NARSIMHA REDDY ENGINEERING COLLEGE
UGC AUTONOMOUS ACCREDITED BY NBA & NAAC WITH A-GRADE

(Approved by AICTE | NAAC Accreditation with "A" Grade | Accredited by NBA | Affiliated to JNTUH)
Maisammuguda, Secunderabad - 500 100, Telangana.

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

B. TECH PROGRAMS (FOUR YEARS)

Department of Electrical and Electronics Engineering

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABUS
NR21

B.Tech Regular Four Year Degree Program
(for the batches admitted from the academic year 2021 - 2022)
&

B.Tech (Lateral Entry Scheme)
(for the batches admitted from the academic year 2022 - 2023)

These rules and regulations may be altered/changed from time to time by the academic council
FAILURE TO READ AND UNDERSTAND THE RULES IS NOT AN EXCUSE

NARSIMHA REDDY ENGINEERING COLLEGE (NRCM)

VISION

To emerge as a destination for higher education by transforming learners into achievers by creating,encouraging and thus building a supportive academic environment

MISSION

To impart Quality Technical Education and to undertake Research and Development with a focus onapplication and innovation which offers an appropriate solution to the emerging societal needs by making the students globally competitive, morally valuable and socially responsible citizens.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be recognized as a centre of excellence to produce competent and ethical electrical engineers who can set a benchmark in finding solutions to benefit the society globally through innovative research, and application of knowledge.

MISSION

To realize the department's vision, various academic and extra-curricular activities will be organized.The goal of these activities will be:

Mission 1: To provide outstanding technical education combined with rigorous academic learning and to nurture students; innovative skills in the field of Electrical and Electronics Engineering.

Mission 2: To enhance the research among students and faculty, as well as develop a technologically inclusive, cost-effective real-time product for societal upliftment.

.

Mission 3: To involve, monitor, and collaborate with top industrial, intellectual, and educational systems in order to structure technological and human resource development systems.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO-I : **Preparation**

To prepare students to excel in higher education in the profession of electrical engineering and interlinked streams.

PEO-II : **Core competence**

To provide the students a strong foundation in Engineering basics, scientific and technical fundamentals, which is essential to solve Engineering problems in Research/ Industry/Higher education/ Entrepreneurship through rigorous learning.

PEO-III : **Professionalism & Lifelong learning**

To provide and achieve a well-balanced education that includes professional with leadership qualities, effective communication skills, an appreciation for social commitments, ethical attitude to learn and adopt new technologies as it evolves and be Lifelong learners.

PROGRAM OUTCOMES(POS)

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

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

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

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

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

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent Responsibilities relevant to the professional engineering practice.

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

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

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's)

PSO1: Engineering Knowledge and Analysis

Apply principles of engineering, science, mathematics and mathematics through differential and integral calculus, complex variables to solve electrical engineering problems.

PSO2: System Design

Ability to utilize logical and technical skills to model, analyze, design, and realize physical systems, simulate, measuring, control and experimenting the components or processes by using software/hardware tools related to Electrical and Electronics Engineering problems and other allied themes.

PSO3: Application of the knowledge on society/environment

Apply the contextual knowledge of Electrical and Electronics Engineering with self-learning to assess societal, environmental, develop the leadership, economics importance with professional ethics in multidisciplinary environments.

ACCREDITED BY NBA & NAAC WITH A-GRADE
NARSIMHA REDDY ENGINEERING COLLEGE
PERMANENTLY AFFILIATED TO JNTUH, HYDERABAD - APPROVED BY AICTE, NEW DELHI
AN ISO 9001 : 2008 CERTIFIED INSTITUTE

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE & SYLLABUS (NR21)

Applicable For 2021-22 Admitted Batch

I YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	MA1101BS	Linear Algebra & Calculus	3	1	0	4
2.	AP1102BS	Applied Physics	3	1	0	4
3.	CS1103ES	Programming for Problem Solving	3	1	0	4
4.	EN1104HS	English	2	0	0	2
5.	AP1105BS	Applied Physics Lab	0	0	3	1.5
6.	CS1106ES	Programming for Problem Solving Lab	0	0	3	1.5
7.	EN1107HS	English Language and Communication Skills Lab	0	0	2	1
8.	MC1001ES*	Environmental Science	3	0	0	0
9.		Induction Programme				
	Total Credits		14	3	8	18

I YEAR II SEMISTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	MA1201BS	Advanced Calculus	3	1	0	4
2.	CH1202BS	Chemistry	3	1	0	4
3.	ME1203ES	Engineering Graphics	1	0	4	3
4.	EE1204ES	Basic Electrical Engineering	3	0	0	3
5.	CH1205BS	Chemistry Lab	0	0	3	1.5
6.	ME1206ES	Engineering Workshop	1	0	3	2.5
7.	EE1207ES	Basic Electrical Engineering Lab	0	0	2	1
	Total Credits		**11**	**2**	**12**	**19**

II YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	EE2101PC	Electromagnetic Fields	3	0	0	3
2.	EE2102PC	Electrical Machines-I	3	1	0	4
3.	EE2103PC	Network Theory	3	1	0	4
4.	EE2104PC	Analog Electronics	3	0	0	3
5.	CS2105ES	Object Oriented Programming using C++	3	0	0	3
6.	EE2106PC	Electrical Machines Lab- I	0	0	3	1.5
7.	EE2107PC	Network Lab	0	0	3	1.5
8.	CS2108ES	C++ Programming Lab	0	0	2	1
9.	MC2001*	Constitution of India	3	0	0	0
	Total Credits		**18**	**2**	**8**	**21**

II YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	EE2201PC	Power System - I	3	0	0	3
2.	MA2202BS	Numerical Methods & Complex Variables	3	1	0	4
3.	EE2203PC	Electrical Machines – II	3	1	0	4
4.	EE2204PC	Control Systems	3	0	0	3
5.	EE2205PC	Digital Electronics	3	0	0	3
6.	EE2206PC	Electrical Machines Lab - II	0	0	2	1
7.	EE2207PC	Control Systems Lab	0	0	2	1
8.	EE2208PC	Basic Electrical simulation Lab	0	0	2	1
9.	EE2209PC	Electronic Circuits Lab	0	0	2	1
10.	MC2002*	Gender Sensitization Lab	0	0	2	0
	Total Credits		**15**	**2**	**10**	**21**

III YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	EE3101PC	Electrical Measurements & Instrumentation	3	1	0	4
2.	EE3102PC	Power System – II	3	1	0	4
3.	EE3103PC	Microprocessors and Microcontrollers	3	1	0	4
4.	SM3104MS	Business Economics and Financial Analysis	3	0	0	3
5.	EE3105PE/ EE3106PE/ EE3107PE	Professional Elective – I	3	0	0	3
6.	EE3108PC	Electrical Measurements & Instrumentation lab	0	0	3	1.5
7.	EE3109PC	Advanced Electrical Simulation Lab	0	0	3	1.5
8.	EE3110PC	Microprocessors and Microcontrollers Lab	0	0	2	1
9.	MC3002*	Artificial Intelligence	3	0	0	0
	Total Credits		**18**	**3**	**8**	**22**

III YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	SM3201MS	Fundamentals of Management for Engineers	3	0	0	3
2.	EE3202PC	Power Electronics	3	1	0	4
3.	EE3203PC	Switch Gear and Protection	3	1	0	4
4.	EE3204PE / 3205PE/ 3206PE	Professional Elective - II	3	0	0	3
5.		Open Elective – I	3	0	0	3
6.	EE3207PC	Power Systems Lab	1	0	3	2.5
7.	EE3208PC	Power Electronics Lab	0	0	3	1.5
8.	EN3209HS	Advanced Communication Skills Lab	0	0	2	1
9.	MC3001*	Cyber Security	3	0	0	0
	Total Credits		**19**	**2**	**8**	**22**

IV YEAR I SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	EE4101PC	Power Semiconductor Drives	3	0	0	3
2.		Open Elective – II	3	0	0	3
3.	EE4102PE /4103PE / 4104PE	Professional Elective – III	3	0	0	3
4.	EE4105PE / 4106PE / 4107PE	Professional Elective – IV	3	0	0	3
5.	EE4108PR	Industrial Oriented Mini-Project/Summer Internship	0	0	0	2**
6.	EE4109PC	Electrical and Electronics Design Lab	1	0	4	3
7.	EE4110PR	Seminar	0	0	2	1
8.	EE4111PR	Major Project Stage-I	0	0	6	3
9.	MC4001*	Intellectual Property Rights	3	0	0	0
	Total Credits		**16**	**0**	**12**	**21**

IV YEAR II SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1.	EE4201PE/ 4202PE/ 4203PE/ 4204 PE	Professional Elective– V	3	0	0	3
2.	EE4205PE/ 4 206PE/ 4207PE/ 4208PE	Professional Elective– VI	3	0	0	3
3.		Open Elective – III	3	0	0	3
4.	EE4209PR	Major Project-II	0	0	14	7
	Total Credits		**9**	**0**	**14**	**16**

*MC – Mandatory Non Credit Course

****Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

PROFESSIONAL ELECTIVES LIST

Professional Electives	Subject Code	Subject Name	Total Credit
Professional Elective I	EE3105PE	Electrical Installation and Estimation	3
	EE3106PE	Electrical Machine Design	3
	EE3107PE	High Voltage Engineering	3
Professional Elective II	EE3204PE	Signals and Systems	3
	EE3205PE	Optimization Technique	3
	EE3206PE	Electrical and Electronics Instrumentation	3
Professional Elective III	EE4102PE	Digital Signal Processing	3
	EE4103PE	Power System Operation and Control	3
	EE4104PE	Advanced Power Electronics	3
Professional Elective IV	EE4105PE	HVDC Transmission	3
	EE4106PE	Electrical and Hybrid Vehicles	3
	EE4107PE	Utilization of Electrical Engineering	3
Professional Elective V	EE4201PE	EHVAC	3
	EE4202PE	Control system design	3
	EE4203PE	Power Quality and FACTS	3
	EE4204PE	AI Techniques in Electrical Engineering	3
Professional Elective VI	EE4205PE	Electrical Distributed System	3
	EE4206PE	Smart Grid Technology	3
	EE4207PE	Power System Reliability	3
	EE4208PE	PLC and SCADA	3

OPEN ELECTIVES LIST

COMPUTER SCIENCE ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	CS3211OE	Introduction to Data Science
	CS3212OE	Data mining
	CS3213OE	Computer Forensics
Open Elective II	CS4121OE	Python Programming
	CS4122OE	R Programming
	CS4123OE	JAVA Programming
Open Elective III	CS4231OE	Machine Learning
	CS4232OE	Cloud Computing
	CS4233OE	Natural Language Processing

ELECTRONICS AND COMMUNICATION ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	EC3211OE	Fundamentals of Internet of Things
Open Elective II	EC4121OE	Principles of Computer Communications and Networks
Open Elective III	EC4231OE	Electronic Measuring Instruments

ELECTRICAL AND ELECTRONICS ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	EE3211OE	Electrical Installation and costing
	EE3212OE	Electrical Engineering Material
Open Elective II	EE4121OE	Renewable Energy sources
	EE4122OE	Reliability Engineering
Open Elective III	EE4231OE	Instrumentation and Control
	EE4232OE	Energy Storage Systems

CIVIL ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	CE3211OE	Basics of Civil Engineering
	CE3212OE	Building Materials and Construction
Open Elective II	CE4121OE	Environmental Impact Assessment
	CE4122OE	Industrial Waste Water Treatment
Open Elective III	CE4231OE	Remote Sensing and GIS
	CE4232OE	Disaster Management

MECHANICAL ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	ME3211OE	Operation Research
	ME3212OE	Fundamentals of Mechanical Engineering
	ME3213OE	Metallurgy of Non-Metallurgists
Open Elective II	ME4121OE	Fabrication Processes
	ME4122OE	Total Quality Management
	ME4123OE	Energy Management and Conservation
Open Elective III	ME4231OE	Reliability Engineering
	ME4232OE	Industrial Management
	ME4233OE	Renewable Energy Sources

B.Tech.

I Year I Sem.

MA1101BS: Linear Algebra & Calculus

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives: To learn

- Types of matrices and their properties.
- Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
- Concept of Fourier Series.
- Concept of nature of the series.
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Evaluation of surface areas and volumes of revolutions of curves.
- Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative
- Finding maxima and minima of function of two and three variables.

Course Outcomes: After learning the contents of this paper the student must be able to

- Write the matrix representation of a set of linear equations and to analyse the solution of the system of equations
- Find the Eigen values and Eigen vectors
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Analyse the nature of sequence and series.
- Solve the applications on the mean value theorems.
- Evaluate the improper integrals using Beta and Gamma functions
- Find the extreme values of functions of two variables with/ without constraints.

UNIT-1: Matrices

Matrices: Introduction. Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations. Gauss elimination method; Gauss Seidel Iteration method, LU Decomposition Method.

UNIT-2: Eigen values and Eigen vectors

Vectors Linear Transformation and Orthogonal Transformation: Eigen values and Eigen vectors and their properties. Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding the inverse an d power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of Quadratic forms; Reduction of Quadratic form to Canonical form by Orthogonal Transformation.

UNIT-3: Fourier series

Definition of periodic function, Fourier expansion of periodic function in $(0,2\pi)\text{and}(-\pi,\pi)$. Determination of Fourier coefficients – Fourier series of even and odd functions – Half – Range Fourier Sine and Cosine expansions.

UNIT-IV: Calculus

Mean value theorems : Rolle's theorem , Lagrange's Mean value theorem with their Geometrical Interpretation and applications , Cauchy's Mean value theorem. Definition of Improper Integral : Beta and Gamma functions and their applications.

UNIT-V: Multivariable calculus (Partial Differentiation and applications)

Definitions of limit and continuity. Partial Differentiation; Euler's Theorem; Total derivative; Jacobian; Functional dependence & independence , Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010

AP1102BS: Applied Physics

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- Students will demonstrate skills in scientific inquiry, problem solving and laboratory techniques.
- Students will be able to demonstrate competency and understanding of the concepts found in Quantum Mechanics, Fiber optics and lasers, Semiconductor physics and Electromagnetic theory and a broad base of knowledge in physics.
- The graduates will be able to solve non-traditional problems that potentially draw on knowledge in multiple areas of physics.
- To study applications in engineering like memory devices, transformer core and superconductors.

Course Outcomes: Upon graduation

- The student would be able to learn the fundamental concepts on Quantum behaviour of matter in its micro state.
- The knowledge of fundamentals of Semiconductor physics, Optoelectronics, Lasers and fibre optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.
- Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.
- The course also helps the students to be exposed to the phenomena of superconductivity and also to have exposure on magnetic materials and dielectric materials**.**

UNIT-I

Principles of Quantum Mechanics: Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, G-P Thomson experiment, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

UNIT-II

Semiconductor Physics: Origin of Energy Band Formation in Solids, Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier transport: diffusion and drift, Hall effect, Formation of PN junction, Open circuit PN junction, Energy diagram of PN diode, I-V Characteristics of PN junction diode, Zener diode –breakdown mechanism and characteristics

UNIT-III

Physics of Semiconductor Devices:, Generation & recombination mechanisms in semiconductors, LED and semiconductor lasers: Device structure, Materials, Characteristics and figures of merit, Photo diode(PIN diode) & Solar cell - their structure, Materials, working principle and Characteristics.

UNIT-IV

Lasers: Introduction to interaction of radiation with matter, Coherence, Principle and working of Laser, Population inversion, Pumping, Types of Lasers: Ruby laser, He-Ne laser, Applications of laser-Scientific & Medical applications.

Fibre Optics: Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Absorption & Bending Losses associated with optical fibres, Applications of optical fibres-

Sensor & Medical Field.

UNIT-V

Dielectric Properties: Polarisation, Permittivity and Dielectric constant, Types of Polarisation, Internal fields in a solid, Clausius-Mossotti equation, Ferroelectrics and Piezoelectrics.

Magnetic Properties: Magnetisation, permeability and susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, Hard & Soft Magnetic materials, Applications of magnetic materials.

TEXT BOOKS:

1. Engineering Physics, B.K. Pandey, S. Chaturvedi - Cengage Learing.
2. Halliday and Resnick, Physics - Wiley.
3. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand.

REFERENCES:

1. Richard Robinett, Quantum Mechanics
2. J. Singh, Semiconductor Optoelectronics: Physics and Technology, Mc Graw-Hill inc. (1995).
3. Online Course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Guptha on NPTEL

CS1103ES: Programming For Problem Solving

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of C programming language.
- To learn the usage of structured programming approach in solving problems.

Course Outcomes: The student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.
- Searching and sorting problems.

UNIT - I: Introduction to Programming

Introduction to components of a computer system: disks, primary and secondary memory, processor,operating system, compilers, creating, compiling and executing a program etc., Number systems Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming Introduction to C Programming Language: variables (with data types and space requirements), Syntaxand Logical Errors in compilation, object and executable code , Operators, expressions andprecedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion,The main method and command line arguments

Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branchingwith if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr.Command line arguments

UNIT - II: Arrays, Strings, Structures and Pointers:

Arrays: one- and two-dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions availablein C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures

Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self- referential structures, usage of self-referential structures in linked list (no implementation) Enumeration data type

UNIT - III: Preprocessor and File handling in C:

Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data toexisting files, Writing and reading structures using binary files, Random access using fseek, ftell andrewind functions.

UNIT - IV: Function and Dynamic Memory Allocation:

Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions,passing pointers to functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursivefunctions

Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of differentdata types

UNIT - V: Introduction to Algorithms:

Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a givenset, finding if a number is prime number, etc.

Basic searching in an array of elements (linear and binary search techniques),

Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms),

Basic concept of order of complexity through the example programs

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rdEdition)

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice
2. Hall of India
3. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
4. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
5. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

EN1104HS: English

B.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

INTRODUCTION In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic, communicative and critical thinking competencies of Engineering students. In English classes, the focus should be on the skills development in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts leading to reading comprehension and different passages may be given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material etc. The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures.

Learning Objectives: The course will help to a. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills. b. Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus. c. Develop study skills and communication skills in formal and informal situations.

Course Outcomes: Students should be able to

1. Use English Language effectively in spoken and written forms.
2. Comprehend the given texts and respond appropriately.
3. Communicate confidently in various contexts and different cultures.
4. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

UNIT –I 'The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press. Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Basic Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

UNIT –II 'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Synonyms and Antonyms.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-
Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.

UNIT –III 'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying**- Providing Examples or Evidence

UNIT –IV ' KING LEAR ' a tragedy story by William Shakespeare, play synopsis of Act 1 & 2 published by Bloom, Harold. "King Lear." Shakespeare : The Invention of the Human. New York: Riverhead, 1998.
Vocabulary: Standard Abbreviations in English Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Practices--Writing Introduction and Conclusion - Essay Writing-Précis Writing.

UNIT –V 'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Technical Vocabulary and their usage
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports
Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Textbook:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.
2. Nahum Tate's 1681 Adaption of King Lear

References:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

AP1105BS: Applied Physics Lab

B.Tech. I Year I Sem.

L	T	P	C
0	0	3	1.5

List of Experiments:

1. Energy gap of P-N junction diode: To determine the energy gap of a semiconductor diode.
2. Solar Cell: To study the V-I Characteristics of solar cell.
3. Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
4. Stewart – Gee's experiment: Determination of magnetic field along the axis of a current carrying coil.
5. Hall effect:To determine Hall co-efficient of a given semiconductor.
6. Photoelectric effect: To determine work function of a given material.
7. LASER: To study the characteristics of LASER sources.
8. Optical fibre: To determine the bending losses of Optical fibres.
9. LCR Circuit: To determine the Quality factor of LCR Circuit.
10. R-C Circuit: To determine the time constant of R-C circuit.

Note: Any 8 experiments are to be performed

CS1106ES: Programming For Problem Solving Lab

B.Tech. I Year I Sem.

L	T	P	C
0	0	3	1.5

[Note:The programs may be executed using any available Open Source/ Freely available IDESome of the Tools available are:
CodeLite: https://codelite.org/ Code::Blocks: http://www.codeblocks.org/
DevCpp : http://www.bloodshed.net/devcpp.htmlEclipse: http://www.eclipse.org
This list is not exhaustive and is NOT in any order of preference]

Course Objectives: The students will learn the following:

- To work with an IDE to create, edit, compile, run and debug programs.
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in Clike operators, control statements etc.
- To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
- To write programs using the Dynamic Memory Allocation concept.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

- Formulate the algorithms for simple problems
- Translate given algorithms to a working and correct program
- Correct syntax errors as reported by the compilers
- Identify and correct logical errors encountered during execution
- Represent and manipulate data with arrays, strings and structures
- Use pointers of different types
- Create, read and write to and from simple text and binary files
- Modularize the code with functions so that they can be reused

Practice sessions:

a. Write a simple program that prints the results of all the operators available in C (including pre/ post increment, bitwise and/or/not, etc.). Read required operand values from standard input.
b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values form standard input.

Simple numeric problems:

a. Write a program for fiend the max and min from the three numbers.
b. Write the program for the simple, compound interest.
c. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be: 5 x 1 = 5 5 x 2 = 10 5 x 3 = 15
e. Write a program that shows the binary equivalent of a given positive number between0 to 255.

Expression Evaluation:

a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula s = ut+(1/2)at^2 where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec^2 (= 9.8 m/s^2)).
b. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
c. Write a program that finds if a given number is a prime number
d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
e. A Fibonacci sequence is defined as follows: the first and second terms in the sequenceare 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
g. Write a C program to find the roots of a Quadratic equation.
h. Write a C program to calculate the following, where x is a fractional value.i. 1-x/2 +x^2/4-x^3/6
i. Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: 1+x+x^2+x^3++x^n. For example: if n is 3 and x is 5, then the program computes 1+5+25+125.

Arrays and Pointers and Functions:

a. Write a C program to find the minimum, maximum and average in an array of integers.
b. Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.
c. Write a C program that uses functions to perform the following:
d. i. Addition of Two Matrices
ii. Multiplication of Two Matrices
iii. Transpose of a matrix with memory dynamically allocated for the new matrix asrow and column counts may not be same.
e. Write C programs that use both recursive and non-recursive functions
f. i. To find the factorial of a given integer.
ii. To find the GCD (greatest common divisor) of two given integers.
iii. To find x^n
g. Write a program for reading elements using pointer into array and display the values using array.
h. Write a program for display values reverse order from array using pointer.
i. Write a program through pointer variable to sum of n elements from array.

Files:

a. Write a C program to display the contents of a file to standard output device.
b. Write a C program which copies one file to another, replacing all lowercase characterswith their uppercase equivalents.
c. Write a C program to count the number of times a character occurs in a text file.

Thefile name and the character are supplied as command line arguments.

d. Write a C program that does the following:
   It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using atoi function)
   Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function)
   The program should then read all 10 values and print them back.
e. Write a C program to merge two files into a third file (i.e., the contents of the firs t file followed by those of the second are put in the third file).

Strings:

a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
c. Write a C program that uses functions to perform the following operations:
d. 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.
e. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
f. Write a C program that displays the position of a character ch in the string S or – 1 if Sdoesn‘t contain ch.
g. Write a C program to count the lines, words and characters in a given text.

