Faculty of Engineering & Technology

Scheme of Instruction and Syllabus

For

B.Tech (AICTE) – I & II Semester

Of

Four Year Degree Course

In

ELECTRICAL & ELECTRONICS ENGINEERING

Mahatma Gandhi University

Nalgonda

Telangana State

508 254

SEMESTER – I

S.No	Course Code	Course Title	Scheme of Instructions				Scheme of Examinations		Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	
THEORY									
1.	BSC 101	Engineering Physics	3	1	0	4	30	70	4
2.	BSC 102	Mathematics – I	3	1	0	4	30	70	4
3.	HSMC 101	English	2	0	0	2	30	70	2
4.	ESC 102	Engineering Graphics	1	0	4	5	30	70	3
PRACTICALS									
5.	BSC 101	Engineering Physics Lab	0	0	3	3	25	50	1.5
6.	HSMC 101	English Lab	0	0	2	2	25	50	1
		Total	**09**	**2**	**9**	**20**	**170**	**380**	**15.5**

L : Lectures
T : Tutorials
P : Practicals
CIE : Continuous Internal Evaluation
SEE : Semester End Examination
BSC : Basic Science Course
HS : Humanities and Social Sciences
ESC: Engineering Science Course

Course Code	Course Title						Core/Elective
BSC 101	ENGINEERING PHYSICS						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course objectives:

- The aim of the course is to acquire the basic knowledge on waves and oscillations, elements of solid state physics.
- To understand the properties of Semiconductors, Ultrasonics, Dielectric materials, Electromagnetic theory and superconductivity. Also get introduction to the basics of Nanomaterials.

Course Outcomes:

- On the completion of course the student will acquire the basic knowledge and understanding on the concepts that are involved in the contents incorporated in the syllabus and students will be able use them in Engineering fields.

UNIT I

Waves and Oscillations: Simple harmonic oscillators- Complex number notation and Phasor representation of simple harmonic motion, Damped harmonic oscillator-heavy, Critical and light damping – energy decay in a damped harmonic oscillator- Quality factor – Forced Oscillators-Impedance-Steady state motion of forced damped harmonic oscillator-Power absorbed by oscillator.

UNIT II

Crystallography: Introduction- Types of crystal system-Bravais lattices- lattice planes and miller indices (Cubic system) inter planar spacing (Cubic system)-Bragg's law- powder diffraction method.

Crystal defects: Classification of point defects-concentration of Schottky defects in metals and ionic crystals-Concentration of Frankel defects- line defects- Screw and Edge dislocations-Burger's vector.

UNIT III

Band Theory of Solids & Semiconductors: Classical free electron theory (Qualitative)- Kroning-Penney model (Qualitative treatment)- Energy band formation in solids- Intrinsic and Extrinsic semiconductors – Concept of a hole – carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode and its I-V characteristics – Thermistor and its characteristics – Hall effect and its applications.

Ultrasonics: Introduction to Ultrasonics waves – Production of ultrasonic waves by Piezoelectric method – Detection of ultrasonic waves: Piezoelectric detector – Properties of Ultrasonics – Wavelength of Ultrasonics by Debye-Sears method – Applications.

UNIT IV

Dielectric Materials : Dielectrics – Types of polarizations- Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability –Frequency and temperature dependence of dielectric polarizations- Determination of dielectric constant by capacitance Bridge method – Ferro electricity – Barium titanate – Applications of Ferroelectrics.

Electromagnetic theory: Basic laws of electricity and magnetism – Maxwell's equations in integral and differential forms – Conduction and displacement current – Relation between D, E and P – **Electromagnetic waves:** Equation of plane wave in free space – Poynting theorem.

UNIT V

Superconductivity: Introduction – General properties of super conductors – Meissner effect –Type-I and Type- II superconductors – BCS theory (Qualitative) – Introduction to High T_c superconductors – Applications of superconductors.

Nanomaterials: Introduction – Properties of materials at reduced size – Surface to volume ratio at nano scale – Classification of nanomaterials – Preparation of nanomaterials : bottom up methods (sol gel and CVD), Top-down methods (ball milling) – Basic ideas of carbon nanotubes – Applications nanomaterials and their health hazards.

Suggested reading:

1. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning 2012.
2. M.S. Avadhanulu and P.G. Kshirasagar – Engg. Physics, S.Chand & Co., 1st Edition, 1992.
3. C. Kittel – Introduction to Solid State Physics, Wiley Eastern Ltd., 5th Edition, 1976.
4. A.K. Bhandhopadhya – Nono Materials, new Age International, 1st Edition, 2007.
5. C.M. Srivastava and C. Srinivasan – Science of Engg. Materials, New Age International, 2002.

Course Code	Course Title						Core/Elective
BSC 102	MATHEMATICS – I						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course objectives:

- To introduce the concepts of sequences, series and their properties
- To Study Fourier Series and its applications.
- To introduce the concepts of functions of several variables and multiple integrals
- To study vector differential and integral calculus

Course Outcomes: After completing this course, the students will able to

- find the nature of sequences and series
- Expand functions as a Fourier Series.
- use the knowledge of multiple integrals in finding the area and volume of any region bounded by given curves
- apply this knowledge to solve the curriculum problems

UNIT I

Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence ; Fourier Series, Half range Sine and Cosine Series, Parseval's theorem.

UNIT II

Calculus of one variable: Rolle's theorem, Lagrange's , Cauchy's mean value theorems (without proof) Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes, Evaluation of definite and improper integrals, Beta, Gamma and Error functions.

UNIT III

Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian , Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions two variables, Lagrange's method of multipliers.

UNIT IV

Multivariable Calculus (Integration): Double integrals, Change of order of integration, Triple integrals, Change of variables in integrals and applications-areas and volumes.

UNIT V

Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals , Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested reading:

1. R.K.Jain & S.R.K Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition 2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, , 2012.
3. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
4. G.B.Thomas , Maurice Weir and Joel Hass, *Thomas' Calculus* , Peterson, 12th Edition,2010.
5. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
6. N.P.Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2010.
7. H.K. Dass, Er. Rajnish Varma, Higher Engineering Mathematics, Schand Technical Third Edition.

Course Code	Course Title						Core/Elective
HSMC 101	ENGLISH						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	0	0	0	30	70	2

Course Objectives:

- Communicate clearly, accurately and appropriately
- Know and use verbal and non-verbal communication appropriately
- Infer information from texts
- Learn basic grammar of the English language
- Use appropriate idiomatic expressions, one word substitutes etc.

UNIT I

Vocabulary Building:

1.1. Word Formation

1.2. Synonyms, Antonyms, Abbreviations and Acronyms

1.3. One word Substitutes

1.4. Words and their categorizations

1.5. Foreign words and Silent letters

UNIT II

Remedial English and Common Errors:

2.1. Tense and Aspects

2.2. Conjuncts and Connectives

2.3. Voice

2.4. Concord

2.5. Degrees of comparison and Question Tags

UNIT III

Writing Practices:

3.1. Sentence Structure

3.2. Use of phrase and clauses in sentence

3.3. Coherence

3.4. Writing sample sentence

3.5. Paragraph-précis and expansion

Textbook:

1. E. Suresh Kumar, Engineering English, Orient Blackswan, 2014.

References:

1. E. Suresh Kumar et al., Communication Skills and Soft Skills,Pearson, 2011.
1. Sanjay Kumar and Pushp Lata, Communication Skills, OUP, 2011.
2. Kavita Tyagi and Padma Misra, Professional Communication, PHI, 2011.
3. Meenakshi aman and Sangeeta Sharma, Technical Communication: Principles and Practice, OUP, 2011.

Course Code	Course Title						Core/Elective
ESC 102	ENGINEERING GRAPHICS						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	1	0	0	4	30	70	3

Course Objective:

- To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcome: The student will learn

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

UNIT I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involute, Scales – Plain, Diagonal.

UNIT II

Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes, Projections of planes inclined Planes - Auxiliary Planes;

UNIT III

Projections of Regular Solids: Inclined to both the Planes- Auxiliary Views, Draw simple annotation, dimensioning and scale.

Sections and Sectional Views of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;

UNIT IV

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

UNIT V

Overview of Computer Graphics with CAD (For Internal Evaluation Weightage only):

Computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids].

Suggested Text/ Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers CAD Software Theory and User Manuals.
5. Computer Aided Engineering Drawing – K Balaveera Reddy- CBS Publishers.

Course Code	Course Title						Core/Elective
BSC 101	ENGINEERING PHYSICS LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	3	25	50	1.5

List of Experiments:

1. Determination of Velocity of ultrasonic waves in a liquid by Debye-Sears method.
2. To draw the I-V characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.
3. Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.
4. To calculate the Numerical aperture (NA) acceptance angle of a given optical fibre.
5. To find the values of Electrical conductivity and energy gap of Ge Crystal by Four probe method.
6. To determine the constants of A, B and a using Thermistor characteristics.
7. Determination of wavelength of LASER using diffraction grating.
8. To draw the I-V Characteristics of a solar cell and to calculate the i) Fill factor ii) Efficiency and iii) Series resistance.
9. Determination of rigidity of modulus of Torsion Pendulum.
10. Determination of logarithmic decrement of Torsional pendulum.

Course Code	Course Title						Core/Elective
HSMC 101	English Lab						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	2	25	50	1

Course Objectives:

- To enable the students to
- learn the sound systems of English
- learn the word stress in English
- learn the rhythm and intonation of English
- improve their articulation skills and participation skills

Note: While teaching the following items, emphasis may be laid on intensive practice in the language lab. Lecturing may be avoided as far as possible.

1. **Pronunciation:** Introduction to Phonetics (speech sounds), Vowels sounds, Consonant Sounds, Consonant clusters etc.
2. **Stress:** Primary stress, Secondary stress, functional stress, rules of word stress
3. **Intonation:** Introduction of Intonation, Major patterns of intonation in English with their semantic implications.
4. **Introduction to Rhythm:** Definition and types of Rhythm. Repetition, Alternation, Gradation.
    1. **Regular Rhythm**
    2. **Flowing Rhythm**
    3. **Progress Rhythm**
5. **Listening Comprehension:** Listening for specific details, Listening Comprehension Tests.
6. **Descriptions, Narrations, Giving Directions**
7. **Group Discussions, Interview Skills, Mock Interviews.**

Lab Manual Recommended:

- E. Suresh Kumar. A Handbook for English Language Laboratories (with CD). Revised edition, Cambridge University Press India Pvt. Ltd. 2014

Text Books:

1. T. Balasubramanian. A Text book of English Phonetics for Indian Students. Macmillan, 2008.
2. Edgar Thorpe. Winning at Interviews. Pearson Education, 2006.
3. J. Sethi et al., A Practical Course in English Pronunciation (with CD). Prentice Hall of India, 2005.
4. Hari Mohan Prasad. How to Prepare for Group Discussions and Interviews. Tata McGraw Hill, 2006.

SEMESTER – II

S.No	Course Code	Course Title	Scheme of Instructions				Scheme of Examinations		Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	
THEORY									
1.	BSC 201	Engineering Chemistry	3	1	0	4	30	70	4
2.	BSC 202	Mathematics –II	3	1	0	4	30	70	4
3.	ESC 201	Programming for Problem Solving	3	0	0	3	30	70	3
4.	ESC 203	Basic Electrical Engineering	3	1	0	4	30	70	4
PRACTICALS									
5.	BSC 201	Engineering Chemistry Lab	0	0	3	3	25	50	1.5
6.	ESC 202	Workshop Practice	0	0	6	6	25	50	3
7.	ESC 201	Programming for Problem Solving Lab	0	0	4	4	25	50	2
8.	ESC 203	Basic Electrical Engineering	0	0	2	2	25	50	1
		Total	**12**	**3**	**15**	**30**	**220**	**480**	**22.5**

L: Lectures
T: Tutorials
P: Practicals
CIE: Continuous Internal Evaluation
SEE: Semester End Examination
BSC: Basic Science Course
HS: Humanities and Social Sciences
ESC: Engineering Science Course

Course Code	Course Title						Core/Elective
BSC 201	ENGINEERING CHEMISTRY						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course Outcome: The concepts developed in this course will help in qualification of several concepts in chemistry that have been introduced at the 10+2 level. Technology is being increasingly based on the electronic, Atomic and Molecular level modifications. The course will enable the student to :

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Gains knowledge in causes of corrosion and its prevention.
- Attains knowledge about the disadvantages of hard water for domestic and industrial purpose.

UNIT I

Periodic properties, Atomic & Molecular Structure and Spectroscopy:

Variation of s, p, d and f orbital, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation states, coordination numbers and geometries.

Molecular Orbital Theory, Linear Combination of Atomic Orbital, Molecular Orbital energy level diagrams of diatomic molecules- O_2, N_2 and NO. Crystal Field Theory salient features, Crystal field splitting of d-orbital of transition metal complexes in Octahedral, Tetrahedral and Square planar geometries.

Principles of Spectroscopy, selection rules of Vibrational, Rotational & Electronic spectroscopy and their applications. Selection rules (Derivation not required)

UNIT II

Thermodynamics and electrochemistry:

Thermodynamics: Thermodynamics first law and its limits, Thermodynamic second law. Thermodynamic functions: Enthalpy, Entropy, Free energy and their significance. Entropy and Free energy change for isothermal process. Variation of free energy change with temperature and pressure.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Nernst equation and its derivation. Application of Nernst equation to electrode potential and emf of cells. Numericals. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. Determination of P^H of a solution by using Quinhydrone electrode. Principles and applications of Conductometric and Potentiometric titrations.

UNIT III

Water chemistry and corrosion:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion-exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination and Ozanization.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and Impressed current cathodic protection method. Surface coating methods: Hot dipping-Galvanizing and Tinning. Electroplating.

UNIT-IV

Energy Sources:

Fuels: Introduction. Classification and advantages, disadvantages of solid, liquid and gaseous fuels. Requirements of good fuel. Bio fuels-Bio Diesel.

Combustion: Calorific Value of the fuel-Lower Calorific Value (LCV), Higher Calorific Value (HCV). Theoretical calculations of calorific value by Dulong's formula- Numerical Problems.

Solid Fuels: Coal- Classification, Proximate and Ultimate analysis and its significance.

Liquid Fuels: Source- Fractional distillation of petroleum, important fractions and their uses. Knocking, Fuel rating-Octane and Cetane numbers.

Gaseous Fuels: LPG, CNG composition and uses.

Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and Methanol-Oxygen fuel cells.

UNIT-V

Engineering materials:

Lubricants: Introduction, Functions and mechanism of lubrication. Hydrodynamic, boundary and extreme pressure lubrication. Classification of lubricants: Solid, semi solid and liquid lubricants.

Properties of lubricants: Viscosity, Viscosity index, Saponification number and acid value.

Composites: Introduction, constituents and characteristics of composites. Types of composits-reinforced, Particulate and Layered composites. Advantages and applications of composites.

Text Book:

1. Jain & Jain, Engineering chemistry, Dhanpat Rai publishing Co.,16th Edition.
2. B.L.Tembe,Kamaluddin and M.S.Krishnan, Engineering Chemistry(NPTELWeb-book)
3. Prashanth Rath, Engineering Chemistry, Cengage Learning.
4. M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, MGH Publishers.
5. B.H.Mahan, University Chemistry, Pearson Publishing Co., 4th Edition.
6. C.N. Banwell, Fundamentals of Molecular Spectroscopy, TMH

Course Code	Course Title						Core/Elective
BSC 202	MATHEMATICS – II						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course objectives:

- To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
- To provide an overview of ordinary differential equations
- To study special functions like Legendre and Bessel functions
- To introduce the concept of functions of complex variable and their properties

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

- solve system of linear equations and eigen value problems
- solve certain first order and higher order differential equations
- determine the analyticity of complex functions and expand functions as Taylor and Laurent series
- evaluate complex and real integrals using residue theorem

UNIT I

Matrices: Elementary row and column operations, Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigenvalues, Eigenvectors, Properties of eigenvalues , Cayley-Hamilton theorem, Quadratic forms, Diagonalization of Matrices, Reduction of quadratic form to canonical form by orthogonal transformation , Nature of quadratic forms.

