EES systems , Mechanical storage systems, Pumped hydro storage (PHS), Compressed air energy storage (CAES), Flywheel energy storage (FES),Electrochemical storage systems, Secondary batteries, Flow batteries, Chemical energy storage, Hydrogen (H2),Synthetic natural gas (SNG).

UNIT IV

Types of Electrical Energy Storage Systems:

Electrical storage systems, Double-layer capacitors (DLC), Superconducting magnetic energy storage (SMES), Thermal storage systems, Standards for EES, Technical comparison of EES technologies.

UNIT V

Applications:

Present status of applications, Utility use (conventional power generation, grid operation & service) , Consumer use (uninterruptable power supply for large consumers), New trends in applications ,Renewable energy generation, Smart Grid, Smart Micro grid, Smart House, Electric vehicles, Management and control hierarchy of storage systems, Internal configuration of battery storage systems, External connection of EES systems ,Aggregating EES systems and distributed generation, Battery SCADA–aggregation of many dispersed batteries.

Text Books

1. "James M. Eyer, Joseph J. Iannucci and Garth P. Corey ", "Energy Storage Benefits and Market Analysis", Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.
3. Edward T. Glasby,"Storage & Reliability of Electricity (Energy Science, Engineering and Technology)", Nova Science Publications, 2011.

Reference Book

1. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010
2. Adam Stienecker,"Hybrid Energy Storage Systems" VDM Verlag, 2009.
3. J K Kaldellis,"Stand-Alone and Hybrid Wind Energy Systems: Technology, Energy Storage and Applications", Woodhead Publishing Series in Energy, 2010.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	-	-	M	M	-	-	M	-	-	H	L	-
CO2	H	L	M	-	-	-	-	-	-	M	-	-	H	-	-
CO3	L	H	M	M	L	-	-	-	-	M	-	-	-	H	-
CO4	L	H	M	M	L	L	-	-	-	M	-	-	H	-	-
CO5	H	-	-	-	M	L	-	-	-	M	-	-	M	-	-

OPEN ELECTIVE-III

19EET35-CONVENTIONAL AND NON CONVENTIONAL SOURCES

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives
1. This course is a beginners fundamental of Power system course.
2. To Learn about conventional and non conventional sources of Electrical Energy.
3. To Impart knowledge on Conventional sources of Electrical energy.
4. To Study about different components in Thermal, Hydel and Nuclear plants.

Course Outcomes
After completion of the course the student will be able to
CO1. Understand the Layout of various generating power stations.
CO2. Design Electrical layout of various generating stations.
CO3. Ability to discuss about various power sources for generation of power merit/Demerit.
CO4. Describe about various methods of production and to classify the electrical energy from economic point of view.
CO5. Discuss the energy resources and energy conversion methods available for the production of electric power in India

UNIT I

Introduction to Energy Sources:
Energy sources and their availability, Non-renewable reserves and resources; renewable resources, Transformation of Energy, Energy scenario in India

UNIT II

Thermal Power Generating Systems:
Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers

UNIT III

Hydro & Nuclear Power Generating Systems:
Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT IV

Solar Energy:
Basic characteristics of sunlight – solar energy resource- Solar collectors, Types and performance characteristics. Photovoltaic cell-characteristics - equivalent circuit- Photovoltaic effect – photo voltaic for battery charging-applications.

UNIT V

Wind Energy:

Wind Distribution – principles of wind energy conversion –basic components of wind energy conversion- advantages and disadvantages- Principles of Operation of wind turbines, types of wind turbines and characteristics, Generators for Wind Turbines, Control strategies.

Text Books

1. G.D. Rai,"Non Conventional Energy Sources", Khanna Publishers, 2004.
2. M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, "A Text Book on Power System Engineering", Dhanpat Rai & Co. Pvt. Ltd., 2016.
3. C.L Wadhwa, "Generation Distribution and Utilization of Electrical energy", New Age International (P) Ltd.,4th edition, 2017.

Reference Books

1. S.N.Singh., "Electrical Power Generation, Transmission and Distribution", PHI, 2008.
2. V.K Mehta and Rohit Mehta, "Principles of Power Systems", S.Chand& Company Ltd., New Delhi, 2005.
3. John Twidell and Tony Weir,"Renewable Energy Resources", 3rdEdition, Routedge 2015.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	-	-	-	-	-	-	-	M	-	-	H	M	-
CO2	M	M	H	-	-	-	M	-	-	M	-	-	M	H	-
CO3	H	-	-	M	-	-	-	-	-	M	M	-	-	H	-
CO4	M	M	-	-	-	-	-	-	-	M	H	-	-	M	H
CO5	H	-	-	-	-	M	M	-	-	M	-	-	M	-	H

19EET36: DESIGN ESTIMATION AND COSTING OF ELECTRICAL SYSTEMS

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To emphasize the estimation and costing aspects of all electrical equipment, Installation and designs on the cost viability.
2. To obtain knowledge installation for buildings and small industries.
3. To design and estimation of wiring.
3. To acquire knowledge on overhead and underground distribution lines,
4. To learn about types of substations and Illumination.

Course Outcomes

After Completion of this course, student will be able to

CO1. Understand the design considerations of electrical installations.
CO2. Design electrical installation for buildings and small industries.
CO3. Identify and design the various types of light sources for different applications.
CO4. Analyzing transmission and distribution problems.
CO5. Describe about types of substation.

UNIT I

Design Considerations of Electrical Installations:

Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of electrical installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections , Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution board, Guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electric installations.

UNIT II

Electrical Installation for Different Types of Buildings and Small Industries:

Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.

UNIT III

Overhead and Underground Transmission and Distribution Lines:

Introduction, Supports for transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables.

UNIT IV

Substations:

Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substations – Floor mounted type.

UNIT V

Design of Illumination Schemes:

Introduction, Terminology in illumination, laws of illumination, various types of light sources, Practical lighting schemes LED, and CFL and OCFL differences.

Text Books

1. "K. B. Raina, S. K. Bhattacharya", "Electrical Design Estimating and Costing", 2nd Edition, NewAge International Publisher, 2010.
2. C.L.Wadhwa,"Electrical Power Systems",7 th editions, New age International, 2016.

Reference Books

1. "Er. V. K. Jain, Er. Amitabh Bajaj", "Design of Electrical Installations", University Science Press.
2. "K. B. Raina, S. K. Bhattacharya, T.Joneja", "Electrical Engineering Materials & Electrical Components ", Katson Publication, 2013.
3. "Gupta J. B., Katson, Ludhiana", "Electrical Installation, estimating and costing", S.K. Kataria and sons 2013.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	-	M	-	-	-	-	-	-	M	M	L	H	L	-
CO2	L	M	H	M	-	M	M	L	-	M	M	-	-	H	-
CO3	M	H	H	L	L	L	M	-	-	M	-	-	-	M	-
CO4	M	H	-	M	-	L	L	-	L	M	-	L	H	-	-
CO5	H	-	M	-	-	-	-	-	-	M	-	-	H	-	-