Miscellaneous:

a. Write a menu driven C program that allows a user to enter n numbers and then choosebetween finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Displayan error message if an invalid choice is entered.

b. Write a C program to construct a pyramid of numbers as follows:

```
1          *          1          1          *
1 2        * *        2 3        2 2        * *
1 2 3      * * *      4 5 6      3 3 3      * * *
                                 4 4 4 4    * *
                                            *
```

Sorting and Searching:

a. Write a C program that uses non recursive function to search for a Key value in a given List of integers using linear search method.
b. Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers using binary search method.
c. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
d. Write a C program that sorts the given array of integers using selection sort in descending order
e. Write a C program that sorts the given array of integers using insertion sort in ascending order

f. Write a C program that sorts a given array of names

Suggested Reference Books for solving the problems:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice
4. Hall of India
5. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
6. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
7. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition

EN1107HS: English Language and Communication Skills Lab

B.Tech. I Year I Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking and interviews

Learning Outcomes: Students will be able to attain

- Better understanding of nuances of English language through audio- visual experience and group activities
- Neutralization of accent for intelligibility
- Speaking skills with clarity and confidence which in turn enhances their employability skills

Syllabus

English Language and Communication Skills Lab (ELCS) shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab

b. Interactive Communication Skills (ICS) Lab

Listening Skills

Objectives

1. To enable students develop their listening skills so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills

Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
   - Oral practice: Just A Minute (JAM) Sessions
   - Describing objects/situations/people
   - Role play – Individual/Group activities

The following course content is prescribed for the English Language and Communication Skills Lab based on Unit-6 of AICTE Model Curriculum 2018 for B.Tech First English. As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the Lab)

Exercise – I
CALL Lab: *Understand:* Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening. *Practice*: Introduction to Phonetics – Speech Sounds – Vowels and Consonants.
ICS Lab: *Understand:* Communication at Work Place- Spoken vs. Written language. *Practice:* Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise – II
CALL Lab: *Understand:* Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context. *Practice:* Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.
ICS Lab: *Understand:* Features of Good Conversation – Non-verbal Communication. *Practice:* Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

Exercise - III
CALL Lab: *Understand:* Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).
Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.
ICS Lab: *Understand:* How to make Formal Presentations. *Practice:* Formal Presentations.

Exercise – IV
CALL Lab: *Understand:* Listening for General Details. *Practice:* Listening Comprehension Tests.
ICS Lab: *Understand:* Public Speaking – Exposure to Structured Talks. *Practice:* Making a Short Speech – Extempore.

Exercise – V
CALL Lab: *Understand:* Listening for Specific Details. *Practice:* Listening Comprehension Tests.
ICS Lab: *Understand:* Interview Skills*. Practice:* Mock Interviews.
****

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
   System Requirement (Hardware component): *Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:*
   i) Computers with Suitable Configuration
   ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**
   The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public-Address System, a LCD and a projector etc.

MC1001ES*: Environmental Science
(Mandatory Non Credit Course)

B.Tech. I Year I Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**0**

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnifications, ecosystem value, services and carrying capacity, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

B.Tech.

I Year II Sem.

MA1201BS: Advanced Calculus

B.Tech. I Year II Sem. **L T P C**

3 1 0 4

Course Objectives: To learn
- Methods of solving the differential equations of first and higher order.
- Evaluation of multiple integrals and their applications
- The physical quantities involved in engineering field related to vector valued functions
- The basic properties of vector valued functions and their applications to line, surface and volume integrals

Course Outcomes: After learning the contents of this paper the student must be able to
- Identify whether the given differential equation of first order is exact or not
- Solve higher differential equation and apply the concept of differential equation to real world problems
- Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelopiped
- Evaluate the line, surface and volume integrals and converting them from one to another

UNIT-I: First Order Ordinary Differential Equations
Exact, linear and Bernoulli's equations ; Applications : Newton's law of cooling , Law of natural growth and decay ; Equations not of first degree : equations solvable for p, Applications: LR circuit problems.

UNIT-II: Ordinary Differential Equations of Higher Order
Second order linear differential equations with constant coefficients : Non-Homogeneous terms of the type e^{ax},sin ax, cos ax, polynomials in x, e^{ax}V(x) and xV(x); method of variation of parameters, Applications: LCR circuit problems.

UNIT-III: Multivariable Calculus (Integration)
Evaluation of Double Integrals (Cartesian coordinates) ; change of order of Integration (only Cartesian form) ; Evaluation of triple Integrals : Change of variables (Cartesian to polar) for double and (Cartesian to Spherical And Cylindrical polar coordinates) for triple integrals.Applications: Areas (double integrals) and volumes (by double integrals and triple integrals).

UNIT-IV: Vector Differentiation
Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vectors Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration
Line, Surface and Volume Integrals. Theorems of Greens, Gauss and Stokes (without proofs) and their applications.

TEXT BOOKS:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984

CH1202BS: Chemistry

B.Tech. I Year II Sem.

L	T	P	C
3	1	0	4

Course objectives:

- To impart the basic knowledge of atomic, molecular and electronic modifications which makes the student to understand the technology based on them.
- To develop specialized knowledge in the analysis of water and waste water which are essential for the engineers and in industry.
- Learn about the fundamentals of electrode reactions and electrochemical cells
- To provide an understanding of the corrosion principles and engineering methods used to minimize and prevent corrosion.
- To familiarize students about the characteristics and applications of different polymers and engineering materials in everyday life.
- To acquire the skills pertaining to spectroscopy and to apply them for medical and other fields.

Course outcomes:

- The knowledge of atomic, molecular and electronic changes, band theory related to conductivity.
- Apply knowledge and understanding of water treatment process to real world problems.
- Interpret the knowledge of electrochemical phenomenon involved in developing batteries and understanding fuel cells fundamentals.
- Ability to determine appropriate method of protection against corrosion for a metal based on its applications in different fields.
- Classify and characterize different polymers engineering materials and apply its knowledge to select suitable materials for specific applications.
- The required skills to get clear concepts on basic spectroscopy and applications to medical and other fields.

UNIT - I:

Molecular structure and Theories of Bonding:

Atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO), molecular orbitals of diatomic orbitals, molecular orbital energy level diagrams for N_2, O_2 and F_2 molecules.

Crystal field theory (CFT): Salient features of CFT- Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and Square planar geometries. Band structure of solids and effect of doping on conductance.

UNIT-II

Water and its treatment: Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent -expression and units of hardness. Numerical problems. Disadvantages of hard water.

Boiler troubles: Scales and Sludges, caustic embrittlement, boiler corrosion, Softening of water by internal treatment of Boiler feed water and ion- exchange processes. Desalination of water – Reverse osmosis. Sewage water treatment. Potable water treatment - Disinfection of potable water by chlorination and Ozonization.

UNIT-III

Electrochemistry, Batteries and Corrosion:

Electrochemistry: Electrochemical cells- Electrode, electrode potential, standard electrode potential, types of electrodes- Calomel and glass electrodes. Nernst equation, electrochemical series and its applications.

Batteries: Cell and battery - Primary (Lithium cell) and secondary batteries (Lead – acid storage battery, Lithium ion battery, advantages and applications of solid state battery)
Fuel cells: Hydrogen-oxygen, solid polymer electrolytic fuel cell, Bio chemical fuel cells-Advantages and Applications.
Corrosion and its control –Concept of corrosion, Types of corrosion,
mechanism of Chemical & Electro chemical corrosion. Types of electro chemical corrosion (Galvanic corrosion, Pitting, Water line corrosion, stress corrosion). Factors affecting corrosion.
Corrosion control methods -Principle of cathodic protection- Sacrificial Anodic Protection (SAP), Impressed Current Cathodic Protection (ICCP) .
Protective coatings: Metallic coatings- Hot dipping, metal cladding, cementation, electroplating of copper, electro less plating of nickel**, paints.**

UNIT-IV
Engineering materials:
Ceramics: Properties & types of ceramics. Engineering applications of ceramics
Polymers: Defnition, classification, properties of polymers. Plastics-Compounding of plastics, Engineering applications of plastics (PVC, Teflon, Bakelite), Fibres - Applications of Nylon 6. FRP- Types, advantages and applications. Natural rubber and its vulcanization. Elastomers- Applications. Conducting polymers and its applications-Mechanism of conduction and doping in poly acetylene. Applications of bio degradable polymers.
Composites: Classification, Constituents, advantages, applications.
Lubricants: Classification, properties and mechanism of lubrication.

UNIT-V
Spectroscopic techniques and applications:
Principles of Spectroscopy, Selection rules and applications of electronic spectroscopy. Vibrational and rotational spectroscopy. Basic concepts of Nuclear Magnetic resonance spectroscopy, Chemical shift. Introduction to Magnetic Resonance Imaging.

Suggested Text Books:
1. Physical Chemistry, by P.W. Atkins
2. Engineering Chemistry by P.C.Jain & M.Jain; Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell
4. University Chemistry, by B.M. Mahan, Pearson IV Edition.
5. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan.
6. R. V. E. Gadag & A. Nityananda Shetty, Engineering Chemistry, IK International Publishing House Private Limited, New Delhi, 2015 Edition.

ME1203ES: Engineering Graphics

B.Tech. I Year II Sem.

L	T	P	C
1	0	4	3

Course objectives:

1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solids.

Course Outcomes: At the end of the course, the student will be able to:

1. Preparing working drawings to communicate the ideas and information.
2. Read, understand and interpret engineering drawings.

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

UNIT- II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes.

UNIT – III

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids –Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion ofIsometric Views to Orthographic Views and Vice-versa –Conventions

Introduction to CAD: (For Internal Evaluation Weightage only):
Introduction to CAD Software Package Commands. - Free Hand Sketches of 2D- Creation of 2DSketches by CAD Package

TEXT BOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:

1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

EE1204ES: Basic Electrical Engineering

B.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the concepts of electrical circuits and its components.
- To understand magnetic circuits, DC circuits and AC single & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.

Course Outcomes:

- To analyze and solve electrical circuits using network laws and theorems.
- To understand and analyze basic Electric and Magnetic circuits.
- To study the working principles of Electrical Machines.
- To introduce components of Low Voltage Electrical Installations.

UNIT-I:

D.C. Circuits Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems and maximum power transfer theorem. Time-domain analysis of first-order RL and RC circuits.

UNIT-II:

A.C. Circuits Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III:

Transformers Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT-IV:

Electrical Machines Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Construction and working principle of Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

UNIT-V:

Electrical Installations Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Power factor measurement using two-wattmeter method, Elementary calculations for energy consumption.

TEXT BOOKS/ REFERENCE BOOKS:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
2. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L.S. Bobrow, Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010.

5. Electrical Engineering Fundamentals, Vincent Deltoro, Second Edition, Prentice Hall India, 1989.

CH1205BS: Chemistry Lab

B.Tech. I Year II Sem.

L	T	P	C
0	0	3	1.5

Course Objectives: The course consists of experiments related to the principles of chemistry required for engineering student. The student will learn:

- Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
- To determine the rate constant of reactions from concentrations as a function of time.
- The measurement of physical properties like adsorption and viscosity.
- To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.

Course Outcomes: The experiments will make the student gain skills on:

- Determination of parameters like hardness and chloride content in water.
- Estimation of rate constant of a reaction from concentration – time relationships.
- Determination of physical properties like adsorption and viscosity.
- Calculation of Rf values of some organic molecules by TLC technique.

List of Experiments:

1. Determination of total hardness of water by complexometric method using EDTA
2. Determination of chloride content of water by Argentometry
3. Estimation of an HCl by Conductometric titrations
4. Estimation of Acetic acid by Conductometric titrations
5. Estimation of HCl by Potentiometric titrations
6. Estimation of Fe2+ by Potentiometry using KMnO4
7. Determination of rate constant of acid catalysed hydrolysis of methyl acetate
8. Synthesis of Aspirin and Paracetamol
9. Thin layer chromatography calculation of Rf values. eg ortho and para nitro phenols
10. Determination of acid value of coconut oil
11. Verification of freundlich adsorption isotherm-adsorption of acetic acid on charcoal
12. Determination of viscosity of castor oil and ground nut oil by using Ostwald's viscometer.
13. Determination of partition coefficient of acetic acid between n-butanol and water.
14. Determination of surface tension of a give liquid using stalagmometer.

References

1. Senior practical physical chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi)
2. An introduction to practical chemistry, K.K. Sharma and D. S. Sharma (Vikas publishing, N. Delhi)
3. Vogel's text book of practical organic chemistry 5th edition
4. Text book on Experiments and calculations in Engineering chemistry – S.S. Dara

ME1206ES: Engineering Workshop

B.Tech. I Year II Sem.

L	T	P	C
1	0	3	2.5

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineeringproducts.
- To provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipmentand machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work toprescribed tolerances.

Course Outcomes: At the end of the course, the student will be able to:

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting,carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes includingdrilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V. Welding Practice – (Arc Welding & Gas Welding)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and WoodWorking

TEXT BOOKS:

1. Workshop Practice /B. L. Juneja / Cengage
2. Workshop Manual / K. Venugopal / Anuradha.

REFERENCE BOOKS:

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ SciTech
2. Workshop Manual / Venkat Reddy/ BSP

EE1207ES: Basic Electrical Engineering Lab

B.Tech. I Year II Sem.

L	T	P	C
0	0	2	1

Course Objectives:

- To analyze a given network by applying various electrical laws and network theorems
- To know the response of electrical circuits for different excitations
- To calculate, measure and know the relation between basic electrical parameters.
- To analyze the performance characteristics of DC and AC electrical machines

Course Outcomes:

- Get an exposure to basic electrical laws.
- Understand the response of different types of electrical circuits to different excitations.
- Understand the measurement, calculation and relation between the basic electrical parameters
- Understand the basic characteristics of transformers and electrical machines.

List of experiments/demonstrations:

1. Verification of Ohms Law.
2. Verification of KVL and KCL.
3. Transient Response of Series RL, RC and RLC circuits using DC excitation.
4. Resonance in series RLC circuit.
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits.
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer.
7. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation).
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta-star, Star-Star).
9. Measurement of Active and Reactive Power in a balanced Three-phase circuit.
10. Open circuit Characteristics of a Separately/Self Excited DC Shunt/Compound Generator.
11. Performance Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
12. Torque-Speed Characteristics of a Separately/Self Excited DC Shunt/Compound Motor.
13. Performance Characteristics of a Three-phase Induction Motor.
14. Torque-Speed Characteristics of a Three-phase Induction Motor.
15. No-Load Characteristics of a Three-phase Alternator.

B.Tech.

II Year I Sem.

EE2101PC:Electromagnetic Fields

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics-II (Ordinary Differential Equations and Multivariable Calculus) &Applied Physics

Course Objectives:

- To introduce the concepts of electric field and magnetic field.
- Applications of electric and magnetic fields in the development of the theory forpower transmission lines and electrical machines.

Course Outcomes: At the end of the course, students will demonstrate the ability

- To understand the basic laws of electromagnetism.
- To obtain the electric and magnetic fields for simple configurations under staticconditions.
- To analyze time varying electric and magnetic fields.
- To understand Maxwell's equation in different forms and different media.
- To understand the propagation of EM waves.

UNIT – I

Static Electric Field: Review of conversion of a vector from one coordinate system to another coordinate system, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

UNIT – II

Conductors, Dielectrics and Capacitance: Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation.

UNIT – III

Static Magnetic Fields and Magnetic Forces: Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions, Magnetic circuits, Self inductances and mutual inductances.

UNIT - IV

Time Varying Fields and Maxwell's Equations: Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

UNIT - V

Electromagnetic Waves: Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane wave in free space and in

a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Pointing theorem.

TEXT BOOKS:

1. M. N. O. Sadiku, “Elements of Electromagnetics”, Oxford University Publication, 2014.
2. W. Hayt, “Engineering Electromagnetics”, McGraw Hill Education, 2012.

REFERENCE BOOKS:

1. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India, 2012.
2. G. W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.
3. W. J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
4. W. J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968.
5. E. G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press, 1966.
6. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers, International Edition, 1971.
7. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009.

EE2102PC:Electrical Machines-I

B.Tech. II Year I Sem.

L	T	P	C
3	1	0	4

Prerequisite: Basic Electrical Engineering

Course Objectives:

- To study and understand different types of DC generators, Motors and Transformers, their construction, operation and applications.
- To analyze performance aspects of various testing methods.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Identify different parts of a DC machine & understand its operation
- Carry out different testing methods to predetermine the efficiency of DC machines
- Understand different excitation and starting methods of DC machines
- Control the voltage and speed of a DC machines
- Analyze single phase and three phase transformers circuits.

UNIT – I

D.C. Generators: Principle of operation – Action of commutator – constructional features –armature windings – lap and wave windings – simplex and multiplex windings – use of laminated armature – E.M.F Equation. Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation. Methods of Excitation- separately excited and self-excited generators – build-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.

UNIT–II

D.C Motors: Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Armature reaction and commutation. Speed control of D.C. Motors - Armature voltage and field flux control methods. Motor starters (3-point and 4-point starters) Testing of D.C. machines - Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

UNIT-III

Testing of DC Machines: Methods of Testing–direct, indirect, and regenerative testing– Brake test- Swinburne's test–Hopkinson's test–Field's test-Retardation test- separation of stray losses in a DC motor test.

UNIT-IV

Single Phase Transformers: Types - constructional details-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.

UNIT – V

Testing of Transformers and Poly-Phase Transformers: 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. Poly-phase transformers – Poly-phase connections - Y/Y, Y/ Δ, Δ/Y, Δ/Δ and open Δ.

TEXT BOOKS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBSPublishers,2004.

REFERENCE BOOKS:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

EE2103PC:Network Theory

B.Tech. II Year I Sem. **L T P C**

3 1 0 4

Prerequisite: Mathematics - II (Ordinary Differential Equations and Multivariable Calculus) &Basic Electrical Engineering.

Course Objectives:

- To understand Magnetic Circuits, Network Topology and Three phase circuits.
- To analyze transients in Electrical systems.
- To evaluate Network parameters of given Electrical network.
- To design basic filter configurations.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyze two port circuit behaviors.

UNIT – I

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Millman's theorem, Analysis with dependent current and voltage sources. Node and Mesh Analysis.

UNIT – II

Magnetic Circuits: Faradays laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, analysis of series and parallel magnetic circuit, composite magnetic circuit.

Network Topology: Definitions - graph, tree, co-tree, twig, link, basic cutest and tie set matrices for planar networks, loop and nodal methods of analysis of networks with dependent and independent voltage and current sources, Duality and Dual networks.

UNIT – III

Electrical Circuit Analysis Using Laplace Transforms: Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances.

UNIT – IV

Two Port Network and Network Functions: Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

UNIT – V

Filter: Introduction to filters, Active, passive filter, Comparison between active and passive filter , constant K - RC, RL low pass, high pass, band pass, band stop filters.

TEXT BOOKS:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.

REFERENCE BOOKS:

1. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
2. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

EE2104PC:Analog Electronics

B.Tech. II Year I Sem. **L T P C**

3 0 0 3

Course Objectives:

- To introduce components such as diodes, BJTs and FETs their switching characteristics, applications.
- Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of basic and feedback amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
- To introduce the basic building blocks of linear integrated circuits.
- To introduce the concepts of waveform generation and introduce some special function ICs.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Know the characteristics, utilization of various components.
- Understand the biasing techniques.
- Design and analyze various rectifiers, small signal amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- A thorough understanding, functioning of OP-AMP, designs OP-AMP based circuits with linear integrated circuits.

UNIT - I

Diode Circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, clamping and clipping circuits. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits.

UNIT - II

MOSFET Circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. small signal equivalent circuits - gain, input and output impedances, small-signal model and common-source, common-gate and common-drain amplifiers, trans conductance, high frequency equivalent circuit.

UNIT - III

Multi-Stage and Power Amplifiers: Direct coupled and RC Coupled multi-stage amplifiers; Differential Amplifiers, Power amplifiers - Class A, Class B, Class C.

UNIT - IV

Feedback Amplifiers: Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems. Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators.

UNIT - V

Operational Amplifiers: Ideal op-amp, Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, Inverting and non-inverting amplifier, Differentiator, integrator, Square-wave and triangular-wave generators.

TEXT BOOKS:

1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2nd edition 2010.

2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.

REFERENCE BOOKS:

1. Electronic Devices Conventional and current version -Thomas L. Floyd 2015, pearson.
2. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
3. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
4. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”,John Wiley & Sons, 2001.

CS2105ES: Object Oriented Programming Using C++

B.Tech. II Year I Sem. **L T P C**

3 0 0 3

Prerequisites: A course on “Programming for Problem Solving using C”.

Course Objectives:

- Introduces Object Oriented Programming concepts using the C++ language.
- Introduces the principles of data abstraction, inheritance and polymorphism;
- Introduces the principles of virtual functions and polymorphism.
- Introduces handling formatted I/O and unformatted I/O.
- Introduces exception handling.

Course Outcomes:

- Able to develop programs with reusability.
- Develop programs for file handling.
- Handle exceptions in programming.
- Develop applications for a range of problems using object-oriented programmingtechniques.

UNIT - I

Object-Oriented Thinking: Different paradigms for problem solving, need for OOP paradigm, differences between OOP and Procedure oriented programming, Overview of OOP concepts- Abstraction, Encapsulation, Inheritance and Polymorphism.

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions - Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de- allocation operators-new and delete, Preprocessor directives.

UNIT - II

C++ Classes and Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction,ADT and information hiding.

UNIT - III

Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Baseand Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

Virtual Functions and Polymorphism: Static and Dynamic binding, virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT - IV

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and Stringstreams, Overloading operators,Error handling during file operations,Formatted I/O.

UNIT - V

Exception Handling: Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications, Stack unwinding, Rethrowing an exception, Catching all exceptions.

TEXT BOOKS:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2. Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch,Pearson Education.

REFERENCE BOOKS:

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream TechPress.
3. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia PublicationsPvt Ltd.

EE2106PC:Electrical Machines Lab-I

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	1.5

Prerequisite: Electrical Machines-I

Course Objectives:

- To expose the students to the operation of DC Generator
- To expose the students to the operation of DC Motor.
- To examine the self-excitation in DC generators.

Course Outcomes: After completion of this lab the student is able to

- Start and control the Different DC Machines.
- Assess the performance of different machines using different testing methods
- Identify different conditions required to be satisfied for self - excitation of DC Generators.
- Separate iron losses of DC machines into different components

List of experiments/demonstrations:

The following experiments are required to be conducted compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed).
2. Load test on DC shunt generator (Determination of characteristics).
3. Load test on DC series generator(Determination of characteristics)
4. Load test on DC compound generator (Determination of characteristics).
5. Hopkinson's test on DC shunt machines (Predetermination of efficiency).
6. Fields test on DC series machines (Determination of efficiency)
7. Swinburne's test and speed control of DC shunt motor (Predetermination of efficiencies).
8. Brake test on DC compound motor (Determination of performance curves).

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

9. Brake test on DC shunt motor (Determination of performance curves).
10. Retardation test on DC shunt motor (Determination of losses at rated speed).
11. Separation of losses in DC shunt motor.

TEXT BOOKS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education,2013.
2. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.

REFERENCE BOOKS:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

EE2107PC: Network Lab

B.Tech. II Year I Sem.

L	T	P	C
0	0	3	1.5

Prerequisite: Basic Electrical Engineering, Electrical Circuit Analysis

Course Objectives:

- To design electrical systems.
- To analyze a given network by applying various Network Theorems.
- To measure three phase Active and Reactive power.
- To understand the locus diagrams.

Course Outcomes: After Completion of this lab the student is able to

- Analyze complex DC and AC linear circuits.
- Apply concepts of electrical circuits across engineering.
- Evaluate response in a given network by using theorems.