UNIT II

First Order Ordinary Differential Equations: Exact first order differential equations , Integrating factors, Linear first order equations , Bernoulli's , Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT III

Differential Equations of Higher Orders: Linear independence and dependence, Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients , Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation, Simultaneous linear differential equations, Power Series

solution, Legendre Polynomial of first kind, Bessel's function of first kind and their properties.

UNIT IV

Functions of a Complex Variable: Limits and continuity of a function, differentiability and analyticity, Elementary Analytic functions, Necessary and Sufficient conditions for a function to be analytic, Cauchy- Riemann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula, Cauchy's inequality, Cauchy's formula for derivatives, Liouville's theorem, Maximum Modulus principle (without proof)and its applications

UNIT V

Residue Calculus: Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, Argument principle, Rouche's Theorem and their applications, conformal mapping Bilinear transformations. (**All Theorems without Proof)**

Suggested Readings:

1. R.K. Jain & S.R.K. lyengar, *Advanced Engineering Mathematics*, Narosa Publications, 4th Edition,2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley , 9th Edition, , 2012.
3. Dr.B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
4. Dr.M.D.Raisinghania, *Ordinary and Partial differential equations*, S.CHAND, 17th Edition 2014.
5. James Brown, R.V Churchill, Complex Variables and applications, Mc GrawHill 9th Edition 2013.

6. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
7. S.L Ross, Differential Equations 3rd Edition, Wiley India.
8. G.F. Simmons and S.G. Krantz, Differential Equations, Tata Mc Graw Hill, 2007.
9. N. Bali, M.Goyal, A text book of Engineering Mathematics,Laxmi publications,2010
10. H.K. Dass, Er. Rajnish Varma, Higher Engineering Mathematics, Schand Technical Third Edition.

Course Code	Course Title						Core/Elective
ESC 201	PROGRAMMING FOR PROBLEM SOLVING						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	0	0	0	30	70	3

Course Objectives:

- To acquire problem solving skills
- To be able to develop flowcharts
- To understand structured programming concepts
- To be able to write programs in C Language
- To understand different type of data representations (Arrays, Structures and Files).
- To understand different types of sorting and searching techniques.

Course Outcome:

- Able to design algorithms for different problems
- Able to write program for various problems.
- Able to write program for matrix representation.
- Able to perform file handling operations.

UNIT I

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)**.**

Introduction to Algorithm: steps to solve logical and numerical problems. Representation of Algorithm**:** Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II

Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops

Introduction to Arrays: Arrays, Representation of Arrays (1-D, 2-D), Character arrays and Strings

UNIT III

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Introduction to Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

UNIT IV

Introduction to Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference

Introduction to Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.

UNIT V

Introduction to Structure: Structures, Defining structures, Array of Structures and Union

Introduction to File: File handling (only if time is available, otherwise should be done as part of the lab)

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

References:

1.Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Code	Course Title						Core/Elective
ESC 203	BASIC ELECTRICAL ENGINEERING						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	0	0	30	70	4

Course Objectives:

- To understand the basic concepts and the applications of DC and AC circuits.
- To master the basics of 3-phase balanced circuits
- To understand the basics of DC machines and Induction motor.
- To understand the characteristics of series, shunt and compound motors,
- To understand the Stepper motor and Brushless DC motor.

Course Outcomes:

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

UNIT I

DC Circuits: Electrical circuit elements (R, L, C), Voltage and current sources, Kirchoff's current and voltage laws, Analysis of simple circuits using with DC excitation, super position, Thevenin's and Norton's theorems, time domian analysis of first order RL and RC circuits.

UNIT II

AC Circuits: Representation of Sinusoidal wave forms, Phasor representation of sinusoidal quantities, Peak and rms values, Active power, Reactive power, apparent power, analysis of single phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance, 3-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III

Tranformers: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, auto transformer, 3-phase transformer connections.

UNIT IV

Electrical machines:

Generation of rotating magnetic field, Construction and working of 3-phase induction motors, significance of torque slip characteristics, loss components and efficiency, Methods of starting and Speed control of induction motors, single phase induction motor.

Construction, working, torque speed characteristics and speed control of separately excited DC motor.

Construction and working of synchronous generators

UNIT V

Electrical installations: Components of LT switch gear: Switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables, earthing. Types of batteries, important characteristics for batteries, elementary calculations for energy consumption, power factor improvement and battery bachup.

Text Books:

1. V.K.Mehta, *Principles of Electrical Engineering*, S.Chand & Co.,1995
2. Kothari and Nagrath, *Basic Electrical Engineering*, Tata McGraw Hill, 2nd Edition, 2006.

References:

1. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
3. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
4. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Course Code	Course Title						Core/Elective
BSC 201	ENGINEERING CHEMISTRY LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	3	25	50	1.5

Course Objective:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Course Outcome: The students will learn to

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

List of Experiments:

I. VOLUMETRIC ANALYSIS

1. Estimation of Hardness of Sample water by EDTA method
2. Estimation of alkalinity of sample water.

II. INSTRUMENTAL ANALYSIS CONDUCTOMETRY

1. Conductometric and acid-base strong acid vs strong base titration.
2. Conductometric weak acid vs strong base titration.
3. Conductometric mixture of acids vs strong base titration.
4. Conductometric precipitation titration-barium chloride against sodium sulphate

III. POTENTIOMETRY

1. Potentiometric acid-base titration –strong acid vs strong base, using Quinhydrone electrode.
2. Potentiometric redox titration-$KMnO_4$vs Fe^{+2}

IV. pH Metry

1. pH Metry strong acid vs strong base titration.
2. pH Metry weak acid vs strong base titration

V. COLORIMETRY

1. Verification of Beer's Law –using Potassium permanganate.
2. Estimation of $KMnO_4$(Mn) in the given solution
3. Estimation of iron in cement

VI. KINETICS

1. First order reaction-hydrolysis of methyl acetate
2. Second order reaction-potassium iodide and persulphate

Text Books:

1. Senior practical Physical Chemistry, BD Khosla, A.Ghulati, VC.Garg., R.Chand and Co., New Delhi 10th ed. 2001.
2. Practical Physical Chemistry, B.Vishwanathan, P.S Raghavan, Viva Books Private Limited.

Course Code	Course Title						Core/Elective
ESC 202	WORKSHOP PRACTICE						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	6	25	50	3

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 various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working precision and safety at work place.
- Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Course Outcomes: The student will able to

- Fabricate components with their own hands.
- Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- Assembling different components, they will be able to produce small devices of their interest.
- Apply basic electrical engineering knowledge for house wiring practice.

I Lectures & videos:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronic
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

II. Workshop Practice (Two from each trade):

1. Machine shop
2. Fitting shop
3. Carpentry
4. Electrical house wiring
5. Welding
6. Black Smithy
7. Tin Smithy
8. Glass Cutting (Demo)

Note:- Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Workshop manual / K.Venugopal /Anuradha

References:

1. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
2. Workshop manual – P. Kannaiah / K.L. Narayana / Scitech
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Code	Course Title						Core/Elective
ESC 201	PROGRAMMING FOR PROBLEM SOLVING LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	4	25	50	2

Course Outcome: The student will be able

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To correct syntax errors as reported by the compilers
- To identify and correct logical errors encountered at run time
- To write iterative as well as recursive programs
- To represent data in arrays, strings and structures and manipulate them through a program
- To declare pointers of different types and use them in defining self-referential structures.
- To create, read and write to and from simple text files

List of Programs:

1. **Tutorial 1:** Problem solving using computers:
   Lab1: Familiarization with programming environment
2. **Tutorial 2:** Variable types and type conversions:
   Lab 2: Simple computational problems using arithmetic expressions
3. **Tutorial 3:** Branching and logical expressions:
   Lab 3: Problems involving if-then-else structures
4. **Tutorial 4:** Loops, while and for loops:
   Lab 4: Iterative problems e.g., sum of series
5. **Tutorial 5:** 1D Arrays: searching, sorting:
   Lab 5: 1D Array manipulation
6. **Tutorial 6:** 2D arrays and Strings
   Lab 6: Matrix problems, String operations
7. **Tutorial 7:** Functions, call by value:
   Lab 7: Simple functions

8. **Tutorial 8 &9:** Numerical methods (Root finding, numerical differentiation, numerical integration):

   Lab 8 and 9: Programming for solving Numerical methods problems
9. **Tutorial 10:** Recursion, structure of recursive calls

   Lab 10: Recursive functions
10. **Tutorial 11:** Pointers, structures and dynamic memory allocation

    Lab 11: Pointers and structures
11. **Tutorial 12:** File handling:

    Lab 12: File operations

Note: The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Course Code	Course Title						Core/Elective
ESC 203	BASIC ELECTRICAL ENGINEERING LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	0	0	0	2	25	50	1

Course Objective:

- To acquaint with practical electric AC &DC circuits implementation

Course Outcomes: On successful completion of the course, the student will acquire the ability to:

- Awareness about various electric safety rules to be followed while working with electrical equipment's.
- Explore themselves in designing basic electric circuits
- Identify requirements for electric machines for domestic and industrial purpose

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Thevinin's & Norton's Theorems.
3. Study of Three-phase Balanced Circuits.
4. Measurement of Power by Two-Wattmeter Method.
5. Study of Single-Phase RLC Series Circuits.
6. Magnetization Curve of a Separately Excited DC Generator.
7. Load Characteristics of Shunt Generator.
8. Performance Characteristics of shunt Motor.
9. Speed Control of DC Shunt Motor.
10. O.C and S.C Test on Single-Phase Transformer.
11. Load Test on Single-Phase Transformer.
12. Load Test on Three-Phase Induction Motor.

Note: At least ten experiments should be conducted in the Semester

With effect from the Academic year 2019-2020, UCE&T, MGU

AICTE III & IV
2018-19
2019-20
2020-21
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SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

(SEMESTER III & IV)

BACHELOR OF TECHNOLOGY

Electrical & Electronics Engineering

Department of Electrical & Electronics Engineering

University College of Engineering & Technology

Mahatma Gandhi University - Nalgonda

SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

B.Tech (Electrical & Electronics Engineering)

SEMESTER - III

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	BS301MT	Mathematics - III	3	1	-	4	30	70	4
2	PC301EE	Electrical Circuit – I	3	1	-	4	30	70	4
3	PC302EE	Electrical Machines – I	3	1	-	4	30	70	4
4	PC303EE	Power Systems - I	3	1	-	4	30	70	4
5	PC304EE	Electromagnetic Fields	3	1	-	4	30	70	4
6	PC305EE	Analog Electronics	3	-	-	3	30	70	3
7	MC101HS	Environmental Science	3	-	-	3	30	70	-
Practicals									
8	PC352EE	Computer Aided Electrical Drawing Laboratory	-	-	3	3	25	50	1.5
9	PC351EE	Analog Electronics Laboratory	-	-	2	2	25	50	1
	Total		***21***	**5**	**5**	**31**	**260**	**590**	**25.5**

NOTE: - *The Practical Class can be of Two and half Hour (Clock hours) duration as per the requirement of the Particular Laboratory*

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SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

B.Tech (Electrical & Electronics Engineering)

SEMESTER - IV

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC401EE	Electrical Circuit – II	3	1	-	4	30	70	4
2	PC402EE	Electrical Machines – II	3	1	-	4	30	70	4
3	PC403EE	Power Systems – II	3	1	-	4	30	70	4
4	PC404EE	Digital Electronics & Logic Design	3	-	-	3	30	70	3
5	ES405ME	Prime Movers & Pumps	3	-	-	3	30	70	3
Practicals									
6	PC451EE	Electrical Circuits Laboratory	-	-	2	2	25	50	1
7	PC452EE	Electrical Machines Laboratory – I	-	-	2	2	25	50	1
8	ES453ME	Mechanical Technology Laboratory			2	2	25	50	1
	Total		***15***	**3**	**6**	**24**	**225**	**500**	**21**

NOTE: - *The Practical Class can be of Two and half Hour (Clock hours) duration as per the requirement of the Particular Laboratory.*

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BS301MT

MATHEMATICS – III

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 04

Course Objectives:

1. Apply general methodology to solve linear first order and second order partial differential equations.
2. To study the classification of second order partial differential equations and solve them by using separation of variables methods.
3. To introduce transforms like Laplace, Fourier, Z-Transforms and their properties.

Course outcomes:

After completion of this course students able to

1. Find solutions of the Heat equation, Wave equation and the Laplace equation subject to boundary conditions.
2. Solve differential equations using Laplace and Fourier transforms.
3. Solve differential equations by using Z-Transforms.

Unit-I:

Partial differential equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, non linear first order equations, and Charpit's method, higher order linear equations with constant coefficients.

Unit-II:

Fourier series applications to partial differential equations: Classification of linear second order partial differential equations, Separation of variable method (Fourier method), Fourier series solution of one dimensional Heat and Wave equations, Laplace's equation.

Unit-III:

Laplace transforms: Introduction to Laplace transforms, sufficient condition for existence of Laplace transform, Laplace transform of derivatives, Laplace transform of integrals, Translation theorems(I & II Shifting theorems), differentiation of Laplace transform(Multiplication by t), integration of Laplace transform(Division by t), convolution theorem, solving initial value problems using Laplace transform.

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Unit-IV:

Fourier transforms: Introduction, Fourier integrals, Fourier sine and cosine integrals, complex form of Fourier integral, Fourier transform, Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, properties of Fourier transforms, convolution theorem for Fourier transforms.

Unit-V:

Z- Transform: Introduction, basic theory of Z- Transforms, Z- Transforms of standard sequences, existence of Z- Transform, linearity property, translation theorem, scaling property, initial and final value theorems, differentiation of Z- Transform, convolution theorem, solution of difference equations using Z- Transforms.

Suggested Reading:

1. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publication, 4th Edition, 2014.
2. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publications, 43rd Edition, 2014.
3. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, 2012.
4. Vasishtha, Gupta, "Integral Transforms", Krishnan Prakashan Publications, 2014.

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PC301EE

ELECTRICAL CIRCUITS - I

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 04

Objectives:

1. To acquire knowledge in circuits and to understand the fundamentals of derived circuit laws.
2. To understand theorems, steady state and transient analysis of single phase and 3-phase circuits.

Outcomes:

At the end of the course the students will be able to
1. Understand network analysis, techniques using mesh and node analysis.
2. Evaluate steady state and transient behavior of single port network for DC and AC excitations.
3. Analyze electric circuits using network theorems.
4. Understand the concept of coupled circuits and poly-phase circuits.

UNIT I

Network Elements & Laws: Active elements, Independent and dependent sources. Passive elements — R, L and C, Energy stored in inductance and capacitance, Kirchhoff's laws, Source transformations, Star-delta transformations, Node voltage method, Mesh current method including super node and super mesh analysis.

UNIT II

Single-Phase Circuits: RMS and average values of periodic sinusoidal and non- sinusoidal waveforms, Phasor representation, Steady-state response of series, parallel and series-parallel circuits. Impedance, Admittance, Current locus diagrams of RL and RC series and parallel circuits with variation of various parameters. Resonance: Series and parallel circuits, Band-width and Q-factor.

UNIT III

Network theorems: Superposition theorem, Thevinin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Milliman's theorem and Reciprocity theorem. (AC & DC)

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UNIT IV

Poly-phase Circuits: Analysis of balanced and unbalanced 3-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads. Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

UNIT V

Transient analysis: Transient response of RLC circuits, Formulation of integral differential equations, Initial conditions, Response of RL, RC and RLC networks subjected to internal energy, Response to impulse, step, ramp, exponential and sinusoidal excitations

Suggested Reading:

1. Van Valkenburg M.E., Network Analysis, Prentice Hall of India, 3rd Edition, 2000.

2. William Hayt H, Kimmerly Jack E, Steven Durbin M, Engineering Circuit Analysis, McGraw Hill, 6th Edition, 2002.

3. Jagan N.C, Lakshrninarayana C., Network Analysis, B.S. Publications, 3rd Edition, 2014.

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PC302EE

ELECTRICAL MACHINES – I

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 04

Objectives:

1. To learn and understand electromechanical energy conversion devices.
2. To be able to understand in detail about DC machines - Construction, principle, performance characteristics and testing.

Outcomes:

At the end of the course the students will be able to
1. Understand construction, operating principle and characteristics of different types of DC motors and generators.
2. Test and calculate performance parameters of DC motors and generators.
3. Select appropriate DC machines for a specific application.

UNIT I

Electromechanical energy conversion: Principle of energy conversion, Flow of energy in electromechanical devices, Coupling-field reaction, Singly excited magnetic system – Electric energy input, Magnetic field energy stored, Mechanical work done – with slow, instantaneous and transient movement of armature, Calculation of mechanical force, Doubly excited magnetic systems, electromagnetic and reluctance torques.

UNIT II

DC Machines: Simple loop generator, Essential parts of DC machine, Details of Lap winding & Wave winding, EMF equation, Armature reaction — Remedies, Ampere turns, Commutation — reactance voltage, Methods of improving commutation — High resistance brushes, shifting of brushes, Interpoles, Compensating winding.

UNIT III

DC Generators; Classification & types of DC generators, Open circuit, Internal & External characteristics — Critical resistance & critical speed, Voltage regulation, Conditions for self

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excitation, Causes of failure of voltage buildup, Parallel operation Series, Shunt and Compound generators, Applications.

UNIT IV

DC Motors: Classification & Types of DC motors, Back emf, Speed regulation, Armature torque, Armature reaction, Operating characteristics, Performance curves, Basic speed control methods Shunt and Series motors, Three & four-point starters, Calculation of step resistances, Applications.

UNIT V

Testing, Losses and Efficiency: Power losses — Copper losses and Rotational losses, Power flow, Efficiency, Testing - Brake Test and Swinburne's test, Hopkinson's test, Field's test, Retardation test, Heat run test.

Suggested Reading:

1. D.P. Kothari, I.J. Nagrath , Electric Machines, Tata McGraw Hill, 4th Edition, 2010.

2. Bhimbra P.S., Electrical Machinery, Khanna Publications, 2000.

3. Gupta J.B., Theory and Performance of Electrical Machines, S.K.Kataria & Sons, Delhi, 2005.

4. AE Clayton and NN Hancock, The Performance and Design of Direct Current Machines, 3rd edition, 1959.

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PC303EE

POWER SYSTEMS – I

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 04

Objectives:

1. To be able to learn and understand the conventional and renewable generating power stations and economics of generation.
2. To be able to understand design concepts of transmission lines and cables.

Outcomes:

1. The students will acquire knowledge in conventional renewable generating power stations and economics of generation
2. The students will acquire knowledge regarding the design concepts of transmission lines and cables.

UNIT I

Economics of Power Generation: Load Curve, Load Demand and Diversified factors, Base Load and Peak load operation, Types of costs and depreciation fund calculations, Methods of power factor improvement, Economics of power factor improvement, Tariffs, Distribution: 2 wire and 3 wire distributors, Ring mains, AC distribution calculations.

UNIT II

Steam Power Stations: Choice of site, Layout & various parts of station, Boilers, Turbines, Super Heaters, Economizers, Air pre-heaters etc. and their Pulverized fuel, Coal handling. Hydro-Electric Power plants: Estimation Hydrograph, Flow duration curve, Mass curve, Storage and pondage, Types electric plants and layouts, Prime movers for hydroelectric plants.

UNIT III

Nuclear Power Plants: Fissile materials, Working principle of nuclear plants and reactor control, Shielding, Types of reactors. Non-Conventional Energy Sources – Basic principles of Wind, solar and gas turbines.

UNIT IV

Over-Head Lines: Supports sag and tension calculations, Effect of wind and ice, Erection conditions, Insulators: Types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, Testing of insulators. Insulated Cables: Conductors for cables, Insulating

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materials, Mechanical protection, Low voltage cables, Grading of cables, Three phase high voltage cables and Super voltage cables, Capacitance of three-core cables.

UNIT V

Inductance and Capacitance of Transmission Lines: Inductance and capacitance of overhead line conductors, Single phase and three phase with symmetrical composite conductors, GMR and GMD Spacing, Transposition, Bundled conductors, Effect of earth.

Suggested Reading:

1. Wadhwa C.L., Electrical Power Systems, New Age International (P) Ltd., 4th Edition, 2007.
2. Wadhwa C.L., Generation, Distribution and Utilization of Electrical Energy, New Age International (P) Ltd., 4th Edition, 2006.
3. Singh S.N., Electrical Power Generation, Transmission and Distribution, Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
4. V.K.Mehta, Principles of Power Systems, S. Chand and Co., 2007.

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PC304EE

ELECTRO MAGNETIC FIELDS

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 03

Objectives:

1. To be able to understand the concepts of electrostatic fields, magneto static fields, electromagnetic waves and Maxwell's equation.
2. To understand the concepts of electromagnetic wave propagation in different media.

Outcomes:

At the end of the course students will be able to
1. Formulate problems within electrostatics, magnetostatics and stationary current distributions in linear, isotropic media.
2. Derive expressions for the energy for electrostatic and magnetostatic fields, and derive Poynting's theorem.
3. Calculate the boundary conditions for electric and magnetic fields between different media.
4. Calculate the reflection and refraction coefficients of electromagnetic waves for different conditions.

UNIT I

Review of Vector Analysis: Coulomb's Law, Electric field intensity, Electric field due to different charge distributions. Electric field due to line charge, Sheet charge, Volume charge distribution, Electric flux density, Gauss's law, Divergence theorem. Potential, Potential gradient, Potential field of different charge distributions, Applications of above laws.

UNIT II

Energy in electrostatic field, Poisson's and Laplace equations, Uniqueness theorem, Solution of Laplace's equation. Conductors, Dielectric capacitance, Conductor properties and Boundary conditions, Calculation of capacitance, Boundary conditions for conductors and perfect dielectric materials.

UNIT III

Steady magnetic field, Biot-Savart's law, Ampere's law, Stoke's theorem, Magnetic scalar vector potential Faraday's law, Magnetic boundary conditions, Self and Mutual inductances, Force on moving charge, Force on differential elements, Magnetic circuits, Analogy with electrical circuits, Applications of above laws.

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UNIT IV

Maxwell's equations in Integral form, Line and surface integrals, Application to static fields, Boundary conditions, Maxwell's equations in differential forms, Continuity equation, Potential function for static fields, Field equations in vector forms, energy storage in electric and magnetic fields.

UNIT V

EM waves in homogeneous medium solutions for free space conditions, Uniform plane wave propagation, Poisson's and Laplace's equations, Sinusoidally time varying uniform plane waves in free space, Uniform plane waves in dielectrics and conductors, Poynting vector, Power dissipation, Reflection of uniform plane waves, Introduction to method of moments, Method of images.

Suggested Reading:

1. Matthew Sadiku N.O., Elements of Electromagnetics, Oxford University Press, 4th Edition, 2006.
2. William. Hayt H, Buck John A., Engineering Electromagnetics, Tata McGraw Hill, 7th Edition, 2003.
3. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, PHI, New Delhi, 5th Edition, 2002.

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PC305EE

ANALOG ELECTRONICS

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 03

Objectives:

1. To understand the diode characteristics.
2. To study the input and out characteristics of different Transistor configurations.
3. To understand the design concepts MOSFET and amplifier.
4. To understand the design concepts of OP-Amp.
5. To understand the Applications of OP-Amp.

Course Outcomes:

At the end of this course, students will demonstrate the ability to
1. Understand the characteristics of transistors.
2. Design and analyze various rectifier and amplifier circuits.
3. Design sinusoidal and non-sinusoidal oscillators.
4. Understand the functioning of OP-AMP and design OP-AMP based circuits.

Unit I

Diode circuits (4 Hours) P-N junction diode, I-V characteristics of a diode, review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Unit-II

BJT circuits (8 Hours) Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: smallsignal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Unit-III

MOSFET circuits (8 Hours) MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

Unit-IV

Differential, multi-stage and operational amplifiers (8 Hours) Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp,

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non-idealities in an op-amp (Output off set voltage, input bias current, input offset current, slew rate, gain bandwidth product).

Unit-V

Linear applications of op-amp (8 Hours) Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, voltage regulator, oscillators (Wein bridge and phase shift).Analog to Digital Conversion: (Flash, Successive Approximation, Dual slope).

Suggested Reading:

1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. D.Roy Chowdary and Shail B Jain, "Linear Integrated Circuits", 3rd Edition, New Age.
5. International (P) Limited, New Delhi, 2008.

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MC101HS

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE I)

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : -- Nil-

Objectives:
1. To know about natural resources and their benefits to the public.
2. To study the concept of ecosystems and biodiversity.
3. To understand the types of pollutions, social issues and disaster management

Course Outcomes:
1. Will have an awareness of effects of hazardous environment.
2. Will have an idea about optimum utilization of natural resources.
3. Will be a catalyst in moving towards Green technologies.
4. Will have information about rules and regulations of pollution control.

Unit-I

Environmental studies: Definition, scope and importance, need for public awareness. Natural resources: Water resources; use and over utilization of surface and ground water, Floods, drought, conflicts over water, dams-benefits and problems. Effects of modern Agriculture, Fertilizer pesticide problems, water logging and salinity.

Unit-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) Energy resources: Growing energy needs renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

Unit-III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

Unit-IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, soil pollution, noise pollution , thermal pollution and solid waste management. Environmental protection act: Air, water, forest and wild life Acts, enforcement of Environmental legislation.

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Unit-V

Social issues and the Environment: Water conservation, watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion. Disaster management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management and methodology, disaster management cycle, and disaster management in India.

Suggested Text/Reference Books:

1. De A.K., "Environmental Chemistry", Wiley Eastern Ltd.
2. Odum E.P., "Fundamentals of Ecology", W.B. Sunders Co., USA.
3. Rao M.N and Datta A.K., "Waste Water Treatment", Oxford and IBK Publications.
4. Benny Joseph, "Environmental studies", Tata McGraw Hill, 2005.
5. Sharma V.K., "Disaster Management", National Centre for Disaster management, IIPE, Delhi, 1999.

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PC351EE

ANALOG ELECTRONICS LABORATORY

Instructions : 2 hours per week
Duration of SEE : 3 Hours
SEE : 50 Marks
CIE : 25 Marks
Credits : 01

Objectives:

1. To understand the diode characteristics.
2. To study the input and out characteristics of different Transistor configurations.
3. To understand the design concepts of amplifier.
4. To understand the design concepts of Combinational and Sequential circuits.
5. To understand the design concepts of OP-Amp.

Course Outcomes:

Students will be
1. Able to design diode circuits.
2. Able to understand the applications of zener diode.
3. Able to understand the operation of HWR & FWR circuits with & without filters.
4. Able to analyze the characteristics of BJTs and FETs.
5. Able to analyze the performance of operation amplifier.

List of Experiments:

1. Characteristics of Semiconductor Diodes(Si, Ge and Zener).
2. Characteristics of BJT (CB,CE).
3. CRO and its Applications.
4. Rectifiers: Half Wave Rectifier, Full Wave Rectifier with and without filters
5. Characteristics of FET.
6. Transistors as an Amplifier.
7. Inverting, Non-Inverting Amplifier using Op amp.
8. RC phase shift Oscillator
9. Wien Bridge Oscillator
10. Integration and Differentiation using Op-amp.

Suggested Readings:

1. David Bell A., Operational Amplifiers and Linear ICS, Prentice Hall of India, 2005.
2. Maheshwari and Anand, Laboratory Experiments and PSPICE Simulations in Analog Electronics, 1st edition, Prentice Hall of India, 2006.

ES352EE

COMPUTER AIDED ELECTRICAL DRAWING LABORATORY

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 50 Marks
CIE : 25 Marks
Credits : 1.5

Objectives :

1. To understand the terminology of electric circuit and electrical components.
2. To be able to familiarize with electrical machines, apparatus and appliances.
3. To acquire knowledge on various Electrical Engg. software's.

Outcomes:

At the end of the course students will be able to

1. Identify and draw different components of electrical systems
2. Draw different control and wiring diagrams.
3. Draw winding diagrams of electrical machines.

Drawing of the following using Electrical CADD / Corel Draw / MS Word / PPT/Visio

1. Lines, Arcs, Curves, Shapes, Filling of objects, Object editing & Transformation.
2. Electrical, Electronic & Electro – mechanical symbols.
3. House – wiring diagrams and layout.
4. Simple power and control circuit diagrams.
5. Electrical machine winding diagrams. (A.C & D.C).
6. Transmission tower, Over head lines – ACSR conductors, Single circuit, Double circuit, Bundle conductor.
7. Constructional features of D.C motors, AC motors and Transformers.
8. D.C and A.C motor starter diagrams.
9. Lamps used in illumination
10. Single line diagram of Power System

Suggested Readings:

1. KB. Raina, S.K. Bhattacharya, Electrical Design, Estimating and Costing, Wiley Eastern Ltd., 1991.
2. Nagrath, Kothari, Electrical Machines, Tata McGraw Hill Publishing Company Ltd., 2000.
3. A.K. Sawhney, A Course in Electrical Machines Design, Dhanpat Rai and Sons, 1996.

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SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

B.Tech (Electrical & Electronics Engineering)

SEMESTER - IV

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC401EE	Electrical Circuit – II	3	1	-	4	30	70	4
2	PC402EE	Electrical Machines – II	3	1	-	4	30	70	4
3	PC403EE	Power Systems – II	3	1	-	4	30	70	4
4	PC404EE	Digital Electronics & Logic Design	3	-	-	3	30	70	3
5	ES405ME	Prime Movers & Pumps	3	-	-	3	30	70	3
Practicals									
6	PC451EE	Electrical Circuits Laboratory	-	-	2	2	25	50	1
7	PC452EE	Electrical Machines Laboratory – I	-	-	2	2	25	50	1
8	ES453ME	Mechanical Technology Laboratory			2	2	25	50	1
	Total		***15***	**3**	**6**	**24**	**225**	**500**	**21**

NOTE: - *The Practical Class can be of Two and half Hour (Clock hours) duration as per the requirement of the Particular Laboratory.*

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PC401EE

ELECTRICAL CIRCUITS – II

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70
Marks CIE : 30 Marks
Credits : 4

Objectives:

1. To acquire knowledge in circuits and to understand the Fourier series and Laplace transformation.
2. To be able to understand the techniques of electric network synthesis.

Outcomes:

At the end of the course the students will be able to
1. Examine the behavior of linear circuits using Fourier transform, Laplace transforms and transfer function of single port network.
2. Obtain two port network parameters and applications of graph theory to electric circuits.
3. Synthesize a network in terms of RL, RC and RLC parameters.