The following experiments are required to be conducted as compulsory experiments

1. Verification of Thevenin's and Norton's Theorems.
2. Verification of Superposition, Reciprocity and Maximum Power Transfer theorems.
3. Locus Diagrams of RL and RC Series Circuits.
4. Series and Parallel Resonance.
5. Time response of first order RC / RL network for periodic non – sinusoidal inputs –Time constant and Steady state error determination.
6. Two port network parameters – Z – Y parameters, Analytical verification.
7. Two port network parameters – A, B, C, D & Hybrid parameters, Analytical verification.
8. Separation of Self and Mutual inductance in a Coupled Circuit. Determination of Co-efficient of Coupling.

In addition to the above eight experiments, at least any two of the experimentsfrom the following list are required to be conducted

9. Verification of compensation & Milliman's theorems.
10. Harmonic Analysis of non-sinusoidal waveform signals using Harmonic Analyzer andplotting frequency spectrum.
11. Determination of form factor for non-sinusoidal waveform.
12. Measurement of Active Power for Star and Delta connected balanced loads.
13. Measurement of Reactive Power for Star and Delta connected balanced loads.

TEXT BOOKS:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.

REFERENCE BOOKS:

1. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
2. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
3. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers,1999.

CS2108ES: C++ Programming Lab

B.Tech. II Year I Sem. **L T P C**

0 0 2 1

Prerequisites: A course on “Programming for Problem Solving”.

Course Objectives:

- Introduces object-oriented programming concepts using the C++ language.
- Introduces the principles of data abstraction, inheritance and polymorphism;
- Introduces the principles of virtual functions and polymorphism.
- Introduces handling formatted I/O and unformatted I/O.
- Introduces exception handling.

Course Outcome:

- Ability to develop applications for a range of problems using object-oriented programming techniques.

List of Experiments

1. Write a C++ Program to display Names, Roll No., and grades of 3 students who haveappeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
2. Write a C++ program to declare Struct. Initialize and display contents of member variables.
3. Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. Write a C++ program to read the data of N employee and compute Net salary of eachemployee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).
6. Write a C++ to illustrate the concepts of console I/O operations.
7. Write a C++ program to use scope resolution operator. Display the various values ofthe same variables declared at different scope levels.
8. Write a C++ program to allocate memory using new operator.
9. Write a C++ program to create multilevel inheritance. (Hint: Classes A1, A2, A3)
10. Write a C++ program to create an array of pointers. Invoke functions using arrayobjects.
11. Write a C++ program to use pointer for both base and derived classes and call themember function. Use Virtual keyword.

TEXT BOOKS:

1. The Complete Reference C++, 4th Edition, Herbert Schildt, Tata McGraw Hill.
2. Problem solving with C++: The Object of Programming, 4th Edition, Walter Savitch,Pearson Education.

REFERENCE BOOKS:

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream TechPress.
3. Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia PublicationsPVT Ltd.

***MC2001: Constitution of India**

(Mandatory Non Credit Course)

B.Tech. II Year I Sem. **L T P C**

3 0 0 0

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the textof the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one ofthe strongest court in the world".

Course content

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy – Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Unionand the States.
8. Parliamentary Form of Government in India – The constitution powers and status ofthe President of India.
9. Amendment of the Constitutional Powers and Procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency.
12. Local Self Government – Constitutional Scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain Freedom under Article 19.

B.Tech.

II Year II Sem.

EE2201PC: Power System - I

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Basic Electrical Engineering, Electrical Machines-I, Electrical Machines-II

Course Objectives:

- To understand the different types of power generating stations.
- To examine A.C. and D.C. distribution systems.
- To understand and compare overhead line insulators and Insulated cables.
- To illustrate the economic aspects of power generation and tariff methods.
- To evaluate the transmission line parameters calculations
- To understand the concept of corona

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the concepts of power systems.
- Understand the operation of conventional generating stations and renewable sources of electrical power.
- Evaluate the power tariff methods.
- Determine the electrical circuit parameters of transmission lines
- Understand the layout of substation and underground cables and corona.

UNIT – I

Generation of Electric Power Conventional Sources (Qualitative): Hydro station, Steam Power Plant, Nuclear Power Plant and Gas Turbine Plant.

Non-Conventional Sources (Qualitative): Ocean Energy, Tidal Energy, Wave Energy, wind Energy, Fuel Cells, and Solar Energy, Cogeneration and energy conservation and storage.

UNIT – II

Economics of Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

UNIT – III

Overhead Line Insulators & Underground Cables: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators. Introduction, insulation, insulating materials, Extra high voltage cables.

Underground cable: Introduction, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables.

UNIT - IV

Inductance & Capacitance Calculations of Transmission Lines: Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, interference between power and Communication lines.

UNIT-V

A.C. Distribution: Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in A.C. Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

DC Distribution: Classification of Distribution Systems.- Comparison of DC vs. AC and Under-Ground vs. Over- Head Distribution Systems.- Requirements and Design features of Distribution Systems.- Voltage Drop Calculations (Numerical Problems) in D.C Distributors for the following cases: Radial D.C Distributor fed one end and at the both the ends (equal/unequal Voltages) and Ring Main Distributor.

TEXT BOOKS:

1. W.D.Stevenson –Elements of Power System Analysis, Fourth Edition, McGraw Hill,1984.
2. C.L. Wadhwa –Generation, Distribution and Utilization of Electrical Energy, SecondEdition, New Age International, 2009.

REFERENCE BOOKS:

1. C.L. Wadhwa –Electrical Power Systems, Fifth Edition, New Age International, 2009.
2. M.V. Deshpande –Elements of Electrical Power Station Design, Third Edition, WheelerPub. 1998.
3. H.Cotton & H. Barber-The Transmission and Distribution of Electrical Energy, English Universities Press, 1970.
4. V.K Mehta and Rohit Mehta, “Principles of Power Systems”, S. Chand & Company Ltd, New Delhi, 2004.

MA2202BS: Numerical Methods & Complex Variables

B.Tech. II Year II Sem.

L	T	P	C
3	1	0	4

Pre-requisites: Mathematics courses of first year of study.

Course Objectives:

- Concept, properties of Laplace transforms.
- Solving ordinary differential equations using Laplace transforms techniques.
- Various methods to the find roots of an equation.
- Concept of finite differences and to estimate the value for the given data usinginterpolation.
- Evaluation of integrals using numerical techniques.
- Solving ordinary differential equations using numerical techniques.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residuetheorem.
- Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes: After learning the contents of this paper the student must be able to

- Use the Laplace transforms techniques for solving ODE's.
- Find the root of a given equation.
- Estimate the value for the given data using interpolation.
- Find the numerical solutions for a given ODE's.
- Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems.
- Taylor's and Laurent's series expansions of complex function.

UNIT I: Laplace Transforms

Laplace Transforms; Laplace Transform of Standard functions; first shifting theorem; Laplace Transform of functions when they are multiplied and divided by t; Laplace Transforms of Derivatives and Integrals of function; Evaluation of Integrals by Laplace Transforms; Laplace Transforms of special functions; Inverse Laplace Transform by different methods; Convolution Theorem (without Proof) Solving ODE s by Laplace Transform method.

UNIT II: Numerical Methods I

Solution of Polynomial and Transcendental equations - Newton Raphson Method and Regula False Method. Finite differences – forward difference – Back ward difference – Central differences – Symbolic Relations and separation of Symbolic Interpolation using Newton's forward and backward difference formulae, Lagrange's method of Interpolation.

UNIT III: Numerical Methods II

Numerical Integration: Trapezoidal rule and Simpson s 1/3 and 3/8 rules. Ordinary differential equations Taylor's series, Picard's method, Euler and Modified Eulers methods and Runge – Kutta method of fourth order, Predictor – Corrector Methods.

UNIT IV: Complex Variables (Differentiation)

Limits, Continuity and Differentiation of Complex functions, Cauchy – Riemann equations (without proof). Milne Thomson methods, Analytic functions, Harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

UNIT V: Complex Variables (Integration)

Line integrals, Cauchy's theorem, Cauchy's integral formula, Liouvilles theorem, Maximum- Modulus theorem (All theorems without proof); zeros of analytic functions, singularities, Taylors series, Laurent's series; Residues, Cauchy's Residue theorem (without proof).

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill,2004.

REFERENCE BOOKS:

1. M. K. Jain, SRK Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

EE2203PC: Electrical Machines–II

B.Tech. II Year II Sem.

L	T	P	C
3	1	0	4

Prerequisite: Basic Electrical Engineering**,** Electrical Machines-I

Course Objectives:

- To deal with the detailed analysis of poly-phase induction motors & Alternators.
- To understand operation, construction and types of single-phase motors andtheir applications in house hold appliances and control systems.
- To introduce the concept of parallel operation of alternators
- To introduce the concept of regulation and its calculations.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines.

UNIT – I

Poly-Phase Induction Machines: Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation.

UNIT – II

Characteristics of Induction Machines: Rotor power input, rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic - equivalent circuit - phasor diagram - crawling and cogging -.No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation**.**

UNIT – III

Synchronous Machines: Constructional Features of round rotor and salient pole machines – Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings – distribution, pitch and winding factors – E.M.F Equation. Harmonics in generated E.M.F. – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – experimental determination - phasor diagram – load characteristics. Regulation by synchronous impedance method, M.M.F. method, Z.P.F. method and A.S.A. methods – salient pole alternators – two reactionanalysis – experimental determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators.

UNIT – IV

Parallel Operation of Synchronous Machines: Synchronizing alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input. Analysis of short circuit current wave form –determination of sub-transient, transient and steady state reactance's.

Synchronous Motors: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed .- hunting and its suppression – Methods of starting – synchronous induction motor.

UNIT – V

Single Phase & Special Machines: Single phase induction motor – Constructional Features - Double revolving field theory – split-phase motors – shaded pole motor- Principles of A.C. Series motor- Universal motor.

TEXT BOOKS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

REFERENCE BOOKS:

1. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

EE2204PC: Control Systems

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Linear Algebra and Calculus, Ordinary Differential Equations and MultivariableCalculus Laplace Transforms, Numerical Methods and Complex variables

Course objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the systemdynamic response.
- To assess the system performance using time domain analysis and methods for improving it.
- To assess the system performance using frequency domain analysis and techniques for improving the performance.
- To design various controllers and compensators to improve system performance.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Understand the concept of stability and its assessment for linear-time invariantsystems.
- Design simple feedback controllers.

UNIT – I

Introduction to Control Systems: Industrial Control examples, Open loop and closed loop control systems, classification of control systems, characteristics and effects of feedback, mathematical models differential equations, translational and rotational mechanical systems.

Transfer Function Representation: Transfer function of DC and AC Servomotor, Synchro transmitter and receiver, Block diagram representation of systems considering electrical systems as examples, Block diagram reduction techniques, signal flow graphs, reduction using Mason's gain formula. Sensitivity of control system.

UNIT – II

Time Response Analysis: Standard test signals, time response of first order systems, characteristic equation of feedback control systems, transient response of second order systems-time domain specifications, steady state response-steady state errors and error constants, effects of proportional derivative, proportional integral systems. Introduction to PID Controller.

UNIT-III

Stability Analysis in Time Domain: Concept of stability, Routh-Hurwitz stability criterion, qualitative and conditional stability.

Root Locus Technique: The root locus concept, construction of root loci, effects of adding poles and zeros to G(s)H(s) on the root loci. Root-loci method of feedback controller design.

UNIT – IV

Frequency-Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response. Lead and Lag compensation in designs.

UNIT – V

State Variable Analysis and Concepts of State Variables: State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability.

TEXT BOOKS:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.

EE2205PC: Digital Electronics

B.Tech. II Year II Sem. **L T P C**

3 0 0 3

Prerequisite: Analog Electronics

Course Objectives:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them toanalyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

UNIT - I

Fundamentals of Digital Systems and Logic Families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT - II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial ladder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT - III

Sequential Circuits and Systems: A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J, K, T and D types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT - IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter,R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel

comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT - V

Semiconductor Memories and Programmable Logic Devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOK:

1. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

EE2206PC: Electrical Machines Lab-II

B.Tech. II Year II Sem. **L T P C**

0 0 2 1

Prerequisite: Electrical Machines – I & Electrical Machines – II

Course Objectives:

- To understand the operation of synchronous machines.
- To understand the analysis of power angle curve of a synchronous machine.
- To understand the equivalent circuit of a single-phase transformer and single-phase induction motor.
- To understand the circle diagram of an induction motor by conducting a blockedrotor test.

Course Outcomes: After the completion of this laboratory course, the student will be able

- Assess the performance of different machines using different testing methods.
- To convert the Phase from three phase to two phase and vice versa.
- Compensate the changes in terminal voltages of synchronous generator afterestimating the change by different methods.
- Control the active and reactive power flows in synchronous machines.
- Start different machines and control the speed and power factor.

List of experiments/demonstrations:

The following experiments are required to be conducted compulsory experiments:

1. O.C. & S.C. Tests on Single phase Transformer.
2. Sumpner's test on a pair of single-phase transformers.
3. No-load & Blocked rotor tests on three phase Induction motor
4. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods.
5. V and Inverted V curves of a three—phase synchronous motor.
6. Equivalent Circuit of a single-phase induction motor.
7. Determination of Xd and Xq of a salient pole synchronous machine.
8. Load test on three phase Induction Motor.

In addition to the above eight experiments, at least any two of the experimentsfrom the following list are required to be conducted:

9. Separation of core losses of a single-phase transformer.
10. Efficiency of a three-phase alternator.
11. Parallel operation of Single-phase Transformers.
12. Regulation of three-phase alternator by Z.P.F. and A.S.A methods.
13. Heat run test on a bank of 3 Nos. of single-phase Delta connected transformers.
14. Measurement of sequence impedance of a three-phase alternator.
15. Vector grouping of Three Transformer.
16. Scott Connection of transformer.

TEXT BOOKS:

1. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

REFERENCE BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
3. A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.
4. P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.

EE2207PC: Control System Lab

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisite: Control Systems

Course Objectives:

- To understand the different ways of system representations such as Transfer. Function representation and state space representations and to assess the systemdynamic response.
- To assess the system performance using time domain analysis and methods for improving it.
- To assess the system performance using frequency domain analysis and techniques for improving the performance.
- To design various controllers and compensators to improve system performance.

Course Outcomes: After completion of this lab the student is able to

- How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application.
- Apply various time domain and frequency domain techniques to assess thesystem performance.
- Apply various control strategies to different applications (example: Power systems, electrical drives etc..)
- Test system controllability and observability using state space representation andapplications of state space representation to various systems.

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system.
2. Characteristics of Synchros.
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.
4. Effect of feedback on DC servo motor.
5. Transfer function of DC motor.
6. Transfer function of DC generator.
7. Temperature controller using PID.
8. Characteristics of AC servo motor.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Effect of P, PD, PI, PID Controller on a second order systems.
2. Lag and lead compensation – Magnitude and phase plot.
3. Simulation of P, PI, PID Controller.
4. Linear system analysis (Time domain analysis, Error analysis) using suitable software.
5. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using suitable software.
6. State space model for classical transfer function using suitable software - Verification.
7. Design of Lead-Lag compensator for the given system and with specification using suitable software.

TEXT BOOKS:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
2. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International,2009.

EE2208PC: Basic Electrical Simulation Lab

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisite: Basic Electrical and Electronics Engineering & Network Theory.

Course Objectives:

- To develop the simulation skills.
- To generate various signals and synthesis for the engineering systems.
- To analyze harmonics in the systems.
- To analyze electrical circuit in simulation environment.

Course Outcomes: After going through this lab the student will be able to

- Apply signal generation in different systems.
- Analyze networks by various techniques
- Analyze circuit responses
- Analyze bridge rectifiers

The following experiments are required to be conducted compulsory experiments:

1. Basic Operations on Matrices.
2. Generation of various signals and sequences (Periodic and Aperiodic), suchas unit Impulse, Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sine.
3. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy, and Average Power.
4. Mesh and Nodal Analysis of Electrical circuits.
5. Application of Network Theorems to Electrical Networks.
6. Waveform Synthesis using Laplace Transform.
7. Locating the Zeros and Poles and Plotting the Pole-Zero maps in S plane and Z-Plane for the given transfer function of Harmonic analysis of non-sinusoidal waveforms.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted.

1. Simulation of DC Circuits.
2. Transient Analysis.
3. Measurement of active Power of three phase circuit for balanced and unbalanced load.
4. Simulation of single phase diode bridge rectifiers with filter for R & RL.
5. Simulation of three phase diode bridge rectifiers with R, RL load.
6. Design of Low Pass and High Pass filters.
7. Finding the Even and Odd parts of Signal / Sequence and Real and imaginaryparts of Signal.
8. Finding the Fourier Transform of a given signal and plotting its magnitude andphase Spectrum.

EE2209PC: Electronic Circuits Lab

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	1

Prerequisite: Digital Electronics, Analog Electronics

Course Objectives:

- To learn basic techniques for the design of analog and digital circuits and fundamental concepts used in the design of digital systems.
- To understand application of analog and digital electronic circuits and to be able bconvert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analogconversion.
- Be able to use PLDs to implement the given logical problem.

List of Experiments:

Analog Electronics (Any six)

1. CE and CC amplifier.
2. CC amplifier (Emitter Follower).
3. Wien bridge and RC Phase shift Oscillator.
4. Current series and Voltage series Feedback Amplifier.
5. Colpitt and Hartley Oscillator.
6. Transistor as a switch.
7. Monostable & A stable multivibrators.
8. Bistable multivibrator & Schmitt trigger.

Digital Electronics Lab (Any six)

1. Realization of Boolean Expressions using Gates.
2. Generation of clock using NAND / NOR gates.
3. Design a 4 – bit Adder / Subtractor.
4. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter.
5. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
6. Design and realization a Synchronous and Asynchronous counters using flip-flops.
7. Design and realization of Asynchronous counters using flip-flops.
8. Design and realization of 2-bit comparator.

TEXT BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOK:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

***MC2002: Gender Sensitization Lab (An Activity-based Course)**
(Mandatory Non Credit Course)

B.Tech. II Year II Sem.

L	T	P	C
0	0	2	0

Course Description

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary. It draws on multiple disciplines – such as literature, history, economics, psychology, sociology, philosophy, political science, anthropology and media studies – to examine cultural assumptions about sex, gender, and sexuality.

This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with race, class, caste, nationality and other social identities. This course also seeks to build an understanding and initiate and strengthen programmes combating gender-based violence and discrimination. The course also features several exercises and reflective activities designed to examine the concepts of gender, gender-based violence, sexuality, and rights. It will further explore the impact of gender-based violence on education, health and development.

Objectives of the Course:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Learning Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT - I: UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

UNIT – II: GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary.

UNIT – III: GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work. - Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

UNIT – IV: GENDER - BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".

Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my fe…."

UNIT – V: GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues - Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

Note: Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

- Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".

- **ESSENTIAL READING:** The Textbook, "Towards a World of Equals: A Bilingual Textbook on Gender" written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

ASSESSMENT AND GRADING:

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

B.Tech.

III Year I Sem.

EE3101PC: Electrical Measurements & Instrumentation

B.Tech. III Year I Sem.

L	T	P	C
3	1	0	4

Pre-requisite: Basic Electrical Engineering, Analog Electronics, Electrical Circuit Analysis & Electro Magnetic fields.

Course objectives:

- To introduce the basic principles of all measuring instruments.
- To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
- To understand the basic concepts of smart and digital metering.

Course Outcomes: After completion of this course, the student able to

- Understand different types of measuring instruments, their construction, operation and characteristics.
- Identify the instruments suitable for typical measurements.
- Apply the knowledge about transducers and instrument transformers to use themeffectively.
- Apply the knowledge of smart and digital metering for industrial applications.

UNIT- I Introduction to Measuring Instruments

SI Units-Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and seriesresistance. Electrostatic Voltmeter electrometer type and attracted disc type – extension of range of E.S. Voltmeters.

UNIT-II Potentiometers & Instrument Transformers

Principle and operation of D.C. Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors.

UNIT-III Measurement of Power & Energy

Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of rangeof wattmeter using instrument transformers – Measurement of active and reactive powersin balanced and unbalanced systems. Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using R.S.S.meter. Three phase energy meter – tri-vector meter, maximum demand meters.

UNIT-IV DC & AC Bridges

Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Carey Foster's bridge, Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge - Owen's bridge. Measurement of capacitance and loss angle – Desaunty's Bridge - Wien's bridge – Schering Bridge.

UNIT-V Transducers

Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principle operation of LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezoelectric transducers, Introduction to Smart and Digital Metering: Digital Multi-meter, True RMS meters, Clamp-on meters, DigitalStorage Oscilloscope.

TEXT BOOKS:

1. G. K. Banerjee, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition,2016
2. S. C. Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.

REFERENCES:

1. A. K. Sawhney, “Electrical & Electronic Measurement & Instruments”,Dhanpat Rai & Co. Publications, 2005.
2. R. K. Rajput, “Electrical & Electronic Measurement & Instrumentation”, S. Chand and Company Ltd., 2007.
3. Buckingham and Price, “Electrical Measurements”, Prentice – Hall, 1988.
4. Reissland, M. U, “Electrical Measurements: Fundamentals, Concepts,Applications”, New Age International (P) Limited Publishers, 1st Edition 2010.
5. E.W. Golding and F. C. Widdis, “Electrical Measurements and measuring Instruments”, fifth Edition, Wheeler Publishing, 2011.

EE3102PC: Power System – II

B.Tech. III Year I Sem. **L T P C**

3 1 0 4

Pre-requisites: Power System-I

Course Objectives:

- To understand real power control and operation.
- To know the importance of frequency control.
- To analyze different methods to control reactive power.
- To understand unit commitment problem and importance of economic load dispatch.
- To understand real time control of power systems.

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

- Understand operation and control of power systems.
- Analyze various functions of Energy Management System (EMS) functions.
- Analyze whether the machine is in stable or unstable position.
- Understand power system deregulation and restructuring.

UNIT- I

Performance of Lines

Representation of lines, short transmission lines, medium length lines, nominal T and PI-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect, Power flow through a transmission line,

UNIT- II

Voltage Control

Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers. Compensation In Power Systems: Introduction - Concepts of Load compensation – Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line – Radial line with asynchronous load – Compensation of lines, Synchronous Condenser.

UNIT- III

Per Unit Representation of Power Systems

The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system. Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

UNIT- IV

Overvoltage Protection and Insulation Coordination

Over voltage due to arcing ground and Peterson coil, lightning, horn gaps, surge diverters, rod gaps, expulsion type lightning arrester, valve type lightning arrester, ground wires, ground rods, counter poise, surge absorbers, insulation coordination, volt-time curves.

UNIT - V

Symmetrical Components and Fault Calculations

Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault,

double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS

1. C. L. Wadhwa, Electrical Power Systems, 3rd Edition, New Age International PublishingCo., 2001.
2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th Edition, Tata McGraw Hill Education Private Limited 2011.

REFERENCE BOOKS:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.

EE3103PC: Microprocessors and Microcontrollers

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	3	**1**	**0**	**4**

Prerequisite: Nil

Course Objectives:

1. To familiarize the architecture of microprocessors and micro controllers.
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To understand the concepts of ARM architecture.
4. To study the basic concepts of Advanced ARM processors.

Course Outcomes: Upon completing this course, the student will be able to

1. Understands the internal architecture, organization and assembly language programming of8086 processors.
2. Understands the internal architecture, organization and assembly language programming of8051/controllers
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.

UNIT - I:

8086 Architecture

8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086. Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

UNIT – II

Introduction to Microcontrollers

Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051. 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

UNIT – III

I/O and Memory Interface LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051. Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.

UNIT – IV

ARM Architecture

ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

UNIT – V

Advanced ARM Processors

Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M.Bhurchandani, TMH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012.

REFERENCE BOOKS:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications - K. Uma Rao, Andhe Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

SM3104MS:Business Economics and Financial Analysis

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objective:

- To learn the basic business types, impact of the economy on Business and Firmsspecifically.
- To analyze the Business from the Financial Perspective.

Course Outcome:

- The students will understand the various Forms of Business and the impact ofeconomic variables on the Business.
- The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt.
- The Students can study the firm's financial position by analysing the FinancialStatements of a Company.

UNIT – I: Introduction to Business and Economics

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT - II: Demand and Supply Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function and Law of Supply.

UNIT- III: Production, Cost, Market Structures & Pricing

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly,Oligopoly, Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.

UNIT - IV: Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT - V: Financial Analysis through Ratios: Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e,Tata McGraw Hill Education Pvt. Ltd. 2012.

REFERENCE BOOKS:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting,5e, Vikas Publications, 2013.

Professional Elective I
EE3105PE: Electrical Installation and Estimation

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Prerequisites: A course on “Electrical basics and power systems”.

Course Objectives:

- To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
- To design and estimation of wiring.
- To design overhead and underground distribution lines, substations and illumination

Course Outcomes:

- Understand the design considerations of electrical installations.
- Design electrical installation for buildings and small industries.
- Identify and design the various types of light sources for different applications.

UNIT – I
Wiring Systems and Safety Procedures

Introduction, importance of electrical wiring, uses of cables, standard wire gauge, size and current carrying capacity of a wire/cable, systems of wiring, electrical wiring accessories, safety accessories, safety procedures, reason for not using fuse in neutral wire, electric shock, procedure for first-aid in case of electric shock.

UNIT – II
Estimation of Lighting and Power Loads

Introduction, types of service mains, selection of service main, selection of system wiring, drawing a wire/cable through a conduit, list of electrical materials & their approximate rates, problems on internal wiring scheme, wiring layouts of a office building, work shop, industry,/cement factory/sugar factory, hotel with a 4-storied with lift arrangement, estimationof power load, single line diagram, types of wiring system, size of cable/wire, materials used in power wiring and their rates, estimation of irrigation pump sets, submersible irrigation pump sets, material used in irrigation pump sets.

UNIT - III
Estimation of Overhead Lines and Earthing

Introduction, main components of overhead lines, conductors, insulators, cross-arms and clamps, guys and stays, steps to solve problems on estimation of OH lines, estimation ofpole and plinth mounted substations, construction of pole and plinth mounted substations, estimation of materials electrical accessories of pole and plinth mounted transformers, earthing, selection of earthing, earth resistance, methods of reducing earth resistance, estimation of materials for pipe and plate earthing.

UNIT - IV
Estimating and Costing of Repairs and Maintenance of Electrical Devices and Equipment

D.O.L. starter, small motor, mono block pump, automatic electric iron, table/ceiling fan, ICDP/ICTP Switch, Preparation of detailed drawing work of the product, Preparation of material quantity sheet for the product, Materials and cost required for maintenance work, Estimation of repairing cost and overall cost, Tools used for repairs & maintenance work Preparation of cost schedule for repair and maintenance of electric fan, automatic electric iron, single phase transformer, mixer grinder, D.O.L starter.

UNIT - V

Departmental Test, REC and Electrical Act 2003

Introduction, departmental procedure for obtaining a service connection, insulation resistance desirable for electrical installation, earth resistance to be maintained for an electric installation, testing of wiring installation, rural electrification scheme, survey of load ina village, capacity of transformer, location of transformer, estimation of electrification of a village, economic feasibility of the scheme, Indian electricity(I.E) rules, general conditions forsupply and use of energy, electric supply lines, systems and apparatus for low and medium voltages.

TEXT BOOKS:

1. K. B. Raina, S. K. Bhattacharya, “Electrical Design Estimating and Costing”, New Age International Publisher, 2010.
2. Er. V. K. Jain, Er. Amitabh Bajaj, “Design of Electrical Installations”,University Science Press.

REFERENCE BOOKS:

1. Electrical installation and estimation, by K. Manjunath, Falcon publications.
2. Gupta J. B., Katson, Ludhiana, “Electrical Installation, estimating and costing”, S. K. Kataria and sons, 2013.
3. Bureau of Indian standards, Electricity supply act-1948.
4. Code of practice for Electrical wiring installations, (System voltage not exceeding650 volts), Indian Standard Institution, IS: 732-1983.
5. Guide for Electrical layout in residential buildings, Indian Standard Institution,IS: 4648-1968.

Professional Elective I
EE3106PE: Electrical Machine Design

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Machines-I, Electrical Machines-II

Course Objectives:

- To know the major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings.
- To analyze the thermal considerations, heat flow, temperature rise, rating of machines.
- To understand the design of transformers.
- To study the design of induction motors.
- To know the design of synchronous machines.
- To understand the CAD design concepts.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the construction and performance characteristics of electrical machines.
- Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines
- Understand the principles of electrical machine design and carry out a basic design of an ac machine.
- Use software tools to do design calculations.

UNIT – I Introduction
Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT – II Transformers
Sizing of a transformer, main dimensions, kVA output for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT – III Induction Motors
Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

UNIT – IV Synchronous Machines
Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of airgap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

UNIT - V

Computer Aided Design (CAD)

Limitations (assumptions) of traditional designs need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function,problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines PMSMs, BLDCs, SRM and claw-pole machines.

TEXT BOOKS:

1. A. K. Sawhney, “A Course in Electrical Machine Design”, Dhanpat Rai and Sons,1970.
2. M.G. Say, “Theory & Performance & Design of A.C. Machines”, ELBS London.

REFERENCE BOOKS:

1. S. K. Sen, “Principles of Electrical Machine Design with computer programmes”, Oxford and IBH Publishing, 2006.
2. K. L. Narang, “A Text Book of Electrical Engineering Drawings”, Satya Prakashan,1969.
3. A. Shanmugasundaram, G. Gangadharan and R. Palani, “Electrical Machine Design Data Book”, New Age International, 1979.
4. M. V. Murthy, “Computer Aided Design of Electrical Machines”, B.S. Publications, 2008.
5. Electrical machines and equipment design exercise examples using Ansoft’s Maxwell 2Dmachine design package.

Professional Elective I
EE3107PE: High Voltage Engineering

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems – I, Electro Magnetic Fields

Course Objectives:

- To deal with the detailed analysis of Breakdown occurring in gaseous,liquids and solid dielectrics.
- To inform about generation and measurement of High voltage and current.
- To introduce High voltage testing methods.

Course outcomes: At the end of the course, the student will demonstrate

- Understand the basic physics related to various breakdown processes insolid, liquid and gaseous insulating materials.
- Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.
- Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.
- Knowledge of how over-voltages arise in a power system, and protectionagainst these over-voltages.

UNIT – I

Breakdown in Gases Ionization processes and de-ionization processes

Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non- uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge Breakdown in Liquid and Solid Insulating Materials Breakdown in pure and commercial liquids, Soliddielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT - II

Generation of High Voltages

Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT- III

Measurements of High Voltages and Currents

Peak voltage, impulse voltage and high direct current measurement method, cathoderay oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT - IV

Lightning and Switching Over-Voltages

Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching overvoltages, Protection against over-voltages, Surge diverters, and Surge modifiers.

UNIT - V

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing ofinsulators and bushings, testing of isolators and circuit breakers, testing of cables,power transformers and some high voltage equipment, High voltage laboratory layout,indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V.Labs.

TEXT BOOKS:

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education, 2013.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers, 2007.

REFERENCE BOOKS:

1. D. V. Razevig (Translated by Dr. M. P. Chourasia), “High Voltage Engineering Fundamentals”,Khanna Publishers, 1993.
2. E. Kuffel, W. S. Zaengl and J. Kuffel, “High Voltage Engineering Fundamentals”, NewnesPublication, 2000.
3. R. Arora and W. Mosch “High Voltage and Electrical Insulation Engineering”, John Wiley &Sons, 2011.
4. Various IS standards for HV Laboratory Techniques and Testing.

EE3108PC: Electrical Measurements & Instrumentation Lab

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Pre-requisite: Measurements and Instrumentation

Course Objectives:

- To calibrate LPF Watt Meter, energy meter, P. F Meter using electrodynamo meter type instrument as the standard instrument
- To determine unknown inductance, resistance, capacitance by performing experiments on D.C Bridges & A. C Bridges
- To determine three phase active & reactive powers using single wattmeter methodpractically
- To determine the ratio and phase angle errors of current transformer and potentialtransformer.

Course Outcomes: After completion of this lab the student is able to

- To choose instruments
- Test any instrument
- Find the accuracy of any instrument by performing experiment
- Calibrate PMMC instrument using d.c potentiometer.

List of experiments/demonstrations:

1. Calibration and Testing of single-phase energy meter.
2. Calibration of dynamometer power factor meter.
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric oil testing using H.T. testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments fromthe following list are required to be conducted

9. Calibration LPF wattmeter – by Phantom testing.
10. Measurement of 3-phase power with single watt meter and two CTs.
11. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angleof given CT by Null method.
12. PT testing by comparison – V. G. as Null detector – Measurement of % ratio errorand phase angle of the given PT
13. Resistance strain gauge – strain measurements and Calibration.
14. Transformer turns ratio measurement using AC bridges.
15. Measurement of % ratio error and phase angle of given CT by comparison.
16. Parameters of choke coil using 3-Ammeters and 3-Voltmeters.

TEXT BOOKS:

1. "G. K. Banerjee", "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition,2016
2. "S. C. Bhargava", "Electrical Measuring Instruments and Measurements", BS Publications, 2012.

REFERENCE BOOKS:

1. "A. K. Sawhney", "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.
2. "R. K. Rajput", "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. "Buckingham and Price", "Electrical Measurements", Prentice – Hall, 1988.
4. "Reissland, M. U", "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
5. "E.W. Golding and F. C. Widdis", "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

EE3109PC: Advanced Electrical Simulation Lab

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

Prerequisite: Electrical and Electronic circuits, Power System Analysis &Power Electronics

Course Objectives:

- To Simulate and analyze electrical and electronic systems**.**
- To evaluate the performance of transmission lines.
- To analyze various Faults in power systems.
- To Model, simulate and analyze the performance of DC Machines and InductionMotors.
- To analyze performance of feedback and load frequency control of the systems.

Course Outcomes: After going through this lab the student will be able to

- Design and Analyze electrical systems in time and frequency domain
- Analyze various transmission lines and perform fault analysis
- Model Load frequency control of Power Systems
- Design various Power Electronic Converters and Drives.

List of Experiments: (Any eight experiments should be conducted)

1. Generation of high frequency transients through RLC circuit.
2. Voltage distribution across insulator string.
3. Comparison of lumped and distributed transmission lines.
4. Calculation of fault currents of transmission line.
5. Time constant calculation of RLC circuit.
6. Simulation of Resonance circuit.
7. Design of first and second order circuits in time and frequency domain.
8. Performance evaluation of medium and long transmission lines.
9. Speed Control of DC Motor.
10. Speed Control of Induction motor.
11. Design and analysis of feedback control system.

NOTE: The above experiments shall be conducted using any software tool.

TEXT BOOKS:

1. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications.
2. User's manual of related software's

REFERENCE BOOKS:

1. Reference guides of related software's.
2. Rashid, Spice for power electronics and electric power, CRC Press.

EE3110PC: Microprocessors and Microcontrollers Lab

B.Tech. III Year I Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Cycle 1: Using 8086 Processor Kits and/or Assembler (5 Weeks)

- Assembly Language Programs to 8086 to Perform
  1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
  2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Cycle 2: Using 8051 Microcontroller Kit (6 weeks)

- Introduction to IDE
  1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
  2. Time delay Generation Using Timers of 8051.
  3. Serial Communication from / to 8051 to / from I/O devices.
  4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

Cycle 3: Interfacing I/O Devices to 8051(5 Weeks)

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8 bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

TEXT BOOKS:

1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006
2. The 8051 Microcontrollers: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

***MC3002 :ARTIFICIAL INTELLIGENCE**
(Mandatory Non Credit Course)

B.Tech. III Year I Sem.

L	T	P	C
3	0	0	0

Course Objectives:

To train the students to understand different types of AI agents, various AI search algorithms,fundamentals of knowledge representation, building of simple knowledge-based systems and to apply knowledge representation, reasoning. Study of Markov Models enable the student ready to step into applied AI.

Course Outcomes:

- Able to use search algorithms in AI.
- Able to apply learning and reasoning to AI systems.

UNIT - I

Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents **Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

UNIT - II

Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Mini-max Search, Alpha-Beta Pruning

Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

UNIT - III

Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non-monotonic Reasoning, Other Knowledge Representation Schemes.

Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

UNIT - IV

Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

UNIT - V

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hillpublications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex ProblemSolving, Pearson Education, 6th ed., 2009.

B.Tech.
III Year II Sem.

SM3201MS: Fundamentals of Management for Engineers

B.Tech. III Year II Sem. **L T P C**

3 0 0 3

Course Objective:

- To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.

Course Outcome:

The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT- I:

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT – II:

Planning and Decision Making: General Framework for Planning - Planning Process, Typesof Plans, Management by Objectives; Production Planning and Control. Decision making andProblem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT- III:

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Job Satisfaction, Job Enrichment, Job Enlargement, Talent Management, Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT- IV:

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT- V:

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetaryand Non- Budgetary Controls. Characteristics of Effective Controls, Establishing controlsystems, Control frequency and Methods.

TEXT BOOKS:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCE BOOKS:

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
3. Industrial Engineering and Management: Including Production Management, T.R.Banga, S.C.Sharma, Khanna Publishers.

EE3202PC: Power Electronics

B.Tech. III Year II Sem.

L	T	P	C
3	1	0	4

Prerequisite: Analog Electronics, Digital Electronics

Course Objectives:

- To Design/develop suitable power converter for efficient control or conversion of power in drive applications
- To Design / develop suitable power converter for efficient transmission and utilization of power in power system applications.

Course Outcomes: At the end of this course students will demonstrate the ability to

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers. Analyze the operation of voltage source inverters

UNIT-I

Power Switching Devices: Concept of power electronics, scope and applications, types of power converters; Power semiconductor switches and their V-I characteristics - Power Diodes, Power BJT, SCR, Power MOSFET, Power IGBT; Thyristor ratings and protection, Series and parallel connections of SCRs, Two transistor analogy of SCR, methods of SCR commutation, UJT as a trigger source, gate drive circuits for BJT and MOSFETs.

UNIT-II

AC-DC Converters(Phase Controlled Rectifiers): Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single- phase half-controlled converter with RL and RLE load, Principles of three-phase fully-controlled converter operation with RLE load, Effect of load and source inductances, General idea of gating circuits, Single phase and Three phase dual converters.

UNIT-III

DC-DC Converters (Chopper/SMPS): Introduction, elementary chopper with an active switch and diode, concepts of duty ratio, average inductor voltage, average capacitor current. Buck converter -Power circuit, analysis and waveform at steady state, duty ratio control of output voltage. Boost converter - Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage. Buck-Boost converter-Power circuit, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT-IV

AC-DC Inverters: Introduction, principle of operation, performance parameters, single phase bridge inverters with R, RL loads, 3-phase bridge inverters - 120- and 180- degrees mode of operation, Voltage control of single-phase inverters–single pulse width modulation, multiple pulse width modulation, sinusoidal pulse width modulation.

UNIT-V

AC-AC Converters: Phase Controller (AC Voltage Regulator) - Introduction, modes of operation of Triac, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter-Principle of operation of single phase cyclo-converters, relevant waveforms, circulating current mode of operation, Advantages and disadvantages.

TEXT BOOKS:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and Design”, John Wiley & Sons, 2007.

REFERENCE BOOKS:

1. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”,Springer Science &Business Media, 2007.
2. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

EE3203PC: Switch Gear and Protection

B.Tech. III Year II Sem.

L	T	P	C
3	1	0	4

Pre-requisites: Power Systems-I, Power Systems-II

Course Objectives:

- To introduce all kinds of circuit breakers and relays for protection of Generators, Transformers and feeder bus bars from Over voltages and other hazards.
- To describe neutral grounding for overall protection.
- To understand the phenomenon of Over Voltages and it's classification.

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

- Compare and contrast electromagnetic, static and microprocessor-based relays
- Apply technology to protect power system components.
- Select relay settings of over current and distance relays.
- Analyze quenching mechanisms used in air, oil and vacuum circuit breakers

UNIT – I

Introduction to Circuit Breakers

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages.- Restriking Phenomenon, Average and Maximum RRRV, Numerical Problems - Current Chopping and Resistance Switching - CB ratings andSpecifications: Types and Numerical Problems. – Auto- reclosures. Description and Operation of following types of circuit breakers: Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum, and SF6 circuit breakers.

UNIT – II

Electromagnetic and Static Relays: Principle of Operation and Construction of Attracted armature, Balanced Beam, induction Disc and Induction Cup relays.
Types of Over Current Relays: Instantaneous, DMT and IDMT types.
Application of relays: Over current/ under voltage relays, Direction relays, Differential Relays and Percentage Differential Relays. Universal torque equation.
Distance relays: Impedance, Reactance, and Mho and Off-Set Mho relays, Characteristicsof Distance Relays and Comparison. Static Relays: Static Relays verses Electromagnetic Relays.

UNIT – III

Protection of Power Equipment: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter- turn fault Protection. Numerical Problems on % Winding Unprotected.
Protection of transformers: Percentage Differential Protection, Numerical Problem on design of CT s Ratio, Buchholtz relay Protection.
Protection of Lines: Over Current, Carrier Current and Three-zone distance relay protection using Impedance relays. Translay Relay.
Protection of Bus bars – Differential protection.

UNIT – IV

Neutral Grounding: Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid,Resistance, Reactance- Arcing Grounds and Grounding Practices.

UNIT - V

Protection Against Overvoltages: Generation of Over Voltages in Power Systems.- Protection against Lightning Over Voltages - Valve type and Zinc- Oxide Lighting Arresters - Insulation Coordination -BIL, Impulse Ratio, Standard Impulse Test Wave, Volt-Time Characteristics.

TEXT BOOKS:

1. Badriram and D.N. Vishwakarma, Power System Protection and Switchgear, TMH 2001.
2. U.A.Bakshi, M.V.Bakshi: Switchgear and Protection, Technical Publications, 2009.

REFERENCE BOOKS:

1. C.Russel Mason – “The art and science of protective relaying, Wiley Eastern, 1995
2. L.P.Singh “Protective relaying from Electromechanical to Microprocessors”,New Age International.

Professional Elective II

EE3204PE: Signals and Systems

B.Tech. III Year II Sem. **L T P C**

3 0 0 3

Course Objectives:

- This gives the basics of Signals and Systems required for all Electrical Engineering related courses.
- To understand the behavior of signal in time and frequency domain.
- To understand the characteristics of LTI systems.
- This gives concepts of Signals and Systems and its analysis usingdifferent transform techniques.

Course Outcomes: Upon completing this course, the student will be able to

- Differentiate various signal functions.
- Represent any arbitrary signal in time and frequency domain.
- Understand the characteristics of linear time invariant systems.
- Analyze the signals with different transform technique.

UNIT - I

Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT – II

Fourier series: Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

UNIT - III

Signal Transmission through Linear Systems: Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV)System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF,and BPF characteristics, Causality and Paley- Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation ofConvolution.

UNIT – IV

Laplace Transforms: Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation

between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. **Z–Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction betweenLaplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints onROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

UNIT - V

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.

Correlation: Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation 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.

TEXT BOOKS:

1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.

REFERENCE BOOKS:

1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH InternationalEdition.
4. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, 3 Ed.,2004, PE.
5. Signals and Systems – K. Deergha Rao, Birkhauser, 2018.

Professional Elective-II
EE3205PE: Optimization Technique

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics –I, Mathematics –II

Course Objectives:

- To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming.
- Constrained and unconstrained optimization techniques for solving and optimizing an electrical and electronic engineering circuits design problems in real world situations.
- To explain the concept of Dynamic programming and its applications to project implementation.

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

- Explain the need of optimization of engineering systems.
- Understand optimization of electrical and electronics engineering problems
- Apply classical optimization techniques, linear programming, simplex algorithm, transportation problem.
- Apply unconstrained optimization and constrained non-linear programming and dynamic programming.
- Formulate optimization problems.

UNIT – I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.

UNIT – II

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solutionof a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.

UNIT – III

Unconstrained Non-linear Programming: One dimensional minimization methods, Classification, Fibonacci method and Quadratic interpolation method

Unconstrained Optimization Techniques: Uni-variant method, Powell's method and steepest descent method.

UNIT – IV

Constrained Non-linear Programming: Characteristics of a constrained problem - classification - Basic approach of Penalty Function method - Basic approach of Penalty Function method - Basic approaches of Interior and Exterior penalty function methods - Introduction to convex programming problem.

UNIT – V

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality –computational procedurein dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4th edition, 2009.
2. H. S. Kasene & K. D. Kumar, Introductory Operations Research, Springer(India), Pvt. Ltd.,2004

REFERENCE BOOKS:

1. George Bernard Dantzig, Mukund Narain Thapa, “Linear programming”, Springer series in operations research 3rd edition, 2003.
2. H. A. Taha, “Operations Research: An Introduction”, 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, “Optimization for Engineering Design – Algorithms and Examples”, PHI Learning Pvt. Ltd, New Delhi, 2005.

Professional Elective II

EE3206PE: Electrical and Electronics Instrumentation

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Measurements & Instrumentation

Course Objectives:

- Instrumentation is essential in monitoring and analysis of any Physical system and its control.
- This course deals with different types of transducers, digital voltmeters, oscilloscopes, and measurement of non-electrical quantities.

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

- Design and implement systems utilizing analog / digital control devices.
- Apply the concepts of automatic control, including measurement, feedback, and feed forward regulation for the operation of continuous and discrete systems.
- Solve technical problems and be proficient in the analysis, design, test, and implementation of instrumentation and control systems.
- Apply the concepts of heat transfer to the design of process control systems.
- Able to utilize modern and effective management skills for performing investigation, analysis, and synthesis in the implementation of automatic control systems.

UNIT–I

Characteristics of Signals and Their Representation: Measuring Systems, Performance Characteristics - Static characteristics, Dynamic Characteristics; Errors in Measurement- Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

Signals and their representation: Standard Test, periodic, aperiodic, modulated signal, sampled data, pulse modulation, and pulse code modulation.

UNIT–II

Oscilloscope and Digital Voltmeters: Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes- applications of CRO- Measurement of phase and frequency - lissajous patterns - Sampling oscilloscope-analog and digital type.

Digital voltmeters-Successive approximation, ramp, dual- Slope integration, continuous balance type - Microprocessor based ramp type DVM, digital frequency meter - digital phase angle meter.

UNIT–III

Signal Analyzers: Wave analyzers - Frequency selective analyzers, Heterodyne, Application of Wave analyzers-Harmonic Analyzers, Total Harmonic distortion, spectrum analyzers, Basic spectrum analyzers, spectral displays, vector impedance meter, Q meter. Peak reading and RMS voltmeters.

UNIT–IV

Transducers: Definition of transducers, Classification of transducers, Advantages of electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor,

inductor, LVDT and capacitor transducers; LVDT Applications, Strain gauge and its principle of operation, gauge factor, Thermistors, Thermocouples, Synchros, Piezoelectric transducers, photovoltaic, photoconductive cells, photo diodes.