UNIT I

Fourier Series and Integral: Fourier series representation of periodic functions, Symmetry conditions, Exponential Fourier series, Discrete spectrum, Fourier integral and its properties, Continuous spectrum, Application to simple networks

UNIT II

Laplace Transform Method of Analysis of Networks: Definition of Laplace pair, Evaluation of Laplace transform of common time function, Laplace properties and theorems, Convolution theorem, Waveforms synthesis, Partial fraction method of inverse transforms, Application to networks, Transfer functions.

UNIT III

Two port network parameters: Open circuit impedance, Short circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks, System function, Impedance and admittance functions

UNIT IV

Topological Description of Networks: Graph, tree, chord, cut-set, incident matrix, circuit matrix and cut-set matrix, Formulation of node equations, loop equations, cut-set equations for RLC networks. Network synthesis of driving point functions, Positive real function, properties of PR functions, Testing of PR functions,

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UNIT V

Synthesis of LC, RC, RL functions, Properties of LC, RC and RL networks, Minimum functions, Synthesis of RLC networks, Brune's method, Properties of networks in terms of poles and zeros.

Suggested Reading:

1. Van Valkenburg M.E, Network Analysis, Prentice Hall of India, 3rd Edition, 2000.
2. William Hayt H, Kimmerly Jack E. and Steven Durbin M, Engineering Circuit Analysis, McGraw Hill, 6th Edition, 2002.
3. Jagan N.C, Lakshminarayana C., Network Analysis, B.S. Publications, 3rd Edition, 2014. 4. Chakravarthy A., Circuit Theory, Dhanpat Rai & Co., First Edition, 1999.

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PC402EE

ELECTRICAL MACHINES –II

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 4

Objectives:

1. To be able to understand in detail about transformers and induction machines. Construction, principle, performance characteristics and testing.
2. To understand the construction, principle and performance characteristics of fractional HP motors.

Outcomes:

The students will be able to

1) Acquire the knowledge of construction, principle of operation and testing of single phase transformers.
2) Impart the knowledge about three phase transformers, three phase to two phase transformation and their parallel operation.
3) Acquire the knowledge about the constructional details, equivalent circuit parameters and performance characteristics of three phase induction motors.
4) Acquire the knowledge about starting and speed control methods of three phase induction motors.
5) Impart the knowledge of constructional details, principle of operation and types of single phase induction motors.

UNIT-I

Single Phase Transformers : Constructional features of single phase transformers, principle of two winding transformer, ideal transformer - transformer on no load and on load - phasor diagrams- equivalent circuits, losses , Testing - Polarity test, OC and SC tests, Sumpner's test, Regulation and efficiency, All day efficiency, separation of losses - Excitation phenomena in transformers, Auto transformer - Comparison with two winding transformer and applications.

UNIT-II

Three - Phase Transformers: Connections - Choice of transformer connections – Third harmonic voltages - Phase conversion - 3-phase to 2-phase transformation, Scott connection - constructional features of poly phase transformers - Tertiary winding, Parallel operation of transformers, phase shifting transformer, Tap changer.

UNIT-III

Three - Phase Induction Motor: Constructional features - Rotating magnetic field theory, Principle of operation of Squirrel cage and Slip ring motors, Phasor diagram, Equivalent Circuit – expression for torque - starting torque - Max torque. Slip-torque characteristics, Equivalent circuit parameters from no-load and blocked rotor test, Circle diagram, Determination of performance characteristics of induction motor, Applications.

UNIT-IV

Starting & Speed Control Methods: Starting methods of 3-phase induction motor - Auto transformer, Star-delta Starter. Double cage machine, Speed control methods – Resistance control, Voltage Control, Pole changing, Cascading, Induction Generator - Principle of operation, Applications.

UNIT-V

Single Phase Motors: Double field revolving theory. Equivalent circuit of single phase induction Motor- Principle of operation, speed torque characteristics of a split phase and capacitor motors. Compensated and uncompensated series motor, Repulsion motor and universal motor - Applications.

Suggested Reading:

1. P.S.Bimbhra- Electrical Machinery, Khanna Publishers 2006.
2. D.P. Kothari & I.J. Nagrath, Electrical Machines, Tata McGraw Hill, 4th Edition, 2010.
3. M.G.Say - The Performance and Design of AC. Machines Pitman Publication, 2002.
4. Irving L. Kosow - Electric Machinery and Transformers. PPH, Pearson Education 2nd Edition, 2009.

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PC403EE

POWER SYSTEMS – II

Instructions : 4 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 4

Objectives:

1. The student able to learn and understand the performance analysis of transmission lines and cables.
2. To be able to comprehend analysis of symmetrical and unsymmetrical faults in the power system.

Outcomes:

The students will be able to
1. Acquire modeling of different short, medium and long transmission lines.
2. To learn the use of per unit quantities and calculation of symmetrical faults on OH transmission lines.
3. Understand the impact of different types of faults on overhead transmission lines and calculation of fault currents and their significance.
4. Explain the reasons for voltage variation, importance of maintaining constant voltage in power system and different voltage control methods.
5. Acquire the knowledge of natural impedance of transmission line and significance in the operation of power system network.

UNIT-I

Transmission Line Theory: Performance of short, medium, long lines - Line calculations - Tuned lines, Power circle diagram and their applications. Corona - Causes - Disruptive and Visual critical voltages - Power loss - Minimization of corona effects.

UNIT-II

Symmetrical Faults: Use of per unit quantities in power systems, advantages of per unit system. Symmetrical Three-phase Faults, Transients in RL series circuits - Short circuit currents - Reactance's of synchronous machines - Symmetrical fault calculations, Short circuit capacity of bus.

UNIT-III

Unsymmetrical Faults: Symmetrical components of unsymmetrical phasors - Power in terms of symmetrical components - Sequence impedance and sequence networks, Sequence networks of unloaded generators - Sequence impedances of circuit elements - Single line to ground, line to line and double line to ground faults on unloaded generator - Unsymmetrical faults of power systems, Open circuit faults.

UNIT-IV

Voltage Control: Phase modifiers, Induction Regulators -Tap changing Transformers, Series and Shunt Capacitors, Reactive Power requirement calculations, Static VAR compensators - Thyristor Controlled reactor, Thyristor switched capacitor.

UNIT-V

Travelling Wave Theory : Causes of over voltages - Travelling wave theory - Wave equation - Open circuited line - The short circuited line - Junction of lines of different natural impedances - Reflection and Refraction Coefficients - Junction of cable and over head lines - Junction of three lines of different natural impedances- Bewley Lattice diagram.

Suggested Readings:

1. CL Wadhwa - Electrical Power Systems, New Age International, 4th edition, 2006.
2. Grainger and Stevenson - Power System Analysis, Tata McGraw Hill, 4th edition, 2003.
3. Nagarath and Kothari - Modern Power System Analysis, Tata McGraw Hill, 4th edition- 2012.

PC404EE

DIGITAL ELECTRONICS AND LOGIC DESIGN

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 3

Objectives:

1. To be able to understand the principles of digital systems and binary arithmetic circuits.
2. To study the properties and realization of various logic gates, A/D and D/A converters.

Outcomes:

At the end of the course the students will be able to
1. Differentiate the number system, convert and compare a number system to another number systems used in digital logic design.
2. Understand Boolean algebra and its application to DeMorgan's theorems and karnaugh map reduction method.
3. Analyze and design various digital combinational circuits

UNIT I

Boolean algebras and combinational logic, AND, OR and NOT operations. Laws of Boolean algebra. Minimization of Boolean expressions, Truth tables and maps. Sum of products and product of sums, Map method of reduction, Incompletely specified functions, Multiple output minimization.

UNIT II

Tabular minimization, Digital logic families and IC's, Characteristics of Digital IC's, Introduction to RTL, DTL, TTL, CMOS, ECL families, Details of TTL logic family, Totem pole, Open collector outputs, wired AND Operation, Comparison of performance, TTL sub-families, Multiplexer and de-multiplexer, Encoder and decoder, Code converters, Implementation of combinational logic using standard logic gates and multiplexers.

UNIT III

Binary arithmetic and circuits, Half and Full adder, Subtractor and Magnitude comparator, Number complements, Two's complement arithmetic, Carry look ahead adder, Decimal numbers and their codes, BCD and Excess -3 arithmetic

UNIT IV

Synchronous Sequential Circuits: basic latch circuits, Debouncing switch, SR, JK, D and T flipflops, Truth table and execution table, Ripple and Synchronous counters, Up/down counters, General BCD counter, Shift registers, ring counters

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UNIT V

A/D and D/A Converters: Converter types — Tracking type, Flash type, Successive approximation type: R-2R ladder, Weighed register type, Switched current source type, Switched capacitor type

Suggested Reading:

1. Anand Kumar A., Fundamentals of Digital Circuits, Prentice Hall of India, 4th Edition, 2003.
2. Morriss Mano M., Digital Design, Prentice Hall of India, 3rd Edition, 2002.
3. Zvykohavi, Switching & Finite Automata Theory, Tata McGraw Hill, 2nd Edition, 1991.

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ES405EE

PRIME MOVERS AND PUMPS

Instructions : 3 hours per week
Duration of SEE : 3 Hours
SEE : 70 Marks
CIE : 30 Marks
Credits : 3

Objectives:

1. To acquire knowledge of fluid mechanics and governing equations.
2. To understand the working principal of hydraulic turbines and pumps.
3. To understand the working principle of steam and gas power plants.
4. To be able to estimate the power developed in the engine, turbines.

Outcomes:

At the end of the course the student will be able to.
1. Knowledge regarding various theories dealing with the flow phenomenon of fluid.
2. Ability to define the nature of a fluid, viscosity effects on flow and characteristics of Newtonian and non-Newtonian fluids.
3. Understanding of basics of the hydraulic, steam and gas turbines, and their components, functions and applications.
4. Knowledge of different types of boilers, turbines and pumps.
5. Recognize typical designs of turbines and pumps.

UNIT-I

Fluid Mechanics: Properties of fluids, Newtonian and non-Newtonian fluids. Continuity, Momentum and Energy equations. Bernoulli's equation and its applications. Laminar and Turbulent flows. Basic Concept of Boundary layer theory and boundary layer thickness.

UNIT-II

Hydraulic Turbines: Layout of Hydroelectric power plant. Working principle of Pelton, Francis and Kaplan turbines. Draft tube in Reaction turbine. Velocity diagrams for impulse and Reaction turbines. Blade angles and dimensions for Reaction turbines. Work done, power output and efficiencies. Simple problem on Pelton, Francis and Kaplan turbines. Selection of turbines for electric power generation, Specific speed and its ranges for Pelton, Francis and Kaplan turbines. Unit quantities. Performance and characteristics curves. Cavitation and its effects.

UNIT-III

Pumps: Reciprocating Pumps – Working of single and double acting types. Functions and use of Air vessels. Problems on pressure head, work done, power required without and with air vessels.
Centrifugal Pumps: Parts and working of CF pumps. Need for priming, pump installation. Velocity diagrams and vane angles. Types of impellers. Work and power required. Manometric and other efficiencies. Simple problems for single stage pumps, Principles of similarity, specific speed and unit quantities. Performance and characteristic curves.

UNIT-IV

Basic Steam Engineering: Generation, properties and dryness fraction of steam. Functions of a boiler. Working of a simple vertical type and Babcock and Wilcox type boilers with simple sketches. Boiler Mountings and Accessories and their functions. Rankine cycle, re-heat and regeneration cycles.

UNIT-V

Steam & Gas Power Plants: Layout of simple steam power plant and working of its individual units. Classification and compounding of steam turbines. Velocity diagrams for single stage impulse and reaction turbines. Simple problems on work done, blade angles, Power output and thermal efficiencies of turbines. Working of reheat and bleeding cycles.

Suggested Readings:

1. Ballaney P.L, "Thermal Engineering", Khanna Publishers, 19th Edition – 2003.
2. Yadav R, " Steam and gas Turbines", Galgotia Publishers, 6th Edition – 1992.
3. Rajput, " Thermal Engineering", Laxmi Publications (P) Ltd, New Delhi.
4. Bansal R.K, " Fluid Mechanics and Hydraulic Machines", Laxmi Publictions (P) Ltd, New Delhi.
5. Kumar D.S, " Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons, 6th Edition – 2003.

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PC451EE

ELECTRICAL CIRCUITS LABORATORY

Instructions : 2 hours per week
Duration of SEE : 2 Hours
SEE : 50 Marks
CIE : 25 Marks
Credits : 01

Objectives :

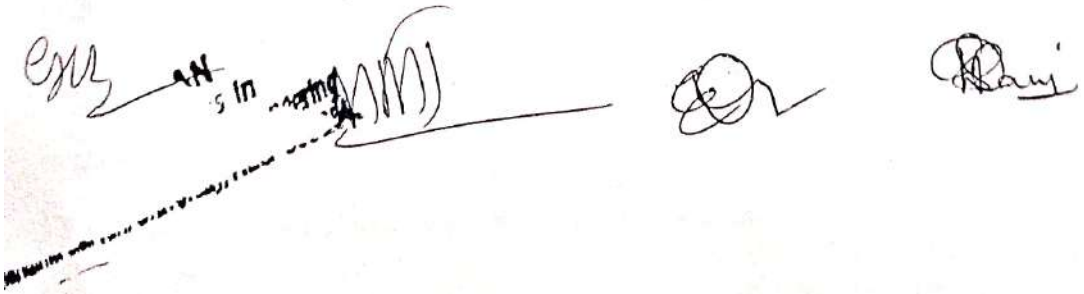
1. To Train the Students for acquiring practical knowledge in time response and frequency response of series / parallel RC, RL and RLC Circuits.
2. To prepare the students for finds out parameters of a given two port network. 3. To make the students for understanding the verification of theorems.

Outcomes:

At the end of the course the student will be able to.
1. Evaluate the time response and frequency response character sties of R,L,C Series and parallel circuits.
2. Able to validate the network theorems.
3. Able to find various parameters of a two-port network.
4. Able to simulate electrical circuits using spice. 5. Able to synthesize networks from a given transfer function

List of Experiments:

1. Charging and Discharging Characteristics of RC and RL series circuits.
2. Locus diagrams of RC and RL Circuits.
3. Frequencies Response of a Series RLC Circuits.
4. Frequencies Response of a Parallel RLC Circuits.
5. Parameters of two port network.
6. Series, parallel and cascade connection of two port networks.
7. Verification of Theorems. (a) Thevenin's theorem (b) Norton's theorem (c) Superposition theorem (d) Maximum power transfer theorem
8. Two Wattmeter method.
9. Transients in RLC circuits.
10. Network Synthesis.
11. Characteristics of Linear, Non-Linear and Bilinear Elements.



PC452EE

ELECTRICAL MACHINES LABORATORY – I

Instructions : 2 hours per week
Duration of SEE : 3 Hours
SEE : 50 Marks
CIE : 25 Marks
Credits : 01

Objectives:

1. To learn operation and performance characteristics of d.c machines by conducting various experiments and tests practically.
2. To understand the operation and performance characteristics of transformers by conducting various experiments and tests.

Outcomes:

The students will be able to:
1. Estimate the efficiency and voltage regulation of D.C. generator and transformers under various loading conditions.
2. Acquire the knowledge of efficiency and speed regulation D.C. Motors under various loading conditions.
3. Able to understand the speed control of DC motor by conducting different experiments.

LIST OF EXPERIMENTS

1. Magnetization characteristics of a separately excited D.C. generator.
2. Determination of the load characteristics of shunt and compound generators.
3. Determination of the performance and mechanical characteristics of series, shunt and compound motors.
4. Separation of iron and friction losses and estimation of parameters in D.C. machine.
5. Speed control of D.C. Shunt motor using shunt field control and armature control methods.
6. Separation of core losses in a single phase transformer.
7. Open circuit and short circuit and load test on a single phase transformer.
8. Sumpner's test on two identical transformers.
9. Three phase Transformer connections.
10. Three phase to two phase transformation and open delta connection.
11. Retardation test.
12. Hopkinson's test.
13. Swinburne's test.

Note: At least ten experiments should be conducted in the Semester.

Suggested Reading:

1. P.S.Bimbhra- Electrical Machinery, Khanna Publishers 2006
2. D.P. Kothari & I.J. Nagrath, Electrical Machines, Tata McGraw Hill, 4th Edition, 2010.
3. M.G.Say - The Performance and Design of AC. Machines Pitman Publication, 2002.

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4. Irving L. Kosow - Electric Machinery and Transformers, PPH, Pearson Education, 2nd Edition, 2009.

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ES453ME

MECHANICAL TECHNOLOGY LAB

Instructions : 2 hours per week
Duration of SEE : 2 Hours
SEE : 50 Marks
CIE : 25 Marks
Credits : 01

Objectives:

1. To gain knowledge of working of pelton and diesel engines.
2. To be able to estimate the power developed in the engine.
3. To understand the working principle of hydraulic turbines and pumps.
4. To understand the performance of turbines using characteristic curves.
5. To gain the knowledge of various flow meters and the concept of fluid mechanics.

Outcomes:

The students will be able to:
1. Knowledge regarding components and functioning of engines.
2. Ability to calculate the power developed, losses in the engines.
3. Understanding of viscosity of oils.
4. Knowledge of flash and fire point of oils, and its importance.
5. Knowledge of estimating the power of turbines and pumps.

A) Thermal Engineering Laboratory:
1. Determination of heat transfer coefficient under natural convention.
2. Determination of thermal conductivity of a composite wall.
3. Determination of volumetric efficiency of multi stage reciprocating air compressor.
4. Performance test on Multi cylinder petrol/ diesel engine.
5. Determination of flash and fire points in lubricants.

B) Thermal Engineering Laboratory:
6. Measurement of discharge by Venturi meter.
7. Measurement of discharge by Orifice meter.
8. Measurement of discharge by Rotameter.
9. Measurement of velocity by Pitot tube.
10. Performance test on Pelton wheel turbine.
11. Characteristic curves test on Pelton wheel turbine.
12. Performance test on Francis wheel turbine.
13. Characteristic curves test on Francis turbine.
14. Performance and characteristics of Reciprocating pump.
15. Performance and characteristics of Centrifugal pump.

C) Study of Construction details of Gear Box.

Note: At least ten experiments should be conducted in the Semester

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With effect from the Academic year 2020-2021, UCE&T, MGU

Faculty of Engineering

Scheme of Instruction and Examination

B.TECH. (Electrical & Electronics Engineering)
V & VI SEMESTER
AICTE Model Curriculum

(Applicable to the batch admitted from the Academic Year 2018-19 and onwards)

2020 – 2021

UNIVERSITY COLLEGE OF ENGINEERING &TECHNOLOGY

MAHATMA GANDHI UNIVERSITY

NALGONDA – 508 254, TELANGANA

SCHEME OF INSTRUCTION AND EXAMINATION

B.TECH. (Electrical & Electronics Engineering)

AICTE Model Curriculum

(Applicable to the batch admitted from the Academic Year 2018-19 and onwards)

V-SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC501EE	Electrical Machines-III	3	1	-	4	30	70	4
2	PC502EE	Measurements and Instrumentation	3	1	-	4	30	70	4
3	PC503EE	Linear Control Systems	3	1	-	4	30	70	4
4	PC504EE	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
5	PC505EE	Power electronics	3	1	-	4	30	70	4
6	OE-I	Open Elective-I	3	-	-	3	30	70	3
Practical									
1	PC551EE	Power Electronics Lab	-	-	2	2	25	50	1
2	PC552EE	Microprocessors and Microcontrollers Lab	-	-	2	2	25	50	1
3	PC553EE	Digital Electronics And Logic Design Lab	-	-	2	2	25	50	1
		TOTAL	**18**	**04**	**06**	**28**	**255**	**570**	**25**

Open Elective-I		
1	OE 501 ME	Material Handling
2	OE 501CE	Disaster Management
3	OE 503 CE	Geospatial Techniques
4	OE 564 CS	Operating Systems
5	OE 501EE	Reliability Engineering
6	OE 501 EC	Embedded Systems
7	OE 502 EC	Digital System Design Using Verilog HDL

L : Lecture **T : Tutorial** **CIE : Continuous Internal Evaluation** **P : Practical**

SEE : Semester End Examination

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PC501EE

ELECTRICAL MACHINES-III

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To be able to understand in detail about synchronous machines. Construction, principle, performance characteristics and testing.
2. To understand the construction, principle and performance characteristics of special machines.

Course Outcomes:

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

1. Acquire the knowledge of types, Constructional Details, characteristics and applications of synchronous generator, synchronous motor, PMSM and brushless DC motors.
2. Explain different methods used to evaluate voltage regulation of synchronous generator.
3. Analyze the behavior of an alternator under transient disturbances.

UNIT - I

Synchronous machines: Types and Constructional Details - Types of Winding, Winding factors - E.M.F. equation - Fractional pitch and fractional slot windings - Suppression of harmonics and tooth ripple -Armature reaction and reactance - Synchronous impedance.

UNIT - II

Synchronous Generator: Voltage Regulation - Phasor diagram of alternator with non-salient poles - O.C. and S.C. Characteristics- Synchronous impedance, Ampere turn, ZPF methods for finding regulation - Principle of two reaction theory and its application for the salient pole-synchronous machine analysis - Synchronizing and parallel operation.

UNIT-III

Synchronous Motor: Theory of operation - Vector diagram - Variation of current and p.f. with excitation - Hunting and its prevention - Current and power circle diagram - Predetermination of performance - Methods of starting and synchronizing - Synchronizing power, Synchronous condenser. Applications.

UNIT- IV

Transient Stability Studies: Elementary ideas of transient behavior of an Alternator - Three phase short circuit of an Alternator- Analysis of symmetrical and asymmetrical short circuit current.

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UNIT-V

Special Machines:

Brushless D.C. Motors: Construction & Principle of Operation, Torque equation,Torque angle Characteristics,Applications.Switched Reluctance Motor:Constructional features, Principle of operation, Torque production, Torque - angle characteristics, various operating modes of SRM, applications. Permanent Magnet Synchronous Motor: Construction, principle operation of PMSM and their operating characteristics. Applications.

Suggested Reading:

1. Kothari D.P. & Nagrath I.J. - Electrical Machines - Tata McGraw Hill, 2004.
2. Bhimbra P.S. - Generalized Theory of Electrical Machines, Khanna Publications, 2000.
3. Say MG. - The Performance and Design of AC. Machines - Pitman Publication, 2002.
4. Irving L. Kosow - Electric Machinery and Transforn1ers, PPH, Pearson Education, 2nd Edition. 2009.

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PC502EE

MEASUREMENTS AND INSTRUMENTATION

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To learn and understand the fundamental concepts, principle of operation and applicatio of various electrical measuring instruments.
2. To understand various types of Bridges in measurement of resistance, inductanc capacitance and frequency.
3. To understand the operation and applications of Ballistic Galvanometer, Flux meter an DC/AC Potentiometer.
4. To understand the application of CRO for measurement of Amplitude, Phase and frequen of sinusoidal signals.

Course Outcomes:

At the end of the course students will be able to

1. Choose the suitable instrument like Ammeter, Voltmeter for AC/DC applications.
2. Select suitable Bridge for measurement of electrical parameters and quantities.
3. Use CRO for measurement of Amplitude, Phase and frequency of sinusoidal signals.

UNIT I

Instruments: indicating, Recording and Integrating instruments, Ammeter, Voltmete Expression for torque of moving coil, moving iron, Dynamometer, induction and electrostat instruments. Extension of range of instruments, Wattmeter Torque expression f dynamometer instruments, Reactive power measurement.

UNIT II

Meters: Energy meters, single phase and 3-phase, Driving torque and braking torque equatio Errors and testing compensation, Maximum demand indicator, Power factor meters, Frequen meters, Electrical resonance type and Weston type of synchroscope.

UNIT III

Bridge Methods and transducers: Measurement of inductance, capacitance and resistan using Bridges, Maxwell's, Hay's. bridge, Anderson, Wein, Desauty's, Schering's bridges, Kelvi

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double bridge, Megger, Loss of charge method, Wagners earthing device. Transducers - Analog and digital transducers, Strain gauges and Hall effect transducers.

UNIT IV

Magnetic Measurements and instrument transformers: Ballistic galvanometer, Calibration by Hibbert' s magnetic standard flux meter, Lloyd-Fischer square for measuring iron loss, Determination of B-H curve and Hysteresis loop using CRO, Instrument transformers – Current and potential transformers, ratio and phase angle errors of CT's and PT's.

UNIT V

Potentiometers: Crompton's DC and AC polar and coordinate types. Applications, Measurements of impedance, Calibration and ammeter voltmeter and wattmeters. Use of oscilloscope in frequency, phase and amplitude measurements

Suggested Reading:

1. Shawney A.K., Electrical and Electronics Measurements and Instruments, Dhanpatrai & Sons, Delhi, 2000.
2. Umesh Sinha, Electrical, Electronics Measurement & Instrumentations, Satya Prakashan, New Delhi.
3. Golding E.W., Electrical Measurements & Measuring Instruments, Sir Issac & Pitman & Sons Ltd., London.
4. U.A.Bakshi, A.V.Bakshi, Electrical and Electronic Instrumentation, Technical publications

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PC503EE **LINEAR CONTROL SYSTEMS**

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To develop basic skills of utilizing mathematical tools needed to analyze and design classical linear control systems.
2. To understand and develop the state space representation of control systems.

Course Outcomes:

At the end of the course students will be able to

1. Understand the concept of the terms control systems, feedback, Mathematical modeling of Electrical and Mechanical systems.
2. Explain the time domain and frequency response analysis of control systems.
3. Acquire the knowledge of various analytical techniques used to determine the stability of control systems.
4. Able to understand the importance of design of compensators.
5. Able to demonstrate controllability and observability of modern control systems.

UNIT-I

Introduction to Control Systems: Classification of control systems. Feed-Back Characteristics, Effects of feedback - Mathematical modeling of Electrical and Mechanical systems -Transfer function- Transfer function of Potentiometer, synchro, AC servo motor, DC servo motor - Block diagram reduction technique - Signal flow graph, Mason's gain formula

UNIT-II

Time Domain Analysis: Standard test signals - Time response of first order systems - Transient response of second order system for unit step input, Time domain specifications - Steady state response - Steady state errors and error constants - Effects of P, PD, PI and PID controllers.

UNIT-III

Stability Analysis in S-Domain: The concept of stability - Routh's stability Criterion, Absolute stability and relative stability- limitations of Routh's stability.

Root Locus Technique: The root locus concept - construction of root loci- Effects of adding poles and zeros on the root loci.

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UNIT-IV

Frequency Response Analysis: Introduction to frequency response - Frequency domain specifications - Bode plot - Stability analysis from Bode plots - Determination of transfer function from the Bode Diagram - Polar Plots, Nyquist Plots, Stability Analysis, Gain margin and phase margin.

Control System Design: Introduction - Lag, Lead and Lag-Lead Compensator design in frequency Domain.

UNIT-V

State Space Analysis: Concepts of state, State variables and state model, Derivation of state models of linear time invariant systems - Controllable, Observable and Diagonal state models - State transition matrix - Solution of state equation - Concepts of Controllability and Observability.

Suggested Reading:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.
2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008.

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With effect from the Academic year 2020-2021, UCE, A

PCSD4E1

MICROPROCESSORS AND MICROCONTROLLERS

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To understand about 8085 microprocessor architecture, instruction set and addressing modes
2. To know the use of interfacing devices and process of interfacing.
3. To understand about 8051 microcontroller architecture, and programming.

Course Outcomes:

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

1. Understand 8085 microprocessor architecture and its operation.
2. Write assembly language program for a given task.
3. Interface memory and I/O devices to 8085 using peripheral devices.
4. Understand microcontrollers uses and their applications.
5. Write microcontroller programs and interface devices.

UNIT- I

Microprocessor Architecture: Microprocessors, Microcomputers, and Assembly Language, Architecture Details and its operation, Bus organization of 8085, Registers, Memory unit of 8085, Instruction decoding & execution, 8085-Based single board Microcomputer, Pin out Diagram of 8085, Bus timings, 8085 Interrupts (Hardware and Software), 8085 Vectored Interrupts.

UNIT-II

8085 Programming: The 8085 Programming Model, Operand Types, Instruction Format, Addressing Modes, Instruction set, Writing and debugging simple assembly Language Programs, Delays.

UNIT-III

Interfacing: Memory and I/O interfacing, Programmable Peripheral Interface 8255 (PPI), Interfacing seven segment display, Interfacing matrix keyboard, A/D and D/A interfacing, Programmable Interval Timer (8253), Programmable Interrupt Controller (8259).

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UNIT- IV

Microcontroller Architecture: Types of Microcontrollers, 8051 Microcontroller – Architecture, Memory organization, special function registers, pins and signals, timing and control, Ports and circuits, Counters and timers, Serial data input / output, Interrupts & timers.

UNIT-V

8051 Programming: The 8051-programming model, Operand Types, Instruction cycle, addressing modes, 8051 instruction set, Classification of instructions. Simple programs and I/O interfacing.

Suggested Reading:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram International Publishing, Fifth Edition, 2011.
2. Krishna Kant - Microprocessors and Microcontrollers - Architecture, Programming and System Design 8085, 8086, 8051, 8096, Prentice-Hall India - 2007.
3. Kenneth. J. Ayala "The 8051 Microcontroller Architecture Programming and Applications", Thomson publishers, 2nd Edition, 2007.
4. A.K. Ray & Bhurchandi, Advanced Microprocessors and Peripherals, Tata McGraw Hill, 2003.

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PC505EE

POWER ELECTRONICS

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Objectives

1. To be able to understand various power switching devices, characteristics and applications.
2. To learn and understand the various converters like rectifiers, choppers and inverters principle operation,characteristics and applications.

Course Outcomes:

The students will be able to

1) Understand the differences between signal level and power level devices.
2) Analyze controlled rectifier circuits.
3) Analyze the operation of DC-DC choppers.
4) Analyze the operation of voltage source single phase inverters.
5) Analyze the three phase inverters and ac voltage controllers

UNIT-I

Power switching devices: Diode, Thyristor, MOSFET, IGBT: static and dynamic Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II

Thyristor rectifiers: Single-phase half-wave, full-wave and semi controlled rectifiers with R-load and highly inductive load; Three-phase half wave, full wave and semi controlled bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT-III

DC-DC Converters: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit and operation of buck, boost and buck-boost converters in continuous conduction mode, duty ratio control of output voltage.

AC-AC Converter: Power circuit and operation of single phase AC Voltage Controller with R & RL Load. Basic concepts of Cycloconverter .

UNIT-IV

Single-phase inverter: Power circuit and operation of single-phase voltage source inverter in square wave mode, sinusoidal pulse width modulation (Unipolar and bi-polar), relation

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between modulation index and output voltage. Calculation of performance parameters of inverter.

UNIT-V

Three-phase inverter: Power circuit and operation of three-phase voltage source inverter in 180^0 and 120^0 modes, Bi-polar sinusoidal pulse width modulation, relation between modulation index and output voltage. Elementary operation of CSI, Comparison of Voltage Source Inverter and Current source Inverter.

Suggested Reading:

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.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. Dr. P.S. Bhimbra, " Power Electronics", Khanna Publishers, 2009.