UNIT–V

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Force Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Venturimeter: Working Principle.

Text Books:

1. D. V. S Murthy, “Transducers and Instrumentation”, Prentice Hall of India, 2nd edition,2009.
2. K. Sawhney, “A course in Electrical and Electronic Measurements andInstrumentation”, Dhanpatrai & Co., 12th edition, 2010.

Reference Books:

1. D O Doeblin, “Measurements Systems, Applications and Design”, TMH Publications,5th edition, 2003.
2. D Helfrick and W. D. Cooper, “Modern Electronic Instrumentation and Measurementtechniques”, Pearson/Prentice Hall of India, 12th edition, 2010.
3. S Morris, “Principles of Measurement and Instrumentation”, Pearson /Prentice Hall ofIndia, 2nd edition, 1994.
4. H. S. Kalsi, “Electronic Instrumentation”, Tata McGraw-Hill Edition, 1995, 1stedition, 1995.

EE3207PC: Power Systems Lab

B.Tech. III Year II Sem.

L	T	P	C
1	0	3	2.5

Prerequisite: Power System-I, Power System-II, Power System Protection, Power SystemOperation and Control, Electrical Machines

Course Objectives:

- Perform testing of CT, PT's and Insulator strings
- To find sequence impedances of 3-Φ synchronous machine and Transformer
- To perform fault analysis on Transmission line models and Generators.

Course Outcomes: After completion of this lab, the student will be able to

- Perform various load flow techniques
- Understand Different protection methods
- Analyze the experimental data and draw the conclusions**.**

The following experiments are required to be conducted as compulsory experiments:

1. Characteristics of IDMT Over-Current Relay.
2. Differential protection of 1-Φ transformer.
3. Characteristics of Micro Processor based Over Voltage/Under Voltage relay.
4. A,B,C,D constants of a Long Transmission line
5. Finding the sequence impedances of 3-Φ synchronous machine.
6. Finding the sequence impedances of 3-Φ Transformer.

In addition to the above six experiments, at least any four of the experiments from thefollowing list are required to be conducted.

1. Formation of YBUS.
2. Load Flow Analysis using Gauss Seidal (GS) Method.
3. Load Flow Analysis using Fast Decoupled (FD) Method.
4. Formation of ZBUS.
5. Simulation of Compensated Line

TEXT BOOKS:

1. C.L. Wadhwa: Electrical Power Systems –Third Edition, New Age International Pub.Co., 2001.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.

REFERENCE BOOK:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.

EE3208PC: Power Electronics Lab

B.Tech. III Year II Sem.

L	T	P	C
0	0	3	1.5

Prerequisite: Power Electronics

Course Objectives:

- Apply the concepts of power electronic converters for efficient conversion/control ofpower from source to load.
- Design the power converter with suitable switches meeting a specific load requirement.

Course Outcomes: After completion of this course, the student is able to

- Understand the operating principles of various power electronic converters.
- Use power electronic simulation packages& hardware to develop the power converters.
- Analyze and choose the appropriate converters for various applications.

Any eight experiments should be conducted

1. Study of Characteristics of SCR, MOSFET & IGBT,
2. Gate firing circuits for SCR's
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase half controlled &fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. Single Phase Cyclo-converter with R and RL loads
7. Single Phase series& parallel inverter with R and RL loads
8. Single Phase Bridge inverter with R and RL loads

Any two experiments should be conducted

1. DC Jones chopper with R and RL Loads
2. Three Phase half-controlled bridge converter with R-load
3. Single Phase dual converter with RL loads
4. (a)Simulation of single-phase Half wave converter using R and RL loads
   (b)Simulation of single-phase full converter using R, RL and RLE loads
   (c)Simulation of single-phase Semi converter using R, RL and RLE loads
5. (a)Simulation of Single-phase AC voltage controller using R and RL loads
   (b)Simulation of Single phase Cyclo-converter with R and RL-loads
6. Simulation of Buck chopper
7. Simulation of single-phase Inverter with PWM control
8. Simulation of three phase fully controlled converter with R and RL loads, with and without freewheeling diode. Observation of waveforms for Continuous and Discontinuous modes of operation.
9. Study of PWM techniques

TEXT BOOKS:

1. M. H. Rashid, Simulation of Electric and Electronic circuits using PSPICE – by M/s PHI Publications.
2. User's manual of related software's

REFERENCE BOOKS:

1. Reference guides of related software's.
2. Rashid, Spice for power electronics and electric power, CRC Press.

EN3209HS: Advanced Communication Skills Lab

B.Tech. III Year II Sem.

L	T	P	C
0	0	2	1

1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd yearlevel. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
2. Further, they would be required to communicate their ideas relevantly and coherently inwriting.
3. To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary**
   a. Starting a conversation – responding appropriately and relevantly – using the right body language
   b. Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** – General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing –improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ emails/ assignments etc.

5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, Intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured andused.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by
- CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt.Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge,5thEdition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumarand Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd,2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford UniversityPress2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. NewDelhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.

***MC3001 Cyber Security**
(Mandatory Non Credit Course)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	0

Prerequisites: NIL

Course objectives:

- To familiarize various types of cyber-attacks and cyber-crimes.
- To give an overview of the cyber laws.
- To study the defensive techniques against these attacks.

Course Outcomes: The students will be able to understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT - I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the

ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks,Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofinginstances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles,Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&FGroup.

B.Tech.
IV Year I Sem.

EE4101PC: Power Semiconductor Drives

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Electronics, Electrical Machines – I, Electrical Machines – II

Course Objectives:

- To introduce the drive system and operating modes of drive and its characteristics.
- To understand Speed – Torque characteristics of different motor drives by various power converter topologies.
- To appreciate the motoring and braking operations of drive.
- To differentiate DC and AC drives.

Course Outcomes: After completion of this course the student is able to

- Identify the drawbacks of speed control of motor by conventional methods.
- Differentiate Phase controlled and chopper-controlled DC drives speed-torque characteristics merits and demerits.
- Understand Ac motor drive speed–torque characteristics using different control strategies its merits and demerits.
- Describe Slip power recovery schemes.

UNIT- 1: Control of DC motors

Introduction to Thyristor controlled Drives, Single Phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – continuous current operation – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque Characteristics- Problems on Converter fed d.c motors.

Three phase semi and fully controlled converters connected to d.c separately excited and d.c series motors – output voltage and current waveforms – Speed and Torque expressions – Speed – Torque characteristics – Problems.

UNIT-II: Four quadrant operation of DC Drives

Introduction to Four quadrant operation – Motoring operations, Electric Braking – Plugging, Dynamic, and Regenerative Braking operations. Four quadrant operation of D.C motors by single phase and three phase dual converters – Closed loop operation of DC motor (Block Diagram Only) **Control of DC Motors By Choppers:** Single quadrant, Two quadrant and four quadrant chopper fed dc separately excited and series motors – Continuous current operation – Output voltage and current wave forms – Speed and torque expressions – speed-torque characteristics – Problems on Chopper fed D.C Motors – Closed Loop operation (Block Diagram Only).

UNIT-III: Control of Induction motors

Variable voltage characteristics-Control of Induction Motor by Ac Voltage Controllers – Waveforms – speed torque characteristics. Variable frequency characteristics-Variable frequency control of induction motor by Voltage source and current source inverter and cyclo converters- PWM control – Comparison of VSI and CSI operations – Speed torque characteristics – numerical problems on induction motor drives – Closed loop operation of induction motor drives (Block Diagram Only).

UNIT-IV: Rotor side control of Induction motors

Static rotor resistance control – Slip power recovery – Static Scherbius drive – Static Kramer Drive – their performance and speed torque characteristics – advantages, applications, problems.

UNIT-V: Control of Synchronous motors

Separate control and self-control of synchronous motors – Operation of self-controlled synchronous motors by VSI, CSI and cyclo converters. Load commutated CSI fed Synchronous Motor – Operation – Waveforms – speed torque characteristics – Applications – Advantages and Numerical Problems – Closed Loop control operation of synchronous motor drives (Block Diagram Only), variable frequency control - Cyclo converter, PWM based VSI & CSI.

TEXT BOOKS:

1. "G K Dubey", Fundamentals of Electric Drives, CRC Press, 2002.
2. "Vedam Subramanyam", Thyristor Control of Electric drives, Tata McGraw Hill Publications,1987.

REFERENCE BOOKS:

1. "S K Pillai", A First course on Electrical Drives, New Age International (P) Ltd. 2nd Edition. 1989.
2. "P. C. Sen", Thyristor DC Drives, Wiley-Blackwell, 1981.
3. "B. K. Bose", Modern Power Electronics, and AC Drives, Pearson 2015.
4. "R. Krishnan", Electric motor drives - modeling, Analysis and control, Prentice HallPTR, 2001.

EE4102PE: Digital Signal Processing

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Analog Electronics

Course Objectives:

- To learn basic techniques for the design of digital circuits and fundamental conceptsused in the design of digital systems.
- To understand common forms of number representation in digital electronic circuitsand to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

UNIT - I

Fundamentals of Digital Systems and Logic Families: Digital signals, digital circuits, AND,OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems- binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT - II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial ladder, ALU, elementary ALU design, popularMSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT - III

Sequential Circuits and Systems: A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J, K, T and D types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT - IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

UNIT - V

Semiconductor Memories and Programmable Logic Devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, Read Only Memory (ROM), Read and Write Memory (RAM), Content Addressable Memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, Complex Programmable Logic Devices (CPLDS), Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCE BOOK:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Professional Elective III

EE4103PE: Power System Operation and Control

B.Tech. IV Year I Sem.	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Pre-requisites: Power System-I, Power System-II

Course Objectives:

- To understand real power control and operation
- To know the importance of frequency control
- To analyze different methods to control reactive power
- To understand unit commitment problem and importance of economic load dispatch
- To understand real time control of power systems

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

- Understand operation and control of power systems.
- Analyze various functions of Energy Management System (EMS) functions.
- Analyze whether the machine is in stable or unstable position.
- Understand power system deregulation and restructuring.

UNIT- 1: Load Flow Studies

Introduction, Bus classification -Nodal admittance matrix - Load flow equations - Iterative methods - Gauss and Gauss Seidel Methods, Newton- Raphson Method - Fast Decoupled method-Merits and demerits of the above methods-System data for load flow study.

UNIT-II: Economic Operation of Power Systems Distribution of load between units within a plant- Transmission loss as a function of plant generation, Calculation of loss coefficients-Distribution of load between plants.

UNIT-III: Load Frequency Control

Introduction, load frequency problem-Megawatt frequency (or P-f) control channel, MVAR voltages (or Q-V) control channel-Dynamic interaction between P-f and Q-V loops. Mathematical model of speed governing system-Turbine models, division of power system into control areas, P-f control of single control area (the uncontrolled and controlled cases)-P-f control of two area systems (the uncontrolled cases and controlled cases).

UNIT-IV: Power System Stability

The stability problem-Steady state stability, transient stability and Dynamic stability-Swing equation. Equal area criterion of stability-Applications of Equalarea criterion, Step by step solution of swing equation-Factors affecting transient stability, Methods to improve steady state and Transient stability, Introduction to voltage stability.

UNIT-V: Electrical Installations

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology

TEXT BOOKS

1. C. L. Wadhwa, Electrical Power Systems, 3rd Edn, New Age International PublishingCo., 2001.
2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th Edn, TataMcGraw Hill Education Private Limited 2011.

REFERENCE BOOKS:

1. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co. 2003.
2. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002.

Professional Elective III

EE4104PE: Advanced Power Electronics

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objective:

- To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT,GTO etc.
- To understand the use and design of Inductors, Capacitors, transformers and filtersfor Choppers, Inverters and Converters.
- To understand application of aforesaid Power Electronics devices in advanced topologies of Choppers, Inverters and Converters etc.
- To understand PWM techniques of DC-DC converters, AC Converters etc.

Course outcomes: Students are able to

- To understand various Power Electronics devices such as SCR, TRIAC, DIAC, IGBT,GTO etc.
- To understand the use of Inductors, Capacitors, transformers and filters for Choppers, Inverters and Converters.
- To understand application of aforesaid Power Electronics devices in Choppers, Inverters and Converters etc.
- To understand control of Electrical Motors through DC-DC converters, AC Converters etc.

Unit-I

Design of Power Converters Components: Design of magnetic components - design of transformer, design of inductor and current transformer - Selection of filter capacitors, Selection of ratings for devices, input filter design, Thermal design, Review of Power Electronic semiconductor devices.

Unit-II

Multi-level converters: Need for multi-level inverters, Concept of multi-level, Topologies for multi-level: Diode Clamped, Flying capacitor and Cascaded H-bridge multilevel Converters configurations; Features and relative comparison of these configurations and its applications, Introduction to Matrix Converters.

Unit III

PWM Techniques for Converters : Concept of PWM techniques, types of PWM, sinusoidalPWM – modified PWM – phase displacement Control – Trapezoidal, staircase, stepped, harmonic injection and delta modulation– numerical problems - Three-Phase Inverters-Sinusoidal PWM- 60^0 PWM- Third Harmonic PWM- Space Vector Modulation-Comparisonof PWM Techniques-

UNIT - IV DC-DC Switch-Mode Converters & Switching DC Power Supplies Control of dc-dc converter: Buck converter, boost converter, buck-boost converter, cuk dc-dc converter, full bridge dc-dc converter, dc-dc converter comparison. Introduction, linear powersupplies, overview of switching power supplies, dc-dc converters with electrical isolation, control of switch mode dc power supplies, power supply protection, and electrical isolation inthe feedback loop, designing to meet the power supply specifications.

UNIT - V Resonant Converters & Power Conditioners and Uninterruptible Power Supplies: Classification of resonant converters, basic resonant circuit concepts, load-resonant converters, resonant-switch converters, zero-voltage-switching, resonant-dc-link inverters with zero-voltage switching's, high frequency-link integral-half cycle converters. Power line disturbances, Introduction to Power Quality, power Conditioners, uninterruptible power supplies, Applications.

Text Books:

1. "M. H. Rashid", Power electronics circuits, Devices and applications, PHI, I edition – 1995.
2. "Ned Mohan, Tore M. Undeland and William P. Robbins, A", "Power Electronics converters, Applications and Design" John Wiley & Sons, Inc., Publication, 3rd Edition 2003

Reference Books:

1. "Bin Wu, A", "High-Power Converters and Ac Drives" John Wiley & Sons, Inc., Publication, 2006.
2. Abraham I. Pressman, Keith Billings &Taylor Morey: Switching Power Supply Design,McGraw Hill International, 3rd Edition, 2009.
3. R.W. Erickson and Dragan Maksimonic: Fundamentals of Power Electronics, Springer, 2nd Edition, 2001.
4. Umanand, L., Power Electronics: Essentials and Applications, John Wiley India, 1stEdition, 2009

.

Professional Elective IV
EE4105PE: HVDC Transmission

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power System-I, Power System-II, Power System Protection, Power System Operation and Control, Power Electronics.

Course Objectives:

- To compare EHV AC and HVDC systems.
- To analyze Graetz circuit and also explain 6 and 12 pulse converters.
- To control HVDC systems with various methods and to perform power flow analysis in AC/DC systems.
- To describe various protection methods for HVDC systems and Harmonics.

Course Outcomes: After completion of this course the student is able to

- Compare EHV AC and HVDC system and to describe various types of DC links.
- Analyze Graetz circuit for rectifier and inverter mode of operation.
- Describe various methods for the control of HVDC systems and to perform power flow analysis in AC/DC systems.
- Describe various protection methods for HVDC systems and classifyHarmonics and design different types of filters.

UNIT- I Introduction
Basic Concepts Necessity of HVDC systems, Economics and Terminal equipment of HVDC transmission systems, Types of HVDC Links, Apparatus required for HVDC Systems, Comparison of AC and DC Transmission, Application of DC Transmission System, Planning and Modern trends in D.C. Transmission.
Analysis of HVDC Converters: Choice of Converter Configuration, Analysis of Graetz circuit, Characteristics of 6 Pulse and 12 Pulse converters, Cases of two 3 phase converters in Y/Y mode –their performance.

UNIT- II
Converter and HVDC System Control: Principle of DC Link Control, Converters Control Characteristics, Firing angle control, Current and extinction angle control, Effect of source inductance on the system, Starting and stopping of DC link, Power Control.
Reactive Power Control in HVDC: Introduction, Reactive Power Requirements in steady state, sources of reactive power- Static VAR Compensators, Reactive power control during transients.

UNIT- III
Power Flow Analysis in AC/DC Systems: Modelling of DC Links, DC Network, DC Converter, Controller Equations, Solution of DC load flow, P.U. System for DC quantities, solution of AC-DC Power flow - Simultaneous method -Sequential method.

UNIT- IV
Converter Faults and Protection: Converter faults, protection against over current and over voltage in converter station, surge arresters, smoothing reactors, DC breakers,Audible noise, space charge field, corona effects on DC lines, Radio interference.

UNIT-V

Harmonics: Generation of Harmonics, Characteristics harmonics, calculation of AC Harmonics, Non-characteristics harmonics, adverse effects of harmonics, Calculation of voltage and Current harmonics,

Effect of Pulse number on Filters: Types of AC filters, Design of Single tuned filters – Design of High pass filters.

TEXT BOOKS:

1. "K. R. Padiyar", HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. "S K Kamakshaiah, V Kamaraju", HVDC Transmission, TMH Publishers, 2011.

REFERENCE BOOKS:

1. "S. Rao", EHVAC and HVDC Transmission Engineering and Practice, Khanna publications, 3rdEdition 1999.
2. "Jos Arrillaga", HVDC Transmission, The institution of electrical engineers, IEE power& energy series 29, 2nd edition 1998.
3. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1, 1971.
4. "E. Uhlmann", Power Transmission by Direct Current, B. S. Publications, 2009.

EE4106PE: Electrical and Hybrid Vehicles

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Semiconductor Drives, Electrical Drives and Control, Utilization of Electric Energy

Course Objectives:

- To understand the fundamental concepts, principles, analysis and design of hybrid and electric vehicles.
- To know the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used energy storage devices, etc.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the models to describe hybrid vehicles and their performance.
- Understand the different possible ways of energy storage.
- Understand the different strategies related to energy storage systems.

UNIT - I

Introduction to Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

UNIT - II

Introduction To Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive- trains on energy supplies.

Hybrid Electric Drive-Trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive- train topologies, fuel efficiency analysis.

UNIT - III

Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Electric Propulsion Unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control ofInduction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT - IV

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

UNIT - V

Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.

REFERENCE BOOKS:

1. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, andFuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2004.
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.

EE4107PE: Utilization of Electrical Engineering

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Machines-I & Electrical Machines-II & Power Electronics

Course Objectives:

- To understand the fundamentals of illumination and good lighting practices.
- To understand the methods of electric heating and welding.
- To understand the concepts of electric drives and their application to electrical traction systems.

Course Outcomes: After completion of this course the student is able to

- Acquire knowledge on, electric drives characteristics and their applicability in industry based on the nature of different types of loads and their characteristics
- Understands the concepts and methods of electric heating, welding, illumination and electric traction
- Apply the above concepts to real-world electrical and electronics problems and applications.

UNIT–I

Electric Drives: Type of electric drives, choice of motor, starting and running characteristics, speed control, heating and cooling curves, particular applications of electric drives, steady state stability, multi quadrant Dynamics, acceleration, deceleration, starting & stopping of drive, types of industrial loads, continuous, intermittent and variable loads, load equalization.

UNIT– II

Electric Heating: Advantages and methods of electric heating, resistance heatinginduction heating and dielectric heating.

Electric Welding: Electric welding, resistance and arc welding, electric weldingequipment, comparison between A.C. and D.C. Welding.

UNIT–III

Illumination: Introduction, terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

Various Illumination Methods: Discharge lamps, MV and SV lamps – comparisonbetween tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT– IV

Electric Traction – I: System of electric traction and track electrification. Review of existing electric traction systems in India. Special features of traction motor, methods of electric braking-plugging rheostat braking and regenerative braking.

Mechanics of train movement: Speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT–V

Electric Traction-II: Calculations of tractive effort, power, specific energy consumption forgiven run, effect of varying acceleration and braking retardation, adhesive weight and coefficient of adhesion.

TEXT BOOKS:

1. E. Openshaw Taylor, Utilisation of Electric Energy – by University press, 1961.
2. Partab, H., 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai andSons, New Delhi, 1986.

REFERENCE BOOKS:

1. N. V. Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited, Publishers, 1996.
2. C. L. Wadhwa, Generation, Distribution and Utilization of electrical Energy, New Age International (P) Limited, Publishers, 1997.
3. Tripathy, S.C., 'Electric Energy Utilisation and Conservation', Tata McGraw Hill Publishing Company Ltd. New Delhi, 1991.

EE4109PC: Electrical and Electronics Design Lab

B.Tech. IV Year I Sem.

L	T	P	C
1	0	4	3

Prerequisite: Basics of Electrical Engineering

Course Objectives:

- To enhance practical knowledge related to different subjects.
- To develop hardware skills such as soldering, winding etc.
- To develop debugging skills.
- To increase ability for analysis and testing of circuits.
- To give an exposure to market survey for available components.
- To develop an ability for proper documentation of experimentation.
- To enhance employability of a student.
- To prepare students for working on different hardware projects.

Course Outcomes: After completion of course, student will be able to

- Get practical knowledge related to electrical.
- Fabricate basic electrical circuit elements/networks.
- Trouble shoots the electrical circuits.
- Design filter circuit for application.
- Get hardware skills such as soldering, winding etc.
- Get debugging skills.

Group A:

1. Design and fabrication of reactor/ electromagnet for different inductance values.
2. Design and fabrication of single-phase Induction/three phase motor stator.
3. Start delta starter wiring for automatic and manual operation.
4. Wiring of distribution box with MCB, ELCB, RCCB and MCCB.
5. Wiring of 40 W tube, T-5, LED, Metal Halide lamps and available latest luminaries.
6. Assembly of various types of contactors with wiring.
7. Assembly of DOL and 3-point starter with NVC connections and overload operation.

Group B: This group consists of electronic circuits which must be assembledand tested on general purpose PCB or bread boards.

1. Design and development of 5 V regulated power supply.
2. Design and development of precision rectifier.
3. Design and development of first order/ second order low pass/high passfilters with an application.
4. Microcontroller Interface circuit for temperature/level/speed/current/voltage measurement.
5. Peak detector using op-amplifiers.
6. Zero crossing detector using op-amplifiers.
7. PCB design and layout.

*MC4001: Intellectual Property Rights
(Mandatory Non Credit Course)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	0

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli,Tata McGraw Hill Publishing company ltd.

B.Tech.

IV Year II Sem.

Professional Elective V

EE4201PE: Extra High Voltage AC (EHVAC)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Systems-I & II

Course Objectives:

- To understand the basic concepts of EHV AC transmission.
- To get the Knowledge on EHV transmission line inductance and capacitance.
- To understand the voltage gradients of conductor.
- To identify corona effects on transmission lines.
- To calculate electrostatic fields of EHV AC lines and its effects.
- To analyze travelling waves.
- To distinguish various compensators for voltage control.

Course Outcomes: After completion of this course the student is able to

- Understand the basic concepts of EHV AC transmission.
- Get the Knowledge on EHV transmission line inductance and capacitance
- Understand the voltage gradients of conductor
- Identify corona effects on transmission lines
- Calculate electrostatic fields of EHVAC lines and its effects
- Analyze travelling waves
- Distinguish various compensators for voltage control

UNIT – I

Preliminaries: Necessity of EHV AC transmission – advantages and problems– Standard Transmission Voltages – power handling capacity and line losses- mechanical considerations in Line performance – resistance of conductors – Properties of bundled conductors –Examples.