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between modulation index and output voltage. Calculation of performance parameters of inverter.

UNIT-V

Three-phase inverter: Power circuit and operation of three-phase voltage source inverter in 180^0 and 120^0 modes, Bi-polar sinusoidal pulse width modulation, relation between modulation index and output voltage. Elementary operation of CSI, Comparison of Voltage Source Inverter and Current source Inverter.

Suggested Reading:

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.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. Dr. P.S. Bhimbra, " Power Electronics", Khanna Publishers, 2009.

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OEC512EE

MATERIAL HANDLING

(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course objectives:

1. To know about the working principle of various materials handling equipments.
2. To understand the material handling relates to the loading, unloading and movement of all types of materials.
3. To understand the estimation of storage space and maintenance of materials handling equipments.

Course outcomes:

1. Able to understand various conveying systems that available in industry.
2. Able to understand various bulk solids handling systems and their design features.
3. Able to understand and various modern material handling systems and their integration.
4. Able to calculate number of MH systems required, storage space, cost and maintenance.

UNIT – I

Mechanical Handling Systems: Belt conveyors and Design, Bucket Elevators, package conveyors Chain and Flight Conveyors, Screw Conveyors, Cranes and Hoists.

UNIT-II

Pneumatic and Hydraulic Conveying Systems: Modes of Conveying and High pressure conveying Systems, Low Velocity Conveying system, Components of Pneumatic Conveying Systems:General Requirements, Fans and Blowers, Boots-type Blowers, Sliding-VaneRotary Compressors, Screw Compressors, Reciprocating Compressors, Vacuum Pumps.

UNIT-III

Bulk solids Handling: Particle and bulk properties, Adhesion, Cohesion and Moisture Content, Gravity Flow of Bulk Solids: Static and Dynamic Pressure Distribution in Bulk Solids, Modes of Flow: Mass flow, Funnel flow and Expanded Flow from Hoppers, Bins and silos.

UNIT-IV

Modern material Handling Systems: constructional features of (I) AVG (II) Automated storage and retrieval systems, Sensors used in AVGs and ASRS,Bar code systems and RFID systems: Fundamentals and their integration with computer-based information systems.

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UNIT-V

Total MH Throughput: Calculation for no. of MH systems; storage space estimation based on no of aisles, Maintenance of MH equipment, spare parts management, cost of materials handling, cost per unit load computations.

Suggested Readings:

1. Dr.Mahesh Varma, "Construction Equipment and it's Planning Application",Metropolitan Bookco.(P) Ltd., New Delhi, India 1997.
2. James M. Apple, "Material Handling Systems Design", The Ronald Press Company, New York, USA, 1972.

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OE 502 CE

DISASTER MANAGEMENT

(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Objectives:

1. To provide students an exposure to disasters, their significance and types.
2. To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
4. To enhance awareness of institutional processes in the country and
5. To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

Outcomes:

1. The students will be able to understand impact on Natural and manmade disasters
2. Able to classify disasters and destructions due to cyclones
3. Able to understand disaster management applied in India

UNIT – I

Introduction to Disasters:

Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Natural and Manmade disasters, impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.)

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UNIT – II

Disaster: Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc.

Differential Impacts - in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.

Cyclones and Floods: Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

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UNIT – III

Approaches to Disaster Risk Reduction: Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structuralnonstructural sources, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRis/ULBs), states, Centre, and other stake-holders

UNIT – IV

Inter-relationship between Disasters and Development: Factors affecting Vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT – V

Disaster Risk Management in India: Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation) Field Work and Case Studies: The field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.

Suggested Reading :

1. Sharma V. K. (1999). Disaster Management, National Centre for Disaster Management, IIPE, Delhi.
2. Gupta Anil K, and Sreeja S. Nair. (2011). Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi.
3. Nick. (1991). Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
4. Kapur, et al. (2005). Disasters in India Studies of grim reality, Rawat Publishers, Jaipur.
5. Pelling Mark, (2003). The Vulnerability of Cities: Natural Disaster and Social Resilience Earthscan publishers, London.

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OE 503 CE

GEOSPATIAL TECHNIQUES

(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Objectives:

1. Description about various spatial and non-spatial data types, and data base management techniques
2. Development of the concepts and professional skills in utility of geospatial techniques
3. Enhancement of knowledge of geospatial techniques to field problems

Outcomes:

1. The students will be able to understand and apply GIS tools
2. Will be able to analyse and process data to apply to the GIS tools.
3. Will be able assimilate knowledge on field problems using remote sensing

UNIT- I

Introduction: Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems. Projections and Coordinate Systems: Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT- II

Data Acquisition and Data Management: data types, spatial, non spatial (attribute) data, data structure and database management, data format, vector and raster data representation, object structural model filters and files data in computer, key board entry, manual digitizing, scanner, aerial photographic data, remotely sensed data, digital data, cartographic database, digital elevation data, data compression, data storage and maintenance, data quality and standards, precision, accuracy, error and data uncertainty.

Data Processing: Geometric errors and corrections, types of systematic and non systematic errors, radiometric errors and corrections, internal and external errors.

UNIT- III

Data Modeling: Spatial data analysis, data retrieval query, simple analysis, recode overlay, vector data model, raster data model, digital elevation model, cost and path analysis, knowledge based system. GIS Analysis and Functions: Organizing data for analysis, analysis

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function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non spatial data

UNIT -IV

Applications of GIS: Environmental and natural resource management, soil and water resources, agriculture, land use planning, geology and municipal applications, urban planning and project management, GIS for decision making under uncertainty, software scenario functions, standard GIS packages, introduction to Global Positioning Systems (GPS) and its applications.

UNIT- V

Introduction to Remote Sensing: General background of remote sensing technology, objectives and limitations of remote sensing, electro-magnetic radiation, characteristics, interaction with earth surface and atmosphere, remote sensing platforms and sensors, satellite characteristics, digital image processing, IRS series and high resolution satellites, software scenario functions, remote sensing applications to watershed modeling, environmental modeling, urban planning and management.

Suggested Reading:

1. Burrough, P. A., and McDonnell R. A. (1998), 'Principles of Geographical Information Systems', Oxford University Press, New York
2. Choudhury S., Chakrabarti, D., and Choudhury S. (2009), 'An Introduction to Geographic Information Technology', I.K. International Publishing House (P) Ltd, New Delhi
3. Kang-tsung Chang. (2006), 'Introduction to Geographical information Systems', Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi
4. Lilysand T.M., and Kiefer R.W. (2002), 'Remote Sensing and Image Interpretation', John Wiley and Sons, Fourth Edition, New York
5. Sabins F.F. Jr. (1978), 'Remote Sensing Principles and Interpretations', W.H. Freeman and Company, San Francisco
6. Tor Bernhardsen. (2002), 'Geographical Information System', Wiley India (P) Ltd., Third Edition, New Delhi
7. Hoffman-Wellenhof, B, et al. (1997), 'GPS Theory and Practice', Fourth Edition, Springer Wein, New York.

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OE 564 CS

OPERATING SYSTEMS
(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives:

1. To understand CPU, Memory, File and Device management
2. To learn about concurrency control, protection and security
3. To gain knowledge of Linux and Windows NT internals

Course Outcomes:

Student will be able to

1. Explain the components and functions of operating systems
2. Analyze various Scheduling algorithms.
3. Apply the principles of concurrency
4. Compare and contrast various memory management schemes
5. Perform administrative tasks on Linux Windows Systems

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.

UNIT-II

Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.

UNIT-III

Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring, Encryption. UNIT-IV Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU-Device interactions, I/O optimization.

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UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT – General Architecture, The NT kernel, The NT executive

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts, Addison Wesley, 2006
2. William Stallings, Operating Systems-Internals and Design Principles, 8th edition, Pearson, 2014
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016.

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OE 501 EE

RELEABILITY ENGINEERING
(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives:

1. To understand the concepts of different types of probability distributions. importance of reliability evaluation of networks.
2. To make the students understand about Reliability, availability model of Power Systems and markov modeling of Power Plants. with identical and nonidentical units.

Outcomes

The students will be able to

3. Understand the meaning of discrete and continuous random variables and their significance, causes of failures of a system.
4. Acquire the knowledge of different distribution functions and their applications.
5. Able to develop reliability block diagrams and evaluation of reliability of different systems

UNIT- I

Discrete and continuous random variables. Probability density function and Cumulative distribution function. Mean and variance. Binomial, Poisson, Exponential and Weibull distributions.

UNIT - II

Failure and causes of failure. Failure rate and failure density. Reliability function and MTTF. Bath tub curve for different systems. Parametric methods for above distributions. Non - Parametric methods from field data.

UNIT- III

Reliability block diagram. Series and parallel systems. Network reduction technique, Examples. Evaluation of failure rate, MTTF and reliability, Active and Standby Redundancy, r out of n configuration. Non-series - parallel systems. Path based and cut set methods.

UNIT- IV

Availability, MTTR and MTBF, Markov models and State transition matrices. Reliability models for single component. two components, Load sharing and standby systems. Reliability and availability models of two unit parallel system with repair and standby systems with repair.

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UNIT-V

Repairable Systems. maintainability. Preventive maintenance, Evaluation of reliability and J1TTF. Overhauling and replacement. Optimum maintenance policy. Markov model of a power plant with identical units and non-identical units. Capacity outage probability table. Frequency of failures and Cumulative frequency.

Suggested Reading:

1. Charles E. Ebeling. Reliability and Maintainability Engineering, McGraw Hill International Edition, 1997.
2. Balaguruswamy, Reliability Engineering, Tata McGraw Hill Publishing Company Ltd, 1984.
3. R.N. Allan. Reliability Evaluation of Engineering Systems, Pitman Publishing, 1996.
4. Endrenyi. Reliability Modeling in Electric Power Systems. John Wiley & Sons, 1978

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OE 501 EC

EMBEDDED SYSTEMS

(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives:

1. To understand the fundamentals of embedded systems
2. To study the block diagram and advanced hardware fundamentals
3. To study the software architecture of embedded systems
4. To learn the tool chain of embedded systems
5. To understand the tools and debugging process of embedded systems.

Course Outcomes:

Student will be

1. Able to acquire an overview of what an embedded system implies
2. Able to understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
3. Able to apply theoretical learning to practical real time problems for automation.
4. Able to understand how to build and debug an embedded system application
5. Able to analyze and design real world applications and interface peripheral devices to the microprocessor.

UNIT – I

Fundamentals of embedded systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory

UNIT – II

Advanced hardware fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT – III

Software architecture of embedded systems: Round- Robin, Round-Robin with Interrupts Function- Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting an Architecture.

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UNIT – IV

Embedded software development tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, InCircuit Emulators.

UNIT – V

Debugging techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools

Suggested Readings:

1. David. E. Simon, "An Embedded Software Primer", Low price edition, Pearson Education, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "Embedded System Design: A Unified Hardware/Software Approach". John Wiley & Sons, October 2001.
3. Rajkamal, "Embedded systems: Programming, architecture and Design", second edition, McGraw-Hill Education (India), March 2009.

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OE 502 EC

DIGITAL SYSTEM DESIGN USING VERILOG HDL

(Open Elective-I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Objectives:

1. To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.
2. To develop combinational and sequential circuits using various modeling styles of Verilog HDL
3. To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU)
4. To learn Synthesis and FPGA design flow.
5. To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU and FIR filter.

Course Outcomes:

Student will be

1. Able to implement and distinguish different Verilog HDL modeling styles
2. Able to construct and analyze Verilog HDL models of combinational and sequential circuits
3. Able to design and develop Verilog HDL modeling and test bench for digital systems for the given specifications
4. Able to outline FPGA design flow and timing analysis

UNIT – I

Structural modeling: Overview of Digital Design with Verilog HDL, Basic concepts, modules and ports, gate-level modeling, hazards and design examples

UNIT – II

Dataflow and Switch level modeling: dataflow modeling, operands and operators. Switch Level Modeling: CMOS switches and bidirectional switches and design examples

UNIT – III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Combinational, sequential logic modules and design examples.

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UNIT – IV

Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions. Verilog HDL synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT – V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Readings:

1. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.

2. Ming-Bo Lin, Digital System Designs and Practices: Using Verilog HDL and FPGA," Wiley India Edition, 2008.

3. J. Bhasker, "A Verilog HDL Primer," 2nd Edition, BS Publications, 2001.

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PC551EE

POWER ELECTRONICS LAB

Instructions	: 2 hours per week
SEE	: 50 Marks
CIE	: 25 Marks
Credits	: 01

Course Objectives:

1. To be able to understand various power switching devices, trigger circuits, characteristics and applications by conducting the experiments.
2. To learn and understand the rectifiers, choppers and inverters principle operation, characteristics and applications.

Course Outcomes:

At the end of the course students will be able to

1. Able to understand speed control of motors by using controlled rectifier
2. Able to understand the applications of cycloconverters
3. Able to simulate different power electronic devices using software

LIST OF EXPERIMENTS

1. R, RC, UJT Trigger Circuits for SCR's.
2. Design and fabrication of trigger circuits for single phase half-controlled and fully controlled bridge rectifiers.
3. Study of SCR chopper.
4. Design and fabrication of trigger circuit for MOSFET chopper.
5. Study of forced commutation techniques of SCRs.
6. Speed control of separately excited DC motor by controlled rectifier.
7. Speed control of universal motors using choppers.
8. Study of single phase half and fully controlled rectifier.
9. Study of single phase and three phase AC voltage controller.
10. Study of single phase dual converter.
11. Study of single phase cyclo converter.
12. IGBT based PWM inverters.
13. Simulation of single phase half and fully controlled rectifier.
14. Simulation of single phase and three phase AC voltage controller.
15. Simulation of single phase inverter & three phase inverter.

Note: At least ten experiments should be conducted in the Semester.

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PC552EE

MICROPROCESSOR AND MICROCONTROLLERS LAB

Instructions	: 2 hours per week
SEE	: 50 Marks
CIE	: 25 Marks
Credits	: 01

Course Objectives:

1. Developing of assembly level programs and providing the basics of the processors
2. To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems
3. To assist the students with an academic environment needed for a successful professional career.

Course Outcomes:

At the end of the course students will be able to

1. familiarize with the assembly language programming.
2. Write programs for given task using different addressing modes.
3. Interface various IO devices using 8255 PPI
4. Write programs using various interrupts.
5. Interface the microcontroller for some real life applications.

LIST OF PROGRAMS:

For 8085:

6. Signed/unsigned multiplication and division.
7. Finding average, largest, square root, etc.
8. Sorting set of numbers.
9. Code conversion like BCD numbers into binary.
10. 8255 PPI for interfacing LEDs.
11. 8255 PPI for interfacing to generate triangular wave using DAC.
12. Using interrupts.
13. Interfacing seven segment display.
14. Interfacing matrix keyboard.

For 8051:

1. Data transfer – block move, exchange, sorting, finding largest element in array.
2. Arithmetic instructions: multi byte operations.
3. Boolean & logical instructions (Bit manipulations).
4. Programs to generate delay, programs using serial port and on chip timer/counter.
5. Use of JUMP and CALL instructions.
6. Square wave generation using timers.
7. Interfacing of keyboard and 7-segment display module.

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PC553EE

DIGITAL ELECTRONICS AND LOGIC DESIGN LAB

Instructions	: 2 hours per week
SEE	: 50 Marks
CIE	: 25 Marks
Credits	: 01

Objectives

1. To gain the knowledge by conducting experiments on Op-amps, oscillators and timing circuits.
2. To study the properties and realization of the various logic gates.