UNIT – II

Line and Ground Reactive Parameters:

Line inductance and capacitances – sequence inductances and capacitances – Line parameters for modes of propagation – Resistance and Inductance of ground return – Examples

Voltage Gradients of Conductors: Electrostatics – field of sphere gap – field of linecharges and properties – charge-potential relations for multi-conductor lines – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle –Examples.

UNIT – III

Corona Effects – I: Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram – Audible noise generation and characteristics - limits and measurements of AN – relation between 1-phase and 3-phaseAN levels – Examples.

Corona Effects – II: Radio interference (RI) – corona pulses: generation, properties– limits for Radio Interference Fields – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions – Examples.

UNIT – IV

Electro Static Field: Electrostatic field: calculation of electrostatic field of EHV/AC lines –effect on humans, animals and plants – electrostatic induction in un- energized circuit of double-circuit line –electromagnetic interference-Examples.

Traveling Wave Theory: Traveling wave expression and solution – source of excitation terminal conditions – open circuited and short-circuited end – reflection and refraction coefficients – Principles of Travelling-Wave Protection of E.H.V. Lines.

UNIT – V

Line Compensation: Generalized constants–No load voltage conditions and charging current–Power circlediagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.

TEXT BOOKS:

1. "K. R. Padiyar", HVDC Power Transmission Systems: Technology and system Interactions, New Age International (P) Limited, and Publishers, 1990.
2. "S K Kamakshaiah, V Kamaraju", HVDC Transmission, TMH Publishers, 2011.
3. "S. Rao", EHVAC and HVDC Transmission Engineering and Practice, Khanna publications, 3rd Edition 1999.

REFERENCE BOOKS:

1. "Jos Arrillaga", HVDC Transmission, The institution of electrical engineers, IEEE power & energy series 29, 2nd edition 1998.
2. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1, 1971.
3. "E. Uhlmann", Power Transmission by Direct Current, B. S. Publications, 2009.

Professional Elective V

EE4202PE: Control system design

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Control Systems

Course Objectives:

- To know the time and frequency domain design problem specifications.
- To understand the design of classical control systems in time-domain.
- To analyze the design aspects of classical control systems in frequency-domain.
- To know the design of various compensator controllers.
- To identify the performance of the systems by design them in state-space.
- To study the effects of nonlinearities on various systems performance.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand various design specifications.
- Design controllers to satisfy the desired design specifications using simple controller structures (P, PI, PID, compensators).
- Design controllers using the state-space approach.

UNIT – I

Design Specifications: Introduction to design problem andphilosophy. 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. Non-linearities and Its Effect on System Performance: Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

TEXT BOOKS:

1. N. Nise, “Control system Engineering”, John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, “Control system engineering”, Wiley, 2000.

REFERENCE BOOKS:

1. M. Gopal, “Digital Control Engineering”, Wiley Eastern, 1988.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall, 2010.
3. B. C. Kuo, “Automatic Control system”, Prentice Hall, 1995.
4. J. J. D’Azzo and C. H. Houpis, “Linear control system analysis and design (conventional and modern)”, McGraw Hill, 1995.
5. R. T. Stefani and G. H. Hostetter, “Design of feedback Control Systems”, SaundersCollege Pub, 1994.

Professional Elective V
EE4203PE: Power Quality and FACTS

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Power Electronics, Power System Operation and Control, HVDC Transmission

Course Objectives:

- Definition of power quality and different terms of power quality.
- Study of voltage power quality issue – short and long interruption.
- Detail study of characterization of voltage sag magnitude and three phase unbalanced voltage sag.
- Know the behaviour of power electronics loads; induction motors, synchronous motor etc.. by the power quality issues.
- Overview of mitigation of power quality issues by the VSI converters.
- To understand the fundamentals of FACTS Controllers,
- To know the importance of controllable parameters and types of FACTS controllers & their benefits
- To understand the objectives of Shunt and Series compensation
- To Control STATCOM and SVC and their comparison and the regulation of STATCOM, Functioning and control of GCSC, TSSC and TCSC

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

- Know the severity of power quality problems in distribution system.
- Understand the concept of voltage sag transformation from up-stream (higher voltages) to down-stream (lower voltage).
- Concept of improving the power quality to sensitive load by various mitigating custom power devices.
- Choose proper controller for the specific application based on system requirements.
- Understand various systems thoroughly and their requirements.
- Understand the control circuits of Shunt Controllers SVC & STATCOM for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping.
- Understand the Power and control circuits of Series Controllers GCSC, TSSC and TCSC.

UNIT-I

Power Quality Problems in Distribution Systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave- form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. International standards of power quality, Computer Business Equipment Associations (CBEMA) curve.

UNIT-II

Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

UNIT-III

Static Shunt Compensators: Objectives of shunt compensation, Methods of controllable VAR generation, Static VAr Compensator, its characteristics, TCR, TSC,FC- TCR configurations, STATCOM, basic operating principle, control approaches and characteristics.

UNIT-IV

Static Series Compensators: Objectives of series compensator, variable impedancetype of series compensators, TCSC, TSSC-operating principles and control schemes, SSSC, Power Angle characteristics, Control range and VAR rating, Capability to provide reactive power compensation, external control.

UNIT-V: Combined Compensators: Introduction to Unified Power Flow Controller Basic operating principles, Conventional control capabilities, Independent control of real and reactive power.

TEXT BOOKS:

1. Electrical Power Systems Quality, Dugan Roger C, Santoso Surya, Mc Granaghan,Marks F.Beaty and H. Wayre, Mc Graw Hill.
2. Power Systems Quality Assessment, J. Arillaga, N.R. Watson, S.Clon, John Wiley.

REFERENCE BOOKS:

1. Power Quality, C.Sankaran, CRC Press. Understanding power quality problems, Math H.Bollen, IEEE press.
2. “Understanding FACTS –Concepts and Technology of Flexible AC TransmissionSystems”, Narain G.Honorani, Laszlo Gyugyi

Professional Elective V
EE4204PE: AI Techniques in Electrical Engineering

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Pre-requisites: Power Systems Operation and Control

Course Objectives:

- To locate soft commanding methodologies, such as artificial neural networks, Fuzzylogic and genetic Algorithms.
- To observe the concepts of feed forward neural networks and about feedback neuralnetworks.
- To practice the concept of fuzziness involved in various systems and comprehensive knowledge of fuzzy logic control and to design the fuzzy control.
- To analyze genetic algorithm, genetic operations and genetic mutations.

Course Outcomes: Upon the completion of this course, the student will be able to

- Understand feed forward neural networks, feedback neural networks and learningtechniques.
- Understand fuzziness involved in various systems and fuzzy set theory.
- Develop fuzzy logic control for applications in electrical engineering.
- Develop genetic algorithm for applications in electrical engineering.

UNIT – I

Artificial Neural Networks: Introduction, Models of Neuron Network-Architectures – Knowledge representation, Artificial Intelligence and Neural networks–Learning process – Error correction learning, Hebbian learning –Competitive learning-
Boltzman learning, supervised learning-Unsupervised learning– Reinforcement learning-Learning tasks.

UNIT – II

ANN Paradigms: Multi-layer perceptron using Back propagation Algorithm (BPA), Self – Organizing Map (SOM), Radial Basis Function Network-Functional Link Network (FLN), Hopfield Network.

UNIT - III

Fuzzy Logic: Introduction –Fuzzy versus crisp, Fuzzy sets- Membership function –Basic Fuzzy set operations, Properties of Fuzzy sets –Fuzzy Cartesian Product, Operations on Fuzzy relations –Fuzzy logic–Fuzzy Quantifiers, Fuzzy Inference- Fuzzy Rule based system, Defuzzification methods.

UNIT - IV

Genetic Algorithms: Introduction-Encoding –Fitness Function- Reproduction operators, Genetic Modeling –Genetic operators- Cross over-Single site cross over, Two point cross over –Multi point cross over Uniform cross over, Matrix cross over-Cross over Rate- Inversion & Deletion, Mutation operator – Mutation – Mutation Rate-Bit-wise operators, Generational cycle- convergence of Genetic Algorithm.

UNIT – V

Applications of AI Techniques: Load forecasting, Load flow studies, Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, Speed control of DC and AC Motors.

TEXT BOOKS

1. S. Rajasekaran and G.A.V. Pai Neural Networks, Fuzzy Logic & Genetic Algorithms,PHI, NewDelhi, 2003.
2. Rober J. Schalkoff, Artificial Neural Networks, Tata McGraw Hill Edition, 2011.

REFERENCE BOOKS:

1. P.D. Wasserman; Neural Computing Theory & Practice, Van Nostrand Reinhold,New York,1989.
2. Bart Kosko; Neural Network & Fuzzy System, Prentice Hall, 1992
3. D.E. Goldberg, Genetic Algorithms, Addison-Wesley 1999.

Professional Elective VI

EE4205PE: Electrical Distributed System

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Power System – I, Power System - II

Course Objectives:

- To distinguish between transmission and distribution systems
- To understand design considerations of feeders
- To compute voltage drop and power loss in feeders
- To understand protection of distribution systems
- To examine the power factor improvement and voltage control

Course Outcomes: After completion of this course, the student able to

- Distinguish between transmission, and distribution line and design the feeders
- Compute power loss and voltage drop of the feeders
- Design protection of distribution systems
- Understand the importance of voltage control and power factor improvement

UNIT- 1: General Concepts: Introduction to distribution system, Distribution system planning, Factors effecting the Distribution system planning, Load modelling and characteristics. Coincidence factor – contribution factor - Loss factor - Relationship between the load factor and loss factor. Load growth, Classification of loads (Residential, commercial, Agricultural and Industrial) and their characteristics.
Distribution Feeders: Design Considerations of Distribution Feeders: Radial, loop and network types of primary feeders, Introduction to low voltage distribution systems (LVDS) and High voltage distribution systems (HVDS), voltage levels, Factors effecting the feeder voltage level, feeder loading, Application of general circuit constants (A, B, C, D) to radial feeders, basic design practice of the secondary distribution system, secondary banking, secondary network types, secondary mains.

UNIT-II: Substations: Location of Substations: Rating of distribution substation, service area with 'n' primary feeders. Benefits derived through optimal location of substations. Optimal location of Substations (Perpendicular bisector rule and X, Y co- ordinate method).
System Analysis: Voltage drop and power-loss calculations: Derivation for voltage drop and power loss in lines, manual methods of solution for radial networks, three phase balanced primary lines, analysis of non-three phase systems, method to analyze the distribution feeder cost.

UNIT-III: Protection: Objectives of distribution system protection, types of common faults and procedure for fault calculations, over current Protective Devices: Principle of operation of Fuses, Auto- Circuit Recloser - and Auto-line sectionalizes, and circuit breakers.
Coordination: Coordination of Protective Devices: Objectives of protection co-ordination, general coordination procedure, Types of protection coordination: Fuse to Fuse, Auto-Recloser to Fuse, Circuit breaker to Fuse, Circuit breaker to Auto-Recloser.

UNIT-IV: Compensation for Power Factor Improvement: Capacitive compensation for power-factor control - Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched), effect of series capacitors, difference between shunt and series capacitors, Calculation of Power factor correction, capacitor allocation – Economic justification of capacitors - Procedure to determine the best capacitor location.

TEXT BOOKS:

1. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 3rd Edition 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, Tata Mc Graw Hill Publishing Company, 2nd edition, 2010.

REFERENCE BOOKS:

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd edition, University press2004.
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing Company, 6th edition, 2013.

Professional Elective VI
EE4206PE: Smart Grid Technology

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Objectives:

- To group various aspects of the smart grid.
- To defend smart grid design to meet the needs of a utility.
- To select issues and challenges that remain to be solved.
- To analyze basics of electricity, electricity generation, economics of supply and demand, and the various aspects of electricity market operations in both regulated and deregulated environment.

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

- Understand the features of small grid in the context of Indian grid.
- Understand the role of automation in transmission and distribution.
- Apply evolutionary algorithms for smart grid.
- Understand operation and maintenance of PMUs, PDCs, WAMs, and voltage andfrequency control in micro grid

UNIT- I

Introduction to Smart Grid: What is Smart Grid? Working definitions of Smart Grid and Associated Concepts – Smart grid Functions - Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages –Indian Smart Grid – Key Challenges for Smart Grid.

UNIT- II

Smart Grid Architecture: Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation –Renewable Integration.

UNIT- III

Tools and Techniques for Smart Grid: Computational Techniques –Static and Dynamic Optimization Techniques – Computational Intelligence Techniques – EvolutionaryAlgorithms – Artificial Intelligence techniques.

UNIT – IV

Distribution Generation Technologies: Introduction to Renewable Energy Technologies – Micro grids – Storage Technologies – Electric Vehicles and plug – in hybrids – Environmental impact and Climate Change – Economic Issues.

Communication Technologies and Smart Grid: Introduction to Communication Technology – Synchro-Phasor Measurement Units (PMUs) –Wide Area Measurement Systems (WAMS).

UNIT – V

Control of Smart Power Grid System: Load Frequency Control (LFC) in Micro Grid System – Voltage Control in Micro Grid System – Reactive Power Control in SmartGrid. Case Studies and Test beds for the Smart Grids.

TEXT BOOKS:

1. Turan Gonen, Electric Power Distribution System Engineering, CRC Press, 3rd Edition 2014.
2. V. Kamaraju, Electrical Power Distribution Systems, Tata Mc Graw Hill PublishingCompany,2nd edition, 2010.

REFERENCE BOOKS:

1. G. Ram Murthy, Electrical Power Distribution hand book, 2nd edition, Universitypress 2004.
2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing company, 6thedition, 2013.

Professional Elective VI
EE4207PE: Power System Reliability

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Reliability Engineering, Power System-I, Power System-II, Power System Operation and Control

Course Objectives:

- To describe the generation system model and recursive relation for capacitive modelbuilding
- To explain the equivalent transitional rates, cumulative probability and cumulativefrequency
- To develop the understanding of risk, system and load point reliability indices
- To explain the basic and performance reliability indices

Course Outcomes: Upon the completion of this course, the student will be able to

- Estimate loss of load and energy indices for generation systems model.
- Describe merging generation and load models.
- Apply various indices for distribution systems.
- Evaluate reliability of interconnected systems.

UNIT- I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability,Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

UNIT - II

Generating System Reliability Analysis: Generation system model – capacity outage probability tables – Recursive relation for capacitive model building – sequential addition method – unit removal – Evaluation of loss of load and energy indices – Examples. Frequency and Duration methods – Evaluation of equivalent transitional rates of identical and non-identical units – Evaluation of cumulative probability and cumulative frequency of non-identical generating units – 2-level daily load representation - merging generation and load models – Examples.

UNIT- III

Operating Reserve Evaluation: Basic concepts - risk indices – PJM methods – security function approach – rapid start and hot reserve units – Modeling using STPM approach. Bulk Power System Reliability Evaluation: Basic configuration – conditional probability approach – system and load point reliability indices – weather effects on transmission lines – Weighted average rate and Markov model – Common mode failures.

Inter Connected System Reliability Analysis: Probability array method – Two inter connected systems with independent loads – effects of limited and unlimited tie capacity - imperfect tie – Two connected Systems with correlated loads – Expression for cumulative probability and cumulative frequency.

UNIT- IV

Distribution System Reliability Analysis: Basic Techniques – Radial networks – Evaluation of Basic reliability indices, performance indices – load point and system reliability indices – customer oriented, loss and energy-oriented indices – Examples. Basic concepts of parallel distribution system reliability

UNIT- V

Substations and Switching Stations: Effects of short-circuits - breakeroperation – Open and Short circuit failures – Active and Passive failures switching after faults – circuitbreaker model – preventive maintenance exponential maintenance times.

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. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by E. Balaguruswamy, TMH Publications.
4. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

Professional Elective VI

EE4208PE: PLC and SCADA

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Basic Electrical Course or equivalent.

Course Objectives:

- To provide knowledge levels needed for PLC programming and operating.
- To make the student show devices to which PLC input and outputmodules are connected.
- To train the students to create ladder diagrams from process control descriptions.
- To make the students understand various types of PLC registers.
- Apply SCADA of industrial processes.
- To make the students understand SCADA.

Course Outcomes: After completion of this course, the student

- Understand the purpose, functions, and operations of a PLC.
- Identify the basic components of the PLC and how they function.
- View a directory of processor files using PLC software.
- Ability to gain knowledge on Programmable Logic Controllers.
- Will understand different types of Devices to which PLC input and output modulesare connected.
- To provide the knowledge about understand various types of PLC registers.
- Able to create ladder diagrams from process control descriptions.
- Ability to apply PLC timers and counters for the control of industrial processes.
- Able to use SCADA for Industrial purposes.

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.

UNIT-II

PLC Programming: input instructions, outputs, operational procedures, programming examples using contacts and coils. Drill-press operation. Digital logic gates programming in the Boolean algebra system, conversion examples Ladder diagrams for process control Ladder diagrams and sequence listings, ladder diagram construction and flow chart for spray process system.

UNIT-III

PLC Registers: Characteristics of Registers module addressing holding registers input registers, output registers. PLC Functions Timer functions and industrial applications counters counter function industrial applications, Architecture functions, Number comparison functions, number conversion functions.

UNIT-IV

SCADA Fundamentals: Introduction, Open system: Need and advantages, Building blocks of SCADA systems, Remote terminal unit (RTU): Evolution of RTUs, Components

of RTU, Communication subsystem, Logic subsystem, Termination subsystem, Testing and human- machine interface (HMI) subsystem, Power supplies, Advanced RTU functionalities, Intelligent electronic devices (IEDs), Data concentrators and merging units, SCADA communication systems, Master Station: Master station software components, Master station hardware components, Server systems in the master station, Small, medium, and large master stations, Global positioning systems (GPS), Master station performance

Unit V

Human-Machine Interface (HMI): HMI components, HMI software functionalities, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements, SCADA Systems: Building the SCADA systems, legacy, hybrid, and new systems, Classification of SCADA systems, SCADA implementation: A laboratory model: The SCADA laboratory, System hardware, System software, SCADA lab field design.

TEXT BOOKS:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/W Bolton/ Pearson.
2. Introduction to Mechatronics / Appukuttan /Oxford

REFERENCE BOOKS:

1. Mechatronics Principles concepts & Applications / N.P.Mahalik/ Mc Graw Hill
2. “Designing Intelligent Machines”. open University, London.

OPEN ELECTIVES LIST

COMPUTER SCIENCE ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	CS3211OE	Introduction to Data Science
	CS3212OE	Data mining
	CS3213OE	Computer Forensics
Open Elective II	CS4121OE	Python Programming
	CS4122OE	R Programming
	CS4123OE	JAVA Programming
Open Elective III	CS4231OE	Machine Learning
	CS4232OE	Cloud Computing
	CS4233OE	Natural Language Processing

ELECTRONICS AND COMMUNICATION ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	EC3211OE	Fundamentals of Internet of Things
Open Elective II	EC4121OE	Principles of Computer Communications and Networks
Open Elective III	EC4231OE	Electronic Measuring Instruments

ELECTRICAL AND ELECTRONICS ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	EE3211OE	Electrical Installation and costing
	EE3212OE	Electrical Engineering Material
Open Elective II	EE4121OE	Renewable Energy sources
	EE4122OE	Reliability Engineering
Open Elective III	EE4231OE	Instrumentation and Control
	EE4232OE	Energy Storage Systems

CIVIL ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	CE3211OE	Basics of Civil Engineering
	CE3212OE	Building Materials and Construction

Open Elective II	CE4121OE	Environmental Impact Assessment
	CE4122OE	Industrial Waste Water Treatment
Open Elective III	CE4231OE	Remote Sensing and GIS
	CE4232OE	Disaster Management

MECHANICAL ENGINEERING

Open Electives	Subject Code	Subject Name
Open Elective I	ME3211OE	Operation Research
	ME3212OE	Fundamentals of Mechanical Engineering
	ME3213OE	Metallurgy of Non-Metallurgists
Open Elective II	ME4121OE	Fabrication Processes
	ME4122OE	Total Quality Management
	ME4123OE	Energy Management and Conservation
Open Elective III	ME4231OE	Reliability Engineering
	ME4232OE	Industrial Management
	ME4233OE	Renewable Energy Sources

OPEN ELECTIVES OFFERED BY DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

CS3211OE: Introduction to Data Science

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- Learn data science project concepts.
- Learn to collect data and process.
- Learn to visualize data.

Course Outcomes:

- Able to collect data from various resources and process data.
- Able to plot data using various methods.
- Able to develop and evaluate models.

Unit – I: Introduction

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit – II: Data Collection and Data Pre-Processing

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit – III: Exploratory Data Analytics

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit – IV: Model Development

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit – V: Model Evaluation

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Over fitting Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing multiple Parameters by using Grid Search.

REFERENCES:

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

CS3212OE: Data Mining

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- Learn data mining concepts understand association rules mining.
- Discuss classification algorithms learn how data is grouped using clustering techniques.
- To develop the abilities of critical analysis to data mining systems and applications.
- To implement practical and theoretical understanding of the technologies for data mining.
- To understand the strengths and limitations of various data mining models;

Course Outcomes:

- Ability to perform the preprocessing of data and apply mining techniques on it.
- Ability to identify the association rules, classification and clusters in large data sets.
- Ability to solve real world problems in business and scientific information using data mining.
- Ability to classify web pages, extracting knowledge from the web.

UNIT - I

Introduction to Data Mining: Introduction, What is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binaryzation, Data Transformation; Measures of Similarity and Dissimilarity- Basics.

UNIT - II

Association Rules: Problem Definition, Frequent Item Set Generation, The APRIORI Principle, Support and Confidence Measures, Association Rule Generation; APRIOIRI Algorithm, The Partition Algorithms, FP-Growth Algorithms, Compact Representation of Frequent Item Set- Maximal Frequent Item Set, Closed Frequent Item Set.

UNIT - III

Classification: Problem Definition, General Approaches to solving a classification problem, Evaluation of Classifiers , Classification techniques, Decision Trees-Decision tree Construction, Methods for Expressing attribute test conditions, Measures for Selecting the Best Split, Algorithm for Decision tree Induction ; Naive-Bayes Classifier, Bayesian Belief Networks; K- Nearest neighbor classification-Algorithm and Characteristics.

UNIT - IV

Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithm, Specific techniques, Key Issues in Hierarchical Clustering, Strengths and Weakness; Outlier Detection.

UNIT - V

Web and Text Mining: Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

TEXT BOOKS:

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch,Pearson Education.
3. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing.

REFERENCE BOOKS:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Mining Principles & Applications – T.V Sveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.
3. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University Press.

CS3213OE: Computer Forensics

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the cyberspace.
- To understand the forensics fundamentals.
- To understand the evidence capturing process.
- To understand the preservation of digital evidence.

Course Outcomes:

- Students will understand the usage of computers in forensic, and how to use various forensic tools for a wide variety of investigations.
- It gives an opportunity to students to continue their zeal in research in computer forensics.

UNIT - I

Computer Forensics Fundamentals: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists Types of Computer Forensics Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement — Computer Forensic Technology — Types of Business Computer Forensic Technology Computer Forensics Evidence and Capture: Data Recovery Defined — Data Back-up and Recovery — The Role of Back-up in Data Recovery — The Data-Recovery Solution.

UNIT-II

Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options — Obstacles — Types of Evidence — The Rules of Evidence — Volatile Evidence — General Procedure — Collection and Archiving — Methods of Collection — Artifacts — Collection Steps — **Controlling Contamination:** The Chain of Custody Duplication and Preservation of Digital Evidence: Preserving the Digital Crime Scene — Computer Evidence Processing Steps — Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication: Special Needs of Evidential Authentication — Practical Consideration —Practical Implementation.

UNIT - III

Computer Forensics analysis and validation: Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developingstandard procedures for network forensics, using network tools, examining the honeynet project.

Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case.

UNIT - IV

Current Computer Forensic tools: evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools.

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.

UNIT - V

Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

TEXT BOOKS

1. Computer Forensics, Computer Crime Investigation by John R. Vacca, FirewallMedia, New Delhi.
2. Computer Forensics and Investigations by Nelson, Phillips Enfinger, Steuart,CENGAGE Learning.

REFERENCE BOOKS

1. Real Digital Forensics by Keith J. Jones, Richard Bejtiich, Curtis W. Rose, Addison-Wesley Pearson Education
2. Forensic Compiling, A Tractitioneris Guide by Tony Sammes and Brian Jenkinson, Springer International edition.
3. Computer Evidence Collection & Presentation by Christopher L.T. Brown, FirewallMedia.
4. Homeland Security, Techniques & Technologies by Jesus Mena, Firewall Media.
5. Software Forensics Collecting Evidence from the Scene of a Digital Crime by Robert M. Slade, TMH 2005
6. Windows Forensics by Chad Steel, Wiley India Edition.

CS4121OE: Python Programming

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data andinformation processing techniques.
- To understand the high-performance programs designed to strengthen the practical expertise.

COURSE OUTCOMES:

- Able to write programs using classes and objects.
- Able to develop GUI.

UNIT - I

Introduction to Python, Installing Python. How a Program Works, Using Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Decision Structures and Boolean Logic: if, if-else, if-elseif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

Data types and Expressions: Strings, Assignment and Comments, Numeric Data Types and Character Sets, Expressions, Functions and Modules.

UNIT - II

Control Statements: Definite Iteration, Formatting Text for Output, Selection, Conditional Iteration.

File and Exceptions: Introduction to File Input and Output, Using Loops to Process Files, Processing Records, Exceptions.

Functions: Introduction, Defining and Calling a Void Function, Designing a Program to Use Functions, Local Variables, Passing Arguments to Functions, Global Variables and Global Constants, Value-Returning Functions-Generating Random Numbers, The math Module, Storing Functions in Modules.

UNIT - III

Strings and Text Files: Accessing Characters and Substrings in a String, Strings and Number System, String Methods, Basic String Operations, String Slicing, Testing, Searching, and Manipulating Strings. Text Files, Data Encryption, Lists, Introduction to Lists, List slicing, Finding Items in Lists with the in Operator, List Methods and Useful Built-in Functions, Copying Lists, Processing Lists, Two-Dimensional Lists, Tuples Sequences, Tuples. Dictionaries and Sets: Dictionaries, Sets, Serializing Objects.

Recursion: Introduction, Problem Solving with Recursion, Examples of Recursive Algorithms.

UNIT - IV

Design with Classes: Classes and Objects, Classes and Functions, Classes and Methods, Working with Instances, Inheritance and Polymorphism. Object-Oriented Programming: Procedural and Object-Oriented Programming, Classes, techniques for Designing Classes.

UNIT - V

Graphical User Interfaces: Behavior of terminal based programs and GUI-based programs, Coding simple GUI-based programs, other useful GUI resources. GUI Programming: Graphical User Interfaces, Using the kinter Module, Display text with Label Widgets, Organizing Widgets with Frames, Button Widgets and Info Dialog Boxes, Getting Input with Entry Widget, Using Labels as Output Fields, Radio Buttons, Check Buttons.

Simple Graphics and Image Processing: Overview of Turtle Graphics, Two dimensional Shapes, Colors and RBG System, Image Processing.

TEXT BOOKS:

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning.
2. Think Python First Edition, by Allen B. Downey, Orielly publishing.

REFERENCE BOOKS:

1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press.
2. James Payne, Beginning Python using Python 2.6 and Python 3, Wrox publishing.
3. Paul Gries, Practical Programming: An Introduction to Computer Science using Python 3,The Pragmatic Bookshelf, 2nd edition (4 Oct. 2013).
4. Charles Dierach, Introduction to Computer Science using Python.

CS4122OE: R Programming

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- Understanding and being able to use basic programming concepts.
- Automate data analysis.
- Working collaboratively and openly on code.
- Knowing how to generate dynamic documents.
- Being able to use a continuous test-driven development approach.

Course Outcomes:

- be able to use and program in the programming language R.
- be able to use R to solve statistical problems.
- be able to implement and describe Monte Carlo the technology.
- be able to minimize and maximize functions using R.

UNIT – I

Introduction: Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Installing R, Running R, Packages in R, Calculations, Complex numbers in R, Rounding, Arithmetic, Modulo and integer quotients, Variable names and assignment, Operators, Integers, Factors, Logical operations.

UNIT – II

Control structures, functions, scoping rules, dates and times, Introduction to Functions, preview of Some Important R Data Structures, Vectors, Character Strings, Matrices, Lists, Data Frames, Classes.

Vectors: Generating sequences, Vectors and subscripts, Extracting elements of a vector usingsubscripts, Working with logical subscripts, Scalars, Vectors, Arrays, and Matrices, Adding and Deleting Vector Elements, Obtaining the Length of a Vector, Matrices and Arrays as Vectors Vector Arithmetic and Logical Operations, Vector Indexing, Common Vector Operations.

UNIT – III

Lists: Creating Lists, General List Operations, List Indexing Adding and Deleting List Elements, Getting the Size of a List, Extended Example: Text Concordance Accessing List Components and Values Applying Functions to Lists, DATA FRAMES, Creating Data Frames, Accessing Data Frames, Other Matrix-Like Operations.

UNIT - IV

FACTORS AND TABLES, Factors and Levels, Common Functions Used with Factors, Working with Tables, Matrix/Array-Like Operations on Tables , Extracting a Subtable, Finding the Largest Cells in a Table, Math Functions, Calculating a Probability, Cumulative Sums and Products, Minima and Maxima, Calculus, Functions for Statistical Distributions

UNIT - V

OBJECT-ORIENTED PROGRAMMING: S Classes, S Generic Functions, Writing S Classes, Using Inheritance, S Classes, Writing S Classes, Implementing a Generic Functionon an S

Class, visualization, Simulation, code profiling, Statistical Analysis with R, data manipulation

TEXT BOOKS:

1. R Programming for Data Science by Roger D. Peng.
2. The Art of R Programming by Prashanth singh, Vivek Mourya, Cengage LearningIndia**.**

CS4123OE: Java Programming

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the object-oriented programming concepts.
- To understand object-oriented programming concepts, and apply them in solving problems.
- To introduce the principles of inheritance and polymorphism; and demonstrate how they relateto the design of abstract classes.
- To introduce the implementation of packages and interfaces.
- To introduce the concepts of exception handling and multithreading.
- To introduce the design of Graphical User Interface using applets and swing controls.

Course Outcomes:

- Able to solve real world problems using OOP techniques.
- Able to understand the use of abstract classes.
- Able to solve problems using java collection framework and I/O classes.
- Able to develop multithreaded applications with synchronization.
- Able to develop applets for web applications.
- Able to design GUI based applications.

UNIT – I

Object-Oriented Thinking- A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling.

Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, purepolymorphism, method overriding, abstract classes, Object class, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.

UNIT - II

Packages- Defining a Package, CLASSPATH, Access protection, importing packages.

Interfaces- defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces.

Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.

UNIT - III

Exception handling - Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Multithreading- Differences between thread-based multitasking and process-based multitasking, Javathread model, creating threads, thread priorities, synchronizing threads, inter thread communication.

UNIT - IV

The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable,Properties, Stack, Vector.

More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner

UNIT - V

GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.

Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes,Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes.

A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications,passing parameters to applets. Creating a Swing Applet, Painting in Swing, A Paint example, ExploringSwing Controls- JLabel and Image Icon, JText Field, **The Swing Buttons**- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.

TEXT BOOKS:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt.Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, PearsonEducation.

REFERENCE BOOKS:

1. An Introduction to programming and design using Java, J. Nino and F.A. Hosch,John Wiley & sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, University Press.
4. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
5. Java Programming and Object-oriented Application Development, R. A. Johnson, CengageLearning.

CS4231OE: Machine Learning

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To be able to formulate machine learning problems corresponding to differentapplications.
- To understand a range of machine learning algorithms along with their strengths andweaknesses.
- To understand the basic theory underlying machine learning.

Course Outcomes:

- Student should be able to understand the basic concepts such as decision trees andneural networks.
- Ability to formulate machine learning techniques to respective problems.
- Apply machine learning algorithms to solve problems of moderate complexity.

UNIT – I

Introduction: An illustrative learning task, and a few approaches to it. What is known from algorithms? Theory, Experiment. Biology. Psychology. Overview of Machine learning, related areas and applications. Linear Regression, Multiple Regression, Logistic Regression, logistic functions. **Concept Learning**: Version spaces. Inductive Bias. Active queries. Mistake bound/ PAC model. Basic results. Overview of issues regarding data sources, success criteria.

UNIT – II

Decision Tree Learning: - Minimum Description Length Principle. Occam's razor. Learning with active queries Introduction to information theory, Decision Trees, Cross Validation and Over fitting. **Neural Network Learning**: Perceptions and gradient descent back propagation, multilayer networks and back propagation.

UNIT – III

Sample Complexity and Over fitting: Errors in estimating means. Cross Validation and jackknifing VC dimension. Irrelevant features: Multiplicative rules for weight tuning.
Support Vector Machines: functional and geometric margins, optimum margin classifier, constrained optimization, Lagrange multipliers, primal/dual problems, KKT conditions, dual of the optimum margin classifier, soft margins, and kernels.
Bayesian Approaches: The basics Expectation Maximization. Bayes theorem, Naïve Bayes Classifier, Markov models, Hidden Markov Models.

UNIT - IV

Instance-based Techniques: Lazy vs. eager generalization. K nearest neighbor, case-based reasoning. **Clustering and Unsupervised Learning:** K-means clustering, Gaussian mixture density estimation, model selection.

UNIT - V

Genetic Algorithms: Different search methods for induction - Explanation-based Learning: using prior knowledge to reduce sample complexity.
Dimensionality reduction: feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, manifold learning.

TEXT BOOKS:

1. Tom Michel, Machine Learning, McGraw Hill, 1997.
2. Trevor Has tie, Robert Tibshirani & Jerome Friedman. The Elements of StaticallyLearning, Springer Verlag, 2001.

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley& Sons Inc.,2001.
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press,1995.

CS4232OE: Cloud Computing

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Course Outcomes:

- Ability to understand the virtualization and cloud computing concepts.

UNIT - I

Systems Modeling, Clustering and Virtualization: Distributed System Models and Enabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centers.

UNIT - II

Foundations: Introduction to Cloud Computing, Migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, The Enterprise Cloud Computing Paradigm.

UNIT – III

Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS): Virtual machines provisioning and Migration services, On the Management of Virtual machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data Storage in Cloud Computing.
Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments.

UNIT - IV

Monitoring, Management and Applications: An Architecture for Federated Cloud Computing, SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Best Practices in Architecting Cloud Applications in the AWS cloud, Building Content Delivery networks using Clouds, Resource Cloud Mashups.

UNIT - V

Governance and Case Studies: Organizational Readiness and Change management in the Cloud age, Data Security in the Cloud, Legal Issues in Cloud computing, Achieving Production Readiness for Cloud Services.

TEXT BOOKS:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg andAndrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C.Fox, Jack J.Dongarra, Elsevier, 2012.

REFERENCE BOOKS:

1. Cloud Computing : A Practical Approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
3. Cloud Computing: Implementation, Management and Security, John W. Rittinghouse,James F.Ransome, CRC Press, rp2012.

4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly, SPD, rp2011.
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, TimMather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp2011.

CS4233OE: Natural Language Processing

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- Introduce to some of the problems and solutions of NLP and their relation to linguistics andstatistics.

Course Outcomes:

- Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
- Understand and carry out proper experimental methodology for training and evaluatingempirical NLP systems.
- Able to manipulate probabilities, construct statistical models over strings and trees, andestimate parameters using supervised and unsupervised training methods.
- Able to design, implement, and analyze NLP algorithms.
- Able to design different language modeling Techniques.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches.

UNIT - II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing,Multilingual Issues.

UNIT - III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT - IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V

Discourse Processing: Cohension, Reference Resolution, Discourse Cohension and Structure **Language Modeling:** Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific ModelingProblems, Multilingual and Cross lingual Language Modeling.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice –Daniel M.Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE BOOK:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, PearsonPublications.

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

EC3211OE: Fundamentals of Internet of Things

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to:

1. Understand the concepts of Internet of Things and able to build IoT applications
2. Learn the programming and use of Arduino and Raspberry Pi boards.
3. Known about data handling and analytics in SDN.

Course Outcomes: Upon completing this course, the student will be able to

1. Known basic protocols in sensor networks.
2. Program and configure Arduino boards for various designs.
3. Python programming and interfacing for Raspberry Pi.
4. Design IoT applications in different domains.

UNIT – I

Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT - II

Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT – III

Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

UNIT - IV

Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT – V

Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.

TEXT BOOKS:

1. "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press).
2. “Make sensors”: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.
3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti.

REFERENCE BOOKS:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”.
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice".
3. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress,

EC4121OE: Principles of Computer Communications and Networks

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To understand the concept of computer communication.
2. To learn about the networking concept, layered protocols.
3. To understand various communications concepts.
4. To get the knowledge of various networking equipment.

Course Outcomes:

1. The student can get the knowledge of networking of computers, data transmission between computers.
2. Will have the exposure about the various communication concepts.
3. Will get awareness about the structure and equipment of computer network structures.

UNIT - I

Overview of Computer Communications and Networking: Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

UNIT - II

Essential Terms and Concepts: Computer Applications and application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes, analog and Digital Communications , Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model.

UNIT - III

Analog and Digital Communication Concepts: Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction, Digital Carrier Systems.

UNIT - IV

Physical and data link layer Concepts: The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer, the logical link control and medium access control sub-layers.

UNIT – V

Network Hardware Components: Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

TEXT BOOKS:

1. Computer Communications and Networking Technologies, Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.
2. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition Mc Graw Hill Education, 2006.

REFERENCE BOOKS:

1. Principles of Computer Networks and Communications, M. Barry Dumas, Morris

Schwartz, Pearson.
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

EC4231OE: Electronic Measuring Instruments (Open Elective - III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Note: No detailed mathematical treatment is required.

Course Objectives:

1. It provides an understanding of various measuring systems functioning and metrics for performance analysis.
2. Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

Course Outcomes: On completion of this course student can be able to

1. Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
2. Measure various physical parameters by appropriately selecting the transducers.
3. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.

UNIT - I

Block Schematics of Measuring Systems and Performance Metrics: Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

UNIT - II

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, and Specifications.

UNIT - III

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes.

UNIT - IV

Recorders: X-Y Plotter, Curve tracer, Galvanometric Recorders, Servo transducers, pen driving mechanisms, Magnetic Recording, Magnetic recording techniques.

UNIT - V

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

TEXT BOOKS:

1. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.

2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

REFERENCES:

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

OPEN ELECTIVES OFFERED BY DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

EE3211OE: Electrical Installation and costing (Open Elective - I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Basic Electrical Engineering

Course Objectives:

- To emphasize the estimation and costing aspects of all electrical equipment, installation and designs on the cost viability.
- To design and estimation of wiring.
- To design overhead and underground distribution lines, substations and illumination.

Course Outcomes: After Completion of this course, student will be able to

- Understand the design considerations of electrical installations.
- Design electrical installation for buildings and small industries.
- Identify and design the various types of light sources for different applications.

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 Installationof 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, CFL and OCFLdifferences.

Text Books:

1. “K. B. Raina, S. K. Bhattacharya”, “Electrical Design Estimating and Costing”, NewAge International Publisher, 2010.
2. “Er. V. K. Jain, Er. Amitabh Bajaj”, “Design of Electrical Installations”, UniversityScience Press.

Reference Books:

1. Code of practice for Electrical wiring installations,(System voltage not exceeding 650volts), Indian Standard Institution, IS: 732-1983.
2. Guide for Electrical layout in residential buildings, Indian Standard Institution,IS:4648-1968.
3. Electrical Installation buildings Indian Standard Institution, IS: 2032.
4. Code of Practice for selection, Installation of Maintenance of fuse (voltage not exceeding 650 V), Indian Standard Institution, IS: 3106-1966.
5. Code of Practice for earthling, Indian Standard Institution, IS: 3043-1966.
6. Code of Practice for Installation and Maintenance of induction motors, Indian StandardInstitution, IS: 900-1965.
7. Code of Practice for electrical wiring, Installations (system voltage not exceeding 650Volts), Indian Standard Institution, IS: 2274-1963.
8. “Gupta J. B., Katson, Ludhiana”, “Electrical Installation, estimating and costing”, S. K.Kataria and sons, 2013.

EE3212OE : Electrical Engineering Materials

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Engineering chemistry and Engineering Physics - II

Course Objective:

- To understand the importance of various materials used in electrical engineering andobtain a qualitative analysis of their behavior and applications.

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

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Acquire Knowledge on Materials used in electrical engineering and applications.

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, magneticallysoft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet 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 andGaseous 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. TTTI Madras, “Electrical Engineering Materials”, McGraw Hill Education, 2004.
2. “Adrianus J.Dekker”, Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, Dhanpat Rai &Sons, 2011.

EE4121OE: Renewable Energy Sources (Open Elective – II)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Pre-requisites: None

Course Objectives:

- To recognize the awareness of energy conservation in students.
- To identify the use of renewable energy sources for electrical power generation.
- To collect different energy storage methods.
- To detect about environmental effects of energy conversion.

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

- Understand the principles of wind power and solar photovoltaic power generation, fuel cells.
- Assess the cost of generation for conventional and renewable energy plants.
- Design suitable power controller for wind and solar applications.
- Analyze the issues involved in the integration of renewable energy sources to the grid.

UNIT - I

Introduction: Renewable Sources of Energy-Grid-Supplied Electricity-Distributed Generation-Renewable Energy Economics-Calculation of Electricity Generation Costs – Demand side Management Options –Supply side Management Options-Modern Electronic Controls of Power Systems.

Wind Power Plants: Appropriate Location -Evaluation of Wind Intensity -Topography - Purpose of the Energy Generated - General Classification of Wind Turbines-Rotor Turbines-Multiple-Blade Turbines Drag Turbines -Lifting Turbines-Generators and Speed Control usedin Wind Power Energy Analysis of Small Generating Systems.

UNIT - II

Photovoltaic Power Plants: Solar Energy-Generation of Electricity by Photovoltaic Effect - Dependence of a PV Cell Characteristic on Temperature-Solar cell Output Characteristics-Equivalent Models and Parameters for Photovoltaic Panels-Photovoltaic Systems-Applications of Photovoltaic Solar Energy-Economical Analysis of Solar Energy.

Fuel Cells: The Fuel Cell-Low and High Temperature Fuel Cells-Commercial and Manufacturing Issues Constructional Features of Proton Exchange-Membrane Fuel Cells – Reformers-Electro-lyzer Systems and Related Precautions-Advantages and Disadvantages of Fuel Cells-Fuel Cell Equivalent Circuit- Practical Determination of the Equivalent Model Parameters -Aspects of Hydrogen as Fuel.

UNIT - III

Induction Generators

Principles of Operation-Representation of Steady-State Operation-Power and Losses Generated-Self- Excited Induction Generator-Magnetizing Curves and Self-Excitation Mathematical Description of the Self-Excitation Process-Interconnected and Stand-alone operation -Speed and Voltage Control -Economical Aspects.

UNIT - IV

Storage Systems: Energy Storage Parameters- Lead–Acid Batteries-Ultra Capacitors-Flywheels –Superconducting Magnetic Storage System-Pumped Hydroelectric Energy

Storage - Compressed Air Energy Storage - Storage Heat -Energy Storage as an Economic Resource.

UNIT - V

Integration of Alternative Sources of Energy: Principles of Power Injection-Instantaneous Active and Reactive Power Control Approach Integration of Multiple Renewable Energy Sources-Islanding and Interconnection Control-DG Control and Power Injection.

Interconnection of Alternative Energy Sources with the Grid: Interconnection Technologies - Standards and Codes for Interconnection - Interconnection Considerations - Interconnection Examples for Alternative Energy Sources.

TEXT BOOKS:

1. Felix A. Farret, M. Godoy Simoes, “Integration of Alternative Sources of Energy”,John Wiley & Sons, 2006.
2. Solanki: Renewable Energy Technologies: Practical Guide for Beginners, PHI Learning Pvt. Ltd., 2008.

REFERENCES:

1. D. Mukherjee: Fundamentals of Renewable Energy Systems, New Age International publishers, 2007.
2. Remus Teodorescu, Marco Liserre, Pedro Rodríguez: Grid Converters for Photovoltaic and Wind Power Systems, John Wiley & Sons, 2011.
3. Gilbert M. Masters: Renewable and Efficient Electric Power Systems, John Wiley & Sons, 2004.

EE4122OE:Reliability Engineering (Open Elective – II)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics-III (Laplace Transforms, Numerical Methods and Complex variables).

Course Objectives:

- To introduce the basic concepts of reliability, various models of reliability.
- To analyze reliability of various systems.
- To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

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

- Model various systems applying reliability networks.
- Evaluate the reliability of simple and complex systems.
- Estimate the limiting state probabilities of repairable systems.
- Apply various mathematical models for evaluating reliability of irreparable systems.

UNIT - I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Mathematical expected – variance and standarddeviation

Binomial Distribution: Concepts, properties, engineering applications.

UNIT- II

Network Modeling and Evaluation of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems - Series-Parallel systems- Partially redundant systems- Examples.

Network Modeling and Evaluation of Complex Systems

Conditional probability method- tie set, Cut-set approach- Event tree and reduced event tree methods-Relationships between tie and cut-sets- Examples.

UNIT - III

Probability Distributions In Reliability Evaluation: Distribution concepts, Terminology of distributions, General reliability functions, Evaluation of the reliability functions, shape of reliability functions –Poisson distribution – normal distribution, exponential distribution, Weibull distribution.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT - IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Application.

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems.

UNIT - V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited.

REFERENCES:

1. Reliability Engineering: Theory and Practice by Alessandro Birolini, Springer Publications.
2. An Introduction to Reliability and Maintainability Engineering by Charles Ebeling, TMH Publications.
3. Reliability Engineering by Elsayed A. Elsayed, Prentice Hall Publications.

EE4231OE: Instrumentation and Control (Open Elective – III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Pre-requisite: Basic Electrical Engineering, Analog Electronics, Mathematics

Course objectives:

- To introduce the basic principles of all measuring instruments
- To deal with the measurement of voltage, current, Power factor, power, energy and magnetic measurements.
- To understand the basic concepts of Control Engineering

Course Outcomes: After completion of this course, the student able to

- Understand different types of measuring instruments, their construction, operation and characteristics.
- Identify the instruments suitable for typical measurements.
- Apply the knowledge about transducers and instrument transformers to use themeffectively.
- Apply the knowledge of basic control engineering.