Course Outcomes:

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

1. Differentiate the number system, convert and compare a number system to another number systems used in digital logic design.
2. Understand the applications of 555 timer.
3. Analyze and design various filters, Clippers and Clampers using Op-Amps

LIST OF EXPERIMENTS

1. Combinational logic function realization.
2. Realization of 4 bit binary adder / subtracter.
3. Construction of Decimal to Binary encoder, BCD to Binary, Binary to BCD, BCD 10 Excess- 3.
4. Serial/parallel input shift registers.
5. 4-bit binary up-down counter.
6. 555 timer applications.
7. Op-Amp applications - Integrator, Adder, summer.
8. Active filters - Low pass filter & High pass filter
9. Clippers and Clampers using Op-Amps.
10. Study of 723 linear voltage regulator and fixed voltage regulator.
11. Generation of triangular and square wave using Op-Amp.
12. Schmitt trigger circuit.

Note: At least ten experiments should be conducted in the semester.

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SCHEME OF INSTRUCTION AND EXAMINATION
B.TECH. (Electrical & Electronics Engineering)
AICTE Model Curriculum
(Applicable to the batch admitted from the Academic Year 2018-19 and onwards)

VI-SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
THEORY									
1.	PC601EE	Switchgear and Protection	3	1	-	4	30	70	4
2.	PC602EE	Signals and Systems	3	1	-	4	30	70	4
3.	PE-I	Professional Elective - I	3	-	-	3	30	70	3
4.	PE-II	Professional Elective - II	3	-	-	3	30	70	3
5.	HS901MB	Managerial Economics and Accountancy	3	-	-	3	30	70	3
PRACTICAL									
1.	PC651EE	Electrical Machines Lab-II	-	-	2	2	25	50	1
2.	PC652EE	Measurements and Instrumentation Lab	-	-	2	2	25	50	1
3.	PC653EE	Control Systems Lab	-	-	2	2	25	50	1
4	PW961EE	Summer Internship*	Six weeks during summer vacation						
			15	**02**	**06**	**23**	**225**	**500**	**20**

*Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.

L : Lecture T : Tutorial CIE : Continuous Internal Evaluation P : Practical
SEE : Semester End Examination

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PROFESSIONAL ELECTIVE – I		
1.	PE601EE	Electric Distribution System
2.	PE602EE	Renewable Energy Sources
3.	PE603EE	Hybrid Electric Vehicles

PROFESSIONAL ELECTIVE - II		
1.	PE621EE	Programmable Logic Controller
2.	PE622EE	Linear Integrated Circuits
3.	PE623EE	Digital Control Systems

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PC601EE

SWITCHGEAR AND PROTECTION

Instruction	:	4 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To be able to understand the need of protection in power system and protection with conventional and static relays.
2. To understand the protection of transformers, generators and need of circuit breakers.

Course Outcomes:

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

1. Acquire the knowledge of construction, working principles of different electromagnetic and static relays used to protect generators, transformers, transmission lines and distribution feeders.
2. Analyze the Characteristics of over current, over voltage, distance and differential relays and also their applications in power system networks.
3. Explain the working principle. Construction, rating and applications of different types of circuit breakers used in power system networks.
4. Understand the construction details, advantages, disadvantages of Gas Insulation substations.

UNIT- I

Introduction to Protective Relays: Need for protection - primary protection - backup protection - Zones of protection - Definitions of relay pick up and reset values - Classification of relays - Operating principles and construction of Electromagnetic and Induction type relays. Over current relay - Over voltage - Directional relay - Universal relay torque equation. Over current protection for radial feeder and ring mains - Protection of parallel lines - Relay settings for over current relays Earth fault and phase fault protection.

UNIT - II

Static phase and Amplitude comparators: Characteristics of dual input comparators. Static Relays -Instantaneous over current relay - Definite time over current relay - Inverse time over current relay - Directional over current relay (Block diagram approach only)

Distance protection - Characteristics of 2- input distance relays on the RX diagram - Input characteristics for various types of distance relays - 3-step distance relays, Microprocessor based over current relay (block diagram).

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UNIT- III

Transformer and Generator Protection: Differential relays -Percentage differential relays protection of generator and transformer using percentage differential relays, Splitphase protection, Overheating, Loss of excitation - Protection of transformers against magnetizing inrush - Buchholz relay - Protection of earthing transformers.

UNIT-IV

Circuit Breakers : Need for circuit breakers, Parts of circuit breaker trip coil circuit- Arc properties - Principles of arc quenching - Theories, Recovery and restriking voltages - Rating of circuit breakers - Rated symmetrical and asymmetrical breaking current - Rated making current - Rated capacity, Voltage and frequency of circuit breakers, Auto re-closure-duty cycle, Current chopping - Resistance switching - Derivations of RR'RV - Maximum RRRV, Recovery voltage, Problems - Types of circuit breakers - Oil, Minimum oil, Air, Air blast, SF , Vacuum and miniature circuit breakers, Testing of circuit breakers.

UNIT-V

Gas Insulated Substations & Over Voltage Protection: Constructional details (components), Merits and Demerits of Gas Insulated Substations over conventional Air insulated Substations. Protection of transmission lines against direct lightning strokes – ground wires - Protection angle - Protection zone - Tower footing resistance and its effects - Equipment protection assuming rod gaps, arcing horns - Different types of lightning arresters - their construction Surge absorbers - Peterson coil - Insulation coordination.

Suggested Reading:

1. Wadhwa C.L. - Electrical Power System, Wiley Eastern Ltd., 3rd Edition-2002.
2. Badriram & Viswakarma-Power System Protection & Switchgear, Tata McGraw Hill, 2003.
3. Sunil S. Rao - Switchgear & Protection, Khanna Publications, 2000.
4. M.S. Naidu - Gas Insulated Substations, I.K. int. Publishing House Pvt. Ltd. -2008.

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PC602EE

SIGNALS AND SYSTEMS

Instruction	:	4Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04

Course Objectives:

1. To understand the classification of continuous-time and discrete-time signals and systems
2. To develop ability to solve systems represented by differential equations and difference equations using analytical methods and Laplace and Z-transforms.
3. To acquire the knowledge of representing the signals in frequency domain using Fourier series and Fourier transform.

Course Outcomes:

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

1. Classify and analyze the continuous time signals and discrete time signals and systems.
2. Generate discrete time signals through sampling process and reconstruct them.
3. Determine the responses of continuous and discrete-time systems which are represented by differential equations and difference equations.
4. Analyze continuous time systems with the help of Laplace transform and discrete time system with Z-transform.
5. Analyze the continuous and discrete-time systems in frequency domain with the help of Fourier series and Fourier Transform.

UNIT-I

Introduction to continuous time signals: Examples of signals and systems as seen in everyday life in relation to engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time- limited signals; Introduction to discrete-time signals - Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Aliasing and its effects. Reconstruction: ideal interpolator, zero-order hold and first-order hold. Classification of discrete time signals.

UNIT-II

Behavior of continuous and discrete-time LTI systems: System properties: linearity: additivity and homogeneity, shift-invariance, causality and stability. Linear time invariant system, properties convolution integral and convolution sum. System representation through differential equations and difference equations.

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UNIT-III

Laplace transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.

Z-transforms: The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis and solution to difference equations.

UNIT-IV

Frequency domain representation of continuous time signals: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, properties, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality.

UNIT-V

Frequency domain representation of discrete time signals: The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Suggested Reading:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

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PE601EE

ELECTRICAL DISTRIBUTION SYSTEM

(Professional Elective – I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives

1. To understand the concepts and Importance of different loads characteristics, Design of Sub-Transmission Lines, Sub-Stations and Feeders.
2. To make the students understand about importance of Power Quality and Applications of Capacitors in distribution systems.

Course Outcomes:

At the end of the course students will be able to

1. Understand the concept of different factors used in design of distribution system components.
2. Explain the different types of secondary distribution systems and their performances. 3. Acquire the knowledge of various components, functions and applications of distribution automation and SCADA.
3. Design the optimal locations and ratings of shunt capacitors used in radial feeder for different loading conditions.

UNIT-I

Introduction, Load characteristics. Diversified demand. Non- coincidence demand. Coincidence factor, contribution factor Problems. Rate structure, customer billing, types of distribution transformers.

UNIT-II Design of Sub-transmission lines and distribution sub-stations. Substation bus schemes, siting of distribution substation, service area with multiple feeders, percent voltage drop calculations.

UNIT-III

Design considerations of primary systems, radial type, loop type primary feeder, primary feeder loading, uniformly distributed load application to a long line. Design considerations of secondary systems. Secondary banking. Secondary networks. Network transformers, unbalanced loads and voltages.

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UNIT-IV

Voltage drop and power loss calculations of 3-phase systems. Voltage fluctuations, measures to reduce flickering. Methods of load flow of Distribution Systems - forward sweep and backward sweep methods.

UNIT-V

Application of capacitors to distribution systems. Effect of series and shunt capacitors, power factor correction, economic justification for capacitors. Best capacitor locationAlgorithm. Distribution Automation: Definitions, Components of distribution SCADA.

Suggested Reading

1. Turan Gonen, Electric Power Distribution Engineering, Mc Graw Hill Book Co., International Student Edition. 1986.

2. A.S. Pabla, Electric Power Distribution, Tata McGraw Hill Publishing Company Ltd., 1997.

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E602EE

RENEWABLE ENERGY SOURCES

(Professional Elective – I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

ourse Objectives: 1. To understand the concepts and Importance of renewable energy sources uch as solar, wind, biomass, tidal power.

2. To make the students understand the advantages and disadvantages of different renewable nergy sources

Course Outcomes:

t the end of the course students will be able to

. Explain the advantages, disadvantages and applications of different conventional and non-onventional sources.

2. Acquire the knowledge of various components, principle of operation and present scenario f different conventional and non-conventional sources.

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for nonconventional energy sources Types of Non- conventional energy sources - Fuel Cells - Principle of operation with special reference to H2 °2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell - Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells — Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors -Solar Energy storage systems - Solar Pond - Application of Solar Pond - Applications of solar energy.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations - Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy -Environmental aspects.

UNIT-IV

Energy from the Oceans - Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

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NIT-V

ergy from Biomass - Biomass conversion technologies / processes - Photosynthesis - otosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification Biogas plants - Details of commonly used Biogas plants in India - Advantages and sadvantages of Biogas generation -Thermal gasification of biomass - Biomass gasifiers.

uggested Reading:

Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 1999.

M.M.El-Wakil, Power Plant Technology. McGraw Hill, 1984.

John Twidell, Tony Weir, Renewable Energy Resources, 3rd Edition, Taylor and Francis.

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PE603 EE

HYBRID ELECTRIC VEHICLES
(Professional Elective – I)

Instruction	:	03 Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives:

1. Know the history of electric hybrid electric vehicles (EV & HEV) and emphasize the need and importance of EV-HEV for sustainable future.
2. Introduce the fundamental concepts and principles of electric and hybrid electric vehicles drive train topologies
3. Develop a thorough understanding of the key elements of EV/HEV: Electric Machines for Propulsion Applications and Energy Sources.

Course Outcomes:

At the end of the course students will be able to

1. To identify and describe the history and evolvement of electric & hybrid electric vehicles to emphasize on the need and importance of EV/HEV for sustainable future.
2. To identify and describe the principles of various EV/HEVs drive train topologies along with their power flow control and fuel efficiency estimation.
3. To design and select electric propulsion system components for EV/HEV drives suitability for the desirable performance and control.
4. To compare and evaluate various energy sources and energy storage components for EV and HEV applications.

UNIT-I

INTRODUCTION: Basics of vehicles mechanisms, history of electric vehicles (EV) and hybrid electric vehicles (HEV), need and importance of EV and HEV, Power/Energy supplies requirements for EV/HEV applications, vehicle power source characterization, and transmission characteristics. Vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion – Propulsion System Design.

UNIT-II

DRIVE-TRAIN TOPOLGIES: Review of electric traction, various electric drive-train topologies, basics of hybrid traction system, various hybrid drive-train topologies, power flow control in drive-train topologies, fuel efficiency analysis.

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UNIT-III

ELECTRICAL MACHINES & POWER CONVERTERS: Electric system components for EV/HEV, suitability of DC and AC machines for EV/HEV applications, AC and DC Motor drives. Permanent magnet and switch reluctance machines, configuration and control of drives. Power Converters Converters for EV and HEV applications

UNIT-IV

ENERGY SOURCES FOR EV/EHV: Requirements of energy supplies and storage in EV/HEV, Review of batteries, fuel cells, flywheels and ultra-capacitors as energy sources for EV/HEV, characteristics and comparison of energy sources for EV/HEV, hybridization of different energy sources.

UNIT-V

ELECTRIC VEHICLES CHARGING STATIONS: Type of Charging station, Selection and Sizing of charging station, Components of charging Station and Single line diagram of charging station. Contactless inductive charging- Stationary Inductive Charging, resonant and compensation circuit topologies.

Suggested Reading:

1. Electric Vehicle Technology Explained, by James Larminie, John Lowry, WIELY USA, 2012.
2. Hybrid Electric Vehicles: Principles and Applications with practical perspective, Chris Mi, M. Abdul Masrur &David Wenzhong Gao, WIELY, 2011
3. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
4. Simora Onori, Hybrid Electric Vehicles Energy Management Strategies, Springer.

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PE621EE

PROGRAMMABLE LOGIC CONTROLLER

(Professional Elective-II)

Instruction	:	3Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04 03

Course Objectives:

1. To be able to understand basics of Programmable logic controllers, basic programming of PLC.
2. To make the students to understand the Functions and applications of PLC

Course Outcomes:

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

1. Develop PLC programs for industrial applications.
2. Acquire the knowledge of PLC counter functions and PLC Arithmetic functions and data handling functions.

UNIT-I

PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information- Programming Procedures - Programming Equipment - Programming Formats- Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT-II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT-III

Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

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UNIT-IV

Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC incremental clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems

UNIT-V

Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Reading:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.

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PE522EE

LINEAR INTEGRATED CIRCUITS

(Professional Elective-II)

Instruction	:	3Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04 03

Course Objectives:

1. To familiarize and able to understand Op-amps.
2. To understand the different linear and non-linear applications of op-amp
3. To understand the voltage regulators and active filters by using op-amps.

Course Outcomes:

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

1. Students will be able to design and use op-amps for various linear and non-linear applications.
2. Ability to design and use voltage regulators and active filters

UNIT – I

Operational amplifiers: Characteristics, Open loop voltage gain, Output impedance, Input impedance, Common Mode Rejection Ratio - Offset balancing techniques - Slew rate, Frequency response - Basic applications - Inverter summer, Analog integrator, Differentiator, Current to voltage converter, Voltage to current converter, Voltage follower, a.c. amplifier

UNIT – II

Circuits using Op-amps: Voltage limiter, Clipper and damper, Precision rectifier-full wave and half wave, Peak detector, Comparator, Zero crossing detector, Schmitt trigger, Monostable, astable and bistable multivibrators, Multiplier, Divider, Difference amplifier, Instrumentation amplifier.

UNIT – III

Waveform generation using Op-amps: Sine, Square, Triangular and Quadrature oscillators, 555 timer - Functional diagram, Operation as monostable and astable, Voltage to frequency converter using 555, 565.

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UNIT – IV

Voltage regulators using Op-amp: Series voltage regulators - Shunt regulators using Op-amp - Switching regulators using Op-amp, Buck, Boost, Buck-boost regulators, Regulators using IC 723 - Dual voltage regulator - Fixed voltage regulators - Current sensing and current fold back protection.

UNIT – V

RC active filters: Butterworth - First order - Second order for low pass - High pass - Band pass - Band reject - Notch - State variable filter - Switched capacitor filter - Universal filter - Power amplifiers - Power boosters, Monolithic power amplifier features.