UNIT–I

Characteristics of Signals: Measuring Systems, Performance Characteristics - Static characteristics, Dynamic Characteristics; Errors in Measurement- Gross Errors, Systematic Errors, Statistical Analysis of Random Errors.

UNIT–II

Oscilloscope: Cathode ray oscilloscope-Cathode ray tube-time base generator-horizontal and vertical amplifiers-CRO probes- applications of CRO- Measurement of phase and frequency - lissajous patterns - Sampling oscilloscope-analog and digital type.

UNIT–III

Transducers: Definition of transducers, Classification of transducers, Advantages of electrical transducers, Characteristics and choice of transducers; Principle of operation of resistor, inductor, LVDT and capacitor transducers.

UNIT–IV

Measurement of Non-Electrical Quantities: Measurement of strain, Gauge sensitivity, Displacement, Force Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow

UNIT–V

Introduction to Control System: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations - Impulse Response and transfer functions - Translational and Rotational mechanical systems.

TEXT BOOKS:

1. G. K. Banerjee, “Electrical and Electronic Measurements”, PHI Learning Pvt. Ltd., 2nd Edition,2016.
2. S. C. Bhargava, “Electrical Measuring Instruments and Measurements”, BS Publications, 2012.
3. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCES:

1. A. K. Sawhney, “Electrical & Electronic Measurement & Instruments”, Dhanpat Rai & Co.Publications, 2005.
2. R. K. Rajput, “Electrical & Electronic Measurement & Instrumentation”, S. Chand and CompanyLtd., 2007.
3. Buckingham and Price, “Electrical Measurements”, Prentice – Hall, 1988.
4. Reissland, M. U, “Electrical Measurements: Fundamentals, Concepts, Applications”, New AgeInternational (P) Limited Publishers, 1st Edition 2010.
5. E.W. Golding and F. C. Widdis, “Electrical Measurements and measuring Instruments”, fifthEdition, Wheeler Publishing, 2011.

EE4232OE: Energy Storage Systems (Open Elective – III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electro chemistry

Course Objective:

- To enable the student to understand the need for energy storage, devices andtechnologies available and their applications.

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

- Analyze the characteristics of energy from various sources and need for storage.
- Classify various types of energy storage and various devices used for the purpose.
- Identify various real time applications.

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, lessfossil fuel, Smart Grid uses, The roles of electrical energy storage technologies, The rolesfromthe 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 storagesystems, 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 (Virtual Power Plant), Battery SCADA–aggregation of many dispersed batteries.

Text Books:

1. “James M. Eyer, Joseph J. Iannucci and Garth P. Corey “, “Energy Storage Benefitsand Market Analysis”, Sandia National Laboratories, 2004.
2. The Electrical Energy Storage by IEC Market Strategy Board.

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.

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

CE3211OE: Basics of Civil Engineering (Open Elective – I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course objectives: The objectives of the course are:

- To explain the concepts of Civil Engineering.
- To Understand the Building Materials for construction
- To understand the concept of Transportation
- To explain the Soil Characteristics for best foundation
- To know the Drinking water Standards & Water Treatment Units.

Course Outcomes: On successful completion of this course, students should be able to:

- Identify different types of building materials for construction.
- Discuss types of Traffic Flow Characteristics.
- To know the soil classification and its properties.
- Distinguish and understand Drinking water and Waste water properties.

UNIT-I, Building Materials for Construction

Bricks & Cement: qualities of good bricks, types of brick, ingredients of cement, types ofcement, Grade of cement.

Concrete & Steel: Properties of cement concrete, types of concrete based on usage & propertiesand uses of various types of steel, Admixtures.

Building components: lintels, walls, stair cases, types of floors, types of roofs, doors, windows-material-types, Finishers-Plastering, Painting, Tiles.

UNIT- II Transportation Engineering

Highway: History and Importance of Highways, Classification of roads, highway cross section,types of Pavement.

Traffic: Road safety-Traffic signals &its types. Road intersections & its types.Railway: Permanent way, Components parts its functions.

Airway: Typical Airport layout, Factors for airport site selection.

UNIT – III Geotechnical Engineering

Soil formation and its three phase diagram, I.S. Classification of soils. Permeability & its Factorsaffecting, capillary rise. Compaction – factors affecting compaction.

Geology- Different types & its properties of Rocks & Minerals.

UNIT - IV Water Resources & Irrigation Engineering

Hydrologic cycle, Forms of precipitation, measurement of precipitation by Symons rain gauge.

Abstractions from precipitation: Infiltration, Evaporation & Runoff & their Factors affecting.

Irrigation: Water requirement of crops, canal & its losses, Types of lining- Advantages anddisadvantages.

Types of dams, Factors affecting selection of a dam site. Tunneling- Purposes of tunneling.

UNIT – V Environmental Engineering

Drinking Water: types of water demand – factors affecting water quality and testing – drinkingwater standards. Layout and general outline of water treatment units.

Waste water: Waste water treatment plant Flow diagram. Waste water collection, manholes &house drainage.
Air & Sound pollution – Effects & Controlling methods.

TEXT BOOKS

1. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain –Laxmi Publications (P) ltd., New Delhi.
2. Transportation Engineering by Khanna & Justo
3. Geotechnical Engineering by Arora
4. Water Resources & Irrigation Engineering by SK Garg
5. Environmental Engineering by Dr.B.C.Punmia

CE3212OE: Building Materials and Construction

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course is to

- List the construction material.
- Explain different construction techniques
- Understand the building bye-laws
- Highlight the smart building materials

Course Outcomes: After the completion of the course student should be able to

- Define the Basic terminology that is used in the industry
- Categorize different building materials, properties and their uses

Unit- I

Cement: Introduction, ingredients of cement, types of cement, cement mortar uses.

Concrete: Properties of cement concrete, materials, standard concrete mix proportions, curing ofconcrete, methods-effects of improper curing.

Unit -II

Bricks & Bricks masonry: qualities of good bricks, types of bricks, brick masonry and types ofbrick masonry

Timber: Structure of a tree, defects in timber, seasoning of timber, qualities of good timber,important Indian timber trees.

Unit –III

Construction Materials: Stone-type of building stones, glass-types based on usage, plastics-advantages and disadvantages, uses, ceramics-types used in building industry.

Structural steel: properties and uses of various types of steel, types. Girders-types & uses.

Unit- IV

Building components: lintels, walls, stair cases, types of floors, types of roofs, doors, windows-material-types.

Fire protection: hazards, classification of fire resistant materials and constructions.

Unit- V

Building planning: principles of building planning, classification of buildings and building bylaws. Building Services: Plumbing-water distribution, sanitary-lines and fittings, **Ventilations:** functional requirements, system of ventilations.

TEXT BOOKS:

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.
3. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - LaxmiPublications (P) ltd., New Delhi.

REFERENCE BOOKS:

1. Building Materials by Duggal, New Age International.
2. Building Materials by P. C. Varghese, PHI.
3. Building Construction by PC Varghese PHI.
4. Construction Technology – Vol – I & II by R. Chubby, Longman UK.
5. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; NewAge Publications.

CE4121OE: Environmental Impact Assessment(Open Elective-II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to

- Define and Classify Environmental Impacts and the terminology.
- Understands the environmental Impact assessment procedure.
- Explain the EIA methodology.
- List and describe environmental audits.

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

- Identify the environmental attributes to be considered for the EIA study.
- Formulate objectives of the EIA studies.
- Identify the methodology to prepare rapid EIA.
- Prepare EIA reports and environmental management plans.

UNIT- I

Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

UNIT- II

EIA Methodologies: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networksmethods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts.

UNIT- III

Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

UNIT- IV

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, TheEnvironment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules. Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials- cost criteria case studies.

UNIT- V

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

TEXT BOOKS:

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S.Publications, Hyderabad, 2007
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

REFERENCE BOOKS:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand ReinholdCo., New York, 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., NewYork, 1996.

CE4122OE: Industrial Waste Water Treatment

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Environmental Engineering

Course Objectives:

- To present the information of wastewater generation from various industries
- To inform about the conventional treatment processes for specific industrial waste waters
- To explain about the new developments in industrial wastewater treatment technologies

Course Outcomes: At the end of the course, the student should be able to:

- Identify the characteristics of industrial wastewaters
- Describe pollution effects of disposal of industrial effluent
- Identify and design treatment options for industrial wastewater
- Formulate environmental management plan

UNIT - I

Introduction: Wastewater Characteristics, Standards of Disposal, Treatment Objective and Strategies, Layouts of Primary, Secondary and Advanced Treatment Units.

UNIT - II

Design of Preliminary and Primary Treatment Operations: Screens, Grit Chambers, Skimming Tank, Primary and Secondary Sedimentation Tanks.

UNIT - III

Biological Treatment Processes: Types, Kinetics of Plug Flow and Completely Mixed Systems. Attached Growth Processes: Trickling Filters (Standard Rate, High Rate), Bio filters, Practices, Features and Design, Operational Difficulties and Remedial Measures, Rotating Biological Contactors. Suspended Growth Processes:

UNIT - IV

Activated Sludge Process, Modifications and Design Equations, Process Design Criteria, Oxygen and Nutrient Requirements - Classification and Design of Oxidation Ponds, Lagoons.

UNIT - V

Sludge Treatment and Disposal: Sludge Thickening, Aerobic and Anaerobic Sludge Digestion Processes, Design of Digester Tank, Sludge Dewatering, Ultimate Disposal, Sludge Drying Beds, Other Methods of Sludge Treatment.

TEXT BOOKS:

1. Wastewater Treatment – Concepts and Design Approach, by G L Karia and R A Christian,Prentice Hall of India, 2006
2. 2.Environmental Engineering by Gerard Kiely, McGraw Hill Education (India) Pvt Ltd, 2013
3. Environmental Engineering – A Design Approach by A. P. Sincero and G A Sincero, PrenticeHall of India, 2014

REFERENCES:

1. Wastewater Engineering - Collection, Treatment, Disposal and Reuse by Metcalf and Eddy, ,McGraw Hill Education (India) Pvt Ltd, 2013
2. Industrial Waste Treatment by Nelson Leonard Nemerow, Butterworth-Heinemann, 2007.

3. Biological Process Designs for Wastewater Treatment by Benefield L.D. and Randall C.D.Prentice Hall Pub. Co., 1980.

CE4231OE: Remote Sensing and GIS (Open Elective-III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Pre Requisites: Surveying

Course Objectives: This course will make the student to understand about the principles of GIS,Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Outcomes: At the end of the course, the student will be able to:

- Retrieve the information content of remotely sensed data.
- Analyze the energy interactions in the atmosphere and earth surface features.
- Interpret the images for preparation of thematic maps.
- Apply problem specific remote sensing data for engineering applications.
- Analyze spatial and attribute data for solving spatial problems.
- Create GIS and cartographic outputs for presentation.

UNIT – I

Introduction to Photogrammetry: Principles& types of aerial photograph, geometry of verticalaerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II

Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro- magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.

UNIT – III

Geographic Information Systems: Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. **Coordinate Systems:** Geographic Coordinate System: Approximation of the Earth, Datum; **Map Projections:** Types of Map Projections-Map projection parameters-Commonly usedMap Projections - Projected coordinate Systems.

UNIT – IV

Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geo base data model; Geometric representation of Spatial Feature and data structure, Topology rules

UNIT – V

Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

TEXT BOOKS:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015.

REFERENCES:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India)Publications.
2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. McDonnell, Oxford Publishers 2004.
3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

CE4232OE: Disaster Management

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: The subject provides different disasters, tools and methods for disaster management.

Course Outcomes: At the end of the course, the student will be able to:

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts and planning of disaster managements

UNIT - I

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards;hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerabilityand disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV

Coping with Disaster: Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

UNIT - V

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) PvtLtd Wiley 2015.

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of

India(http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

OPEN ELECTIVES OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING

ME3211OE: Operations Research (Open Elective I)

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives: Understanding the mathematical importance of development of model in a particular optimization model for the issue and solving it.

Course Outcome: Understanding the problem, identifying variables & constants, Formulation of optimization model and applying appropriate optimization technique

UNIT-I

Development- definition - characteristics and phases - Types of models - Operations Research models- applications.

Allocation: Linear Programming Problem Formulation-Graphical solution- Simplex method- Artificial variable techniques: Two-phase method, Big-M method.

UNIT-II

Transportation problem – Formulation - Optimal solution, unbalanced transportation problem- Degeneracy.

Assignment problem- Formulation-Optimal solution, - Variants of Assignment problem- Travelling salesman problem.

UNIT-III

Sequencing. Introduction-Flow-Shop sequencing- n jobs through two machines - n jobs through three machines- Job shop sequencing-two jobs through 'm' machines – graphical model

Replacement: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

UNIT-IV

Theory of Games: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle - m x 2 & 2 x n games- Graphical method.

Inventory: Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models - Demand may be discrete variable or continuous variable- single period model and no setup cost.

UNIT-V

Waiting lines: Introduction- Terminology- Single channel- Poisson arrivals and Exponential service times with infinite population and finite population models.

Dynamic Programming: Introduction- Terminology, Bellman's principle of optimality Applications of Dynamic programming- shortest path problem- linear programming problem.

TEXT BOOK:

1. Operations Research/ J. K. Sharma / MacMilan
2. Introduction to OR/ Hillier & Libemann /TMH

REFERENCE BOOKS:

1. Introduction to OR /Taha /PHI

2. Operations Research/NVS Raju/SMS Education/3rd Revised Edition
3. Operations Research /A. M. Natarajan, P.Balasubramaniam, A. Tamilarasi/Pearson Education.

ME3212OE: Fundamentals of Mechanical Engineering

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives: Understanding of basic principles of Mechanical Engineering is required in various field of engineering.

Course Outcomes: After learning the course the students should be able to

- To understand the fundamentals of mechanical systems.
- To understand and appreciate significance of mechanical engineering in different Fields of engineering.

UNIT - I

Introduction: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law.

Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion.

UNIT - II

Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process

Properties of Steam: Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters.

Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, functioning of different mountings and accessories.

UNIT - III

Heat Engines: Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles.

Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/two- stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies.

UNIT - IV

Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming

Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistage.

Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners.

UNIT - V

Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc).

Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.

Engineering Materials: Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

TEXT BOOKS:

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson.
2. Introduction to Engineering Materials / B.K. Agrawal/ Mc Graw Hill.

REFERENCE BOOKS:

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI.
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria.

ME3213OE: Metallurgy of Non Metallurgists

B.Tech. III Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives:

- To describe the basic principles of metallurgy and the importance of metallurgy in various discipline of engineering.
- Gain a thorough knowledge about heat treatment of steels.
- Gain knowledge about properties and uses of cast irons and non-ferrous metals.
- Gain a working knowledge of basic testing methods for metals.

Course Outcomes: At the end of the course Student would be able

- To use and apply metallurgy in his own branch of engineering.
- The student will be able to justify the various testing methods adopted for metals.

UNIT - I

Introduction: Crystal structure and defects, Crystal structure of metals, Classification of steels, Carbon steels.

Engineering Materials: Types and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer.

UNIT - II

Heat Treatment of Steels: The Iron carbon systems, Common phases in steels, Annealing, Normalizing, Hardening and tempering.

UNIT - III

Cast irons: Properties and applications of Ductile irons, Malleable irons, Compacted graphite iron.

UNIT - IV

Non Ferrous Metals: Properties and applications of Light Metals (Al, Be, Mg, Ti), Super alloys.

UNIT - V

Testing of Metals: Hardness testing, Tensile Testing, Impact Testing, Fatigue Testing.

TEXT BOOKS:

1. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
2. Introduction to Physical Metallurgy – SH Avner, TATA Mc GRAW HILL, 1997.
3. Mechanical Metallurgy – G. E. Dieter.

REFERENCE BOOKS:

1. Engineering Physical Metallurgy and Heat treatment – Y Lakhtin.
2. C. Suryanarayana, Experimental Techniques in Mechanics and Materials, John Wiley, John Wiley, NJ, USA, 2006.
3. Foundations of Materials Science and Engineering – WF Smith.

ME4121OE: Fabrication Processes(Open Elective - II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives:

- To understand the philosophies of various Manufacturing process.

Course Outcomes: At the end of the course, for given product, one should be able identify the manufacturing process.

UNIT - I

Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns- Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands.

Methods of Melting - Crucible melting and cupola operation – Defects in castings;

Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design.

UNIT - II

Welding: Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermite welding.

Inert Gas Welding - TIG Welding, MIG welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT - III

Hot working, cold working, strain hardening, recovery, recrystallisation, and grain growth. Stamping, forming, and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning. Types of presses and press tools. Forces and power requirement in the above operations.

UNIT - IV

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion.

UNIT - V

Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS:

1. Manufacturing Technology / P.N. Rao / Mc Graw Hill
2. Manufacturing Engineering and Technology/Kalpakjin S/ Pearson.

REFERENCE BOOKS:

1. Metal Casting / T. V Ramana Rao / New Age
2. Métal Fabrication Technology/ Mukherjee/PHI

ME4122OE: Total Quality Management

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

UNIT - I

Introduction: The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT -II

Customer Focus and Satisfaction: Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships.

Bench Marking: Evolution of Bench Marking, meaning of bench marking, benefits of bench marketing, the bench marking procedure, pitfalls of bench marketing.

UNIT- III

Organizing for TQM: The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, lshikawa diagram, paneto diagram, Kepner &Tregoe Methodology.

UNIT- IV

The Cost of Quality: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

UNIT -V

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

TEXT BOOK:

1. Total Quality Management / Joel E. Ross/Taylor and Franscis Limited
2. Total Quality Management/P. N. Mukherjee/PHI

REFERENCE BOOKS:

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant.
3. Total Quality Management:A Practical Approach/H. Lal.
4. Quality Management/Kanishka Bedi/Oxford University Press/2011.
5. Total Engineering Quality Management/Sunil Sharma/Macmillan.

ME4123OE: Energy Management and Conservation

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives: To acquaint the student with the conventional energy sources and their utilization. To understand the importance of heat recovery and energy conservation methods and energy audit.

Course Outcomes: Students would have a good knowledge about conventional energy sources and their audit. Ability to apply the fundamentals of energy conservation and management.

UNIT-I

Introduction: Global & Indian Energy Scenario - Classification of Energy sources - Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns, Basics of Energy and its various forms.

UNIT-II

Energy Audit: Types of energy audit, Energy management (audit) approach understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.

Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.

UNIT-III

Energy Action Planning, Financial Management: Financial analysis techniques- Risk and sensitivity analysis- Financing options, Energy performance contracts and role of ESCOs - Energy Monitoring and Targeting: Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM).

UNIT-IV

Building Envelope – principles of analysis – Envelope performance -Envelope analysis of Existing and new buildings – Building standards for new and Existing constructions. HVAC Systems types – Energy conservation opportunities – cooling equipment – Domestic hot water Estimating HVAC Energy consumption.

UNIT-V

Principles of Electric Energy Management, Energy Management control systems – Energy systems maintenance. Energy management in water and waste water treatment – solid waste treatment- air pollution control systems .Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration – Waste Heat recovery. Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act.

TEXT BOOKS:

1. Energy Management by Murfy.
2. General Aspects of Energy Management and Audit, National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management).

REFERENCE BOOKS:

1. Energy Management Handbook, W.C. Turner, 5th Edition, Marcel Dekker, Inc, New York, 2005.
2. Guide to Energy Management, B. L. Capehart, W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.
3. Energy Management by O.P. Collagan.

ME4231OE: Reliability Engineering (Open Elective - III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Mathematics III

Course Objectives:

- To introduce the basic concepts of reliability, various models of reliability
- To analyze reliability of various systems
- To introduce techniques of frequency and duration for reliability evaluation of repairable systems.

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

- Model various systems applying reliability networks.
- Evaluate the reliability of simple and complex systems.
- Estimate the limiting state probabilities of repairable systems.
- Apply various mathematical models for evaluating reliability of irreparable systems.

UNIT - I

Basic Probability Theory: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation - Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution.

Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models - Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time between Failures.

UNIT – II

Network Modeling and Evaluation of Simple Systems: Basic concepts- Evaluation of network Reliability / Unreliability - Series systems, Parallel systems- Series-Parallel systems partially redundant systems- Examples.

Network Modeling and Evaluation of Complex systems: Conditional probability method tie set, Cut set approach- Event tree and reduced event tree methods- Relationships between tie and cut sets- Examples.

UNIT – III

Time Dependent Probability: Basic concepts- Reliability function f(t). F(t), R(t) and h(t) - Relationship between these functions.

Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples.

UNIT – IV

Discrete Markov Chains: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples.

Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT – V

Frequency and Duration Techniques: Frequency and duration concepts, application to multi state problems, Frequency balance approach.

Approximate System Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples.

TEXT BOOKS:

1. Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Plenum Press, 1983.
2. E. Balagurusamy, Reliability Engineering by Tata McGraw-Hill Publishing Company Limited, 2002.

REFERENCE BOOK:

1. K. K. Agarwal, Reliability Engineering-Kluwer Academic Publishers, 1993.

ME4232OE: Industrial Management (Open Elective - III)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course objectives:

- Understand the philosophies of management gurus.
- Understand the various types of organization structures and their features, and their advantages and disadvantages.
- Learning various Industrial Engineering Practices like Operations Management techniques, work study, statistical quality control techniques, Job evaluation techniques and network analysis techniques.

Course outcomes:

- Able to apply principles of management.
- Able to design the organization structure.
- Able to apply techniques for plant location, design plant layout and value analysis.
- Able to carry out work study to find the best method for doing the work and establish standard time for a given method.
- Able to apply various quality control techniques and sampling plans.
- Able to do job evaluation and network analysis.

UNIT- I

Introduction to Management: Entrepreneurship and organization - Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

UNIT- II

Designing Organizational Structures: Departmentalization and Decentralization, Types of Organization structures - Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

UNIT- III

Operations Management: Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

UNIT- IV:

Work Study: Introduction - definition - objectives - steps in work study - Method study - definition, objectives - steps of method study. Work Measurement - purpose - types of study-stop watch methods - steps - key rating - allowances - standard time calculations - work sampling.

Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, - Attributes- Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

UNIT- V

Job Evaluation: Methods of job evaluation - simple routing objective systems - classification

method factor comparison method, point method, benefits of job evaluation and limitations. Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

TEXT BOOKS:

1. Industrial Engineering and Management/O.P. Khanna/Khanna Publishers.
2. Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers.

REFERENCE BOOKS:

1. Motion and Time Study by Ralph M Barnes! John Willey & Sons Work Study by lLO.
2. Human factors in Engineering & Design/Ernest J McCormick / TMH.
3. Production & Operation Management / Paneer Selvam/ PHI.
4. Industrial Engineering Management / NVS Raju/ Cengage Learning.
5. Industrial Engineering Hand Book / Maynard.
6. Industrial Engineering Management I Ravi Shankar/Galgotia.

ME4233OE: Renewable Energy Sources

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: None

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems.
- To outline utilization of renewable energy sources for both domestic and industrial applications.
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

- Understanding of renewable energy sources
- Knowledge of working principle of various energy systems
- Capability to carry out basic design of renewable energy systems

UNIT-I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT-II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT-III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy - Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Safety and environmental aspects, wind energy potential and installation in India.

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Geothermal Energy: Geothermal power plants, types of Geothermal resources, hot springs and steam ejection.

TEXT BOOKS:

1. Renewable Energy Sources / Twidell, J.W. and Weir, A. / EFN Spon Ltd., 1986.
2. Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers.

REFERENCE BOOKS:

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012.
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.
3. Non-Conventional Energy Resources by E H Khan.