Suggested Reading :

1. Gayakwad W.A. Op-Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India, 2002.
2. Malvino Albert Paul , Electronic Principles, 6th Edition, Tata McGraw Hill, 1999.
3. Roy Choudhury, Shail Jam - Linear integrated Circuits, New Age International, 2nd Edition, 2003.
4. William D. Stanley, OP Amps with Linear Integrated Circuits, Pearson, 2000.

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PE623EE

DIGITAL CONTROL SYSTEMS

(Professional Elective-II)

Instruction	:	3Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	04 03

Course Objectives:

1. To understand fundamentals digital control systems, z-transforms.
2. State space representation of the control systems, concepts of controllability and observability.
3. To estimate of stability in different domains, design of discrete time control systems, compensators, state feedback controllers, state observers through various transformations.

Course Outcomes:

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

1. Evaluate the output of a digital system for a given input. C
2. Describe the dynamics of a Linear, Time Invariant and Causal digital systems through difference equations
3. Analyze digital systems using the Z-transformation, state space methods
4. Design digital controllers for physical systems

UNIT-I

Introduction: Introduction, Examples of Data control systems — Digital to Analog conversion and Analog to Digital conversion, sample and hold operations. Z — TRANSFORMS: Introduction, linear difference equations, pulse response, Z — transforms, Theorems of Z — Transforms, the inverse Z — transforms, Modified Z- Transforms. Z-Transform method for solving difference equations; Pulse transforms function) block diagram analysis of sampled — data systems, mapping between s-plane and z-plane

UNIT-II

State Space Analysis: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and its Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state — space equations. Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.

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UNIT-III

Stability Analysis: Mapping between the S-Plane and the Z-Plane — Primary strips and Complementary Strips — Constant frequency loci, Constant damping ratio loci, Stability Analysis of closed loop systems in the Z-Plane. Jury stability test — Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.

UNIT-IV

Design of Discrete Time Control System: Transient and steady — State response Analysis — Design based on the frequency response method — Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.

UNIT-V

State Feedback Controllers & Observers: Design of state feedback controller through pole placement — Necessary and sufficient conditions, Ackerman's formula. State Observers — Full order and Reduced order observers.

Suggested Reading:

1. Discrete-Time Control systems – K. Ogata, Pearson Education/PHI, 2 Edition.
2. Digital Control Systems, V. I. George, C. P. Kurian, Cengage Learning
3. Digital Control Systems, Kuo, Oxford University Press, 2 Edition, 2003.Digital Control and State Variable Methods by M.Gopal, TMH.
4. Digital Control Engineering Analysis and Design M. Sami Fadali Antonio Visioli, AP Academic Press.

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HS901MB

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction	:	3Hrs per week
Duration of SEE	:	3 Hours
SEE	:	70 Marks
CIE	:	30 Marks
Credits	:	03

Course Objectives:

1. To learn important concepts of Managerial Economics
2. To understand various parameters that determine the consumers' behavior.
3. To understand the concepts of capital budgeting and payback period.

Course Outcomes:

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

1. Understand management concepts and apply them to evaluate business decisions.
2. Evaluate the factors that affect production.
3. Estimate working capital requirements.
4. Evaluate of capital budgeting opportunities.
5. Understand the concepts of various book-keeping methods.

UNIT-I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT-II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium.

UNIT - III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly.

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UNIT-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital. Introduction to capital Budgeting, methods of payback and discounted cash flow methods with problems.

UNIT-V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.

Suggested Reading:

1 Mehta P.L., Managerial Economics - Analysis, Problems and Cases, Sulthan Chand & Sons Educational Publishers, 2011

2 Maheswari S.N., Introduction to Accountancy, Vikas Publishing House, 2005

3 Pandey I.M., Financial Management, Vikas Publishing House, 2009

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PC651EE

ELECTRICAL MACHINES LAB – II

Instruction	:	02 Hrs per week
SEE	:	50 Marks
CIE	:	25 Marks
Credits	:	01

Course Objectives:

1. To learn operation and performance characteristics of induction machines by conducting various experiments and tests practically.
2. To understand the operation and performance characteristics of synchronous machines by conducting various experiments and tests.

Course Outcomes:

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

1. Understand Performance characteristics of single-phase induction motor
2. Understand the importance of Voltage regulation of an alternator
3. Explain different methods used to measure the voltage regulation of an alternator

LIST OF EXPERIMENTS:

1. No-load test, blocked rotor test and load test on 3-phase induction motor.
2. Speed control of 3-phase induction motor by (a) Cascade connection (b) Rotor resistance control (C) Pole changing (d) Slip power recovery scheme.
3. Performance characteristics of single-phase induction motor.
4. Voltage regulation of an alternator by (a) Synchronous impedance method (b) Ampere - turn method (c) Z.P.F. method.
5. Regulation of alternator by slip test.
6. Determination of V curves and inverted V curves of synchronous motor.
7. Power angle characteristics of a synchronous machine.
8. Power factor improvement of three phase Induction motor using capacitors.
9. Dynamic braking of 3-phase induction motor.
10. Speed control of BLOC motor.
11. Load characteristics of induction generator.
12. Speed control of SRM motor.

Note: Atleast ten experiments should be conducted in the Semester.

Suggested Reading :

1. Kothari D.P. & Nagrath I.J. - Electrical Machines - Tata McGraw Hill, 2004.
2. Bhimbra P.S. - Generalized Theory of Electrical Machines, Khanna Publications, 2000.
3. Say MG. - The Performance and Design of AC. Machines - Pitman Publication, 2002.

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4. Irving L. Kosow - Electric Machinery and Transforn1ers, PPH, Pearson Education, 2nd Edition.
2009.
5. Satish Kumar Peddapelli and Sridhar Gaddam, Electrical Machines - A Practical Approach, De
Gruyter Publisher, Germany, 2020

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PC652EE

MEASUREMENTS AND INSTRUMENTATION LAB

Instruction	:	2Hrs per week
SEE	:	50 Marks
CIE	:	25 Marks
Credits	:	01

Course Objectives:

1. To train the students for acquiring practical knowledge for measuring resistance, inductance and capacitance using various bridges.
2. To train the student for the usage of A.C. and D.C. potentiometers.
3. To make the student understand the operation of CRO and its usefulness in finding the amplitude, phase and frequency of waveforms.

Course Outcomes:

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

1. Measure the inductance, capacitance and resistance using various bridges.
2. Measure resistance and calibrate ammeter, voltmeters and wattmeter using A.C. and D.C. potentiometers.
3. Have hands on experience on the operation of CRO.

LIST OF EXPERIMENTS

1. Measurement of low resistance by Kelvin's Double Bridge.
2. Calibration of single phase energy meter.
3. Measurement of inductance by Maxwell's and Anderson's bridges.
4. Measurement of capacitance by Desauty's and Schering's bridges.
5. Measurement of Iron losses by Lloyd, Fishers magnetic square.
6. Measurement of Resistance and calibration of Ammeter using D.C. potentiometer.
7. Calibration of voltmeter and wattmeter using D.C. potentiometer.
8. Measurement of unknown voltage and impedance using A.C. potentiometer.
9. Calculation of iron losses using B-H curve with oscilloscope.
10. Localizing Ground and short circuit faults using Murray loop test and Varley loop test.
11. Measurement of relative permittivity (Er) of a dielectric medium using Schering bridge.
12. Measurement of frequency of unknown sinusoidal signal with CRO.
13. Measurement of phase and amplitude using CRO.
14. Calibration of given power factor meter using calibrated voltmeter, ammeter and wattmeter.

Note: Atleast ten experiments should be conducted in the Semester.

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Suggested Reading:

1. Shawney A.K., Electrical and Electronics Measurements and Instruments, Dhanpatrai & Sons, Delhi, 2000.
2. Umesh Sinha, Electrical, Electronics Measurement & Instrumentations, Satya Prakashan, New Delhi.
3. Golding E.W., Electrical Measurements & Measuring Instruments, Sir Issac & Pitman & Sons Ltd., London.

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PC653EE

CONTROL SYSTEMS LAB

Instruction	:	02 Hrs per week
SEE	:	50 Marks
CIE	:	25 Marks
Credits	:	01

Course Objectives:

1. To develop transfer function of various control system plants practically by conducting the experiments.
2. To understand the various controllers, basic features of PLC
3. Programming and control system concepts using MATLAB.

Course Outcomes:

At the end of the course students will be able to

1. Able to understand Performance of P, PI and PID Controllers
2. Able to develop PLC programs for certain applications
3. Acquire the knowledge of Data acquisition system and Industrial process control

List Of Experiments

1. Characteristics of D.C. and AC. Servomotor and their transfer function.
2. Characteristics of synchros.
3. Frequency response of second order system.
4. Operating characteristics of Stepper motor.
5. Step response of second order system.
6. D.C. Position control system.
7. A.C. Position control system.
8. Performance of P, PI and PID Controller on system response.
9. Design of lag and lead compensation.
10. ON - OFF temperature control systems.
11. Simulation of control system concepts using MATLAB.
12. PLC (Programmable Logic Controller) applications. (a) Bottle filling (b) Speed control of Stepper motor (c) Liquid level control.
13. Data acquisition system and applications.
14. Industrial process control trainer.

Note: Atleast ten experiments should be conducted in the Semester.

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PW661EE

SUMMER INTERNSHIP

Instruction	:	8 Weeks
CIE	:	50 Marks
Credits	:	02

Course Objectives:

1. To give an experience to the students in solving real life practical problems with all its constraints.
2. To give an opportunity to integrate different aspects of learning with reference to real life problems.
3. To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes:

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

1. Design/develop a small and simple product in hardware or software.
2. Complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
3. Learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
4. Implement the selected solution and document the same.
5. Able to write a technical report and present it to appropriate audience

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessionals are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Summer Internship.

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.**

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Suggested Reading:

1. Nagrath I.J. & Gopal.M - Control System Engineering, Wiley Eastern, 2003.
2. B.C.Kuo - Automatic Control Systems, Wiley India edition, 7th Edition, 2002.
3. K.Ogata - Modern Control System, Prentice Hall of India, 4th edition, 2002.
4. N.C.Jagan - Control Systems, B.S Publications, 2nd edition,2008.

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Faculty of Engineering & Technology

Scheme of Instruction and Syllabus

For

B. Tech (CBCS) VII and VIII semester

(AICTE MODEL)

Of

Four Year Degree Course

In

ELECTRICAL AND ELECTRONICS ENGINEERING

(WITH EFFECT FROM THE ACADEMIC YEAR 2021-22)

UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY

MAHATMA GANDHI UNIVERSITY

NALGONDA – 508 254 TELANGANA

UNIVERSITY COLLEGE OF ENGINEERING & TECHNOLOGY

B.TECH (CBCS) 4 YEAR (8 SEMESTER) REGULAR PROGRAMME

DEPARTMENT OF EEIE

(Applicable from the batch admitted from the Academic Year 2018-19 and onwards)

SEMESTER – I

Course Code	Course Title	Scheme of Instructions				Scheme of Examinations		Credits
		L	T	P/D	Contact Hrs/Wk	CIE	SEE	
THEORY								
BSC 101	Engineering Physics	3	1	0	4	30	70	4
BSC 102	Mathematics –I	3	1	0	4	30	70	4
HSMC 101	English	2	0	0	2	30	70	2
ESC 102	Engineering Graphics	1	0	4	5	30	70	3
PRACTICALS								
BSC 101	Engineering Physics	0	0	3	3	25	50	1.5
HSMC 101	English Lab	0	0	2	2	25	50	1
	Total	10	3	9	22	170	380	15.5

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SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

B.Tech (Electrical & Electronics Engineering)

SEMESTER - III

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	BS301MT	Mathematics - III	3	1	-	4	30	70	4
2	PC301EE	Electrical Circuit – I	3	1	-	4	30	70	4
3	PC302EE	Electrical Machines – I	3	1	-	4	30	70	4
4	PC303EE	Power Systems - I	3	1	-	4	30	70	4
5	PC304EE	Electromagnetic Fields	3	1	-	4	30	70	4
6	PC305EE	Analog Electronics	3	-	-	3	30	70	3
7	MC101HS	Environmental Science	3	-	-	3	30	70	-
Practicals									
8	PC352EE	Computer Aided Electrical Drawing Laboratory	-	-	3	3	25	50	1.5
9	PC351EE	Analog Electronics Laboratory	-	-	2	2	25	50	1
	Total		*21*	**5**	**5**	**31**	**260**	**590**	**25.5**

NOTE: - *The Practical Class can be of Two and half Hour (Clock hours) duration as per the requirement of the Particular Laboratory*

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SCHEME OF INSTRUCTION AND EXAMINATION

AICTE MODEL CURRICULUM

B.Tech (Electrical & Electronics Engineering)

SEMESTER - IV

S.No	Course Code	Course Title	Scheme of Instruction			Contact Hrs/wk	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC401EE	Electrical Circuit – II	3	1	-	4	30	70	4
2	PC402EE	Electrical Machines – II	3	1	-	4	30	70	4
3	PC403EE	Power Systems – II	3	1	-	4	30	70	4
4	PC404EE	Digital Electronics & Logic Design	3	-	-	3	30	70	3
5	ES405ME	Prime Movers & Pumps	3	-	-	3	30	70	3
Practicals									
6	PC451EE	Electrical Circuits Laboratory	-	-	2	2	25	50	1
7	PC452EE	Electrical Machines Laboratory – I	-	-	2	2	25	50	1
8	ES453ME	Mechanical Technology Laboratory			2	2	25	50	1
	Total		***15***	**3**	**6**	**24**	**225**	**500**	**21**

NOTE: - *The Practical Class can be of Two and half Hour (Clock hours) duration as per the requirement of the Particular Laboratory.*

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With effect from the Academic year 2020-2021, UCE&T, MGU

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(Applicable to the batch admitted from the Academic Year 2018-19 and onwards)

V-SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1	PC501EE	Electrical Machines-III	3	1	-	4	30	70	4
2	PC502EE	Measurements and Instrumentation	3	1	-	4	30	70	4
3	PC503EE	Linear Control Systems	3	1	-	4	30	70	4
4	PC504EE	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
5	PC505EE	Power electronics	3	1	-	4	30	70	4
6	OE-I	Open Elective-I	3	-	-	3	30	70	3
Practical									
1	PC551EE	Power Electronics Lab	-	-	2	2	25	50	1
2	PC552EE	Microprocessors and Microcontrollers Lab	-	-	2	2	25	50	1
3	PC553EE	Digital Electronics And Logic Design Lab	-	-	2	2	25	50	1
		TOTAL	**18**	**04**	**06**	**28**	**255**	**570**	**25**

Open Elective-I		
1	OE 501 ME	Material Handling
2	OE 501CE	Disaster Management
3	OE 503 CE	Geospatial Techniques
4	OE 564 CS	Operating Systems
5	OE 501EE	Reliability Engineering
6	OE 501 EC	Embedded Systems
7	OE 502 EC	Digital System Design Using Verilog HDL

L : Lecture **T : Tutorial** **CIE : Continuous Internal Evaluation** **P : Practical**
SEE : Semester End Examination

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VI-SEMESTER

S.No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
THEORY									
1.	PC601EE	Switchgear and Protection	3	1	-	4	30	70	4
2.	PC602EE	Signals and Systems	3	1	-	4	30	70	4
3.	PE-I	Professional Elective - I	3	-	-	3	30	70	3
4.	PE-II	Professional Elective - II	3	-	-	3	30	70	3
5.	HS901MB	Managerial Economics and Accountancy	3	-	-	3	30	70	3
PRACTICAL									
1.	PC651EE	Electrical Machines Lab-II	-	-	2	2	25	50	1
2.	PC652EE	Measurements and Instrumentation Lab	-	-	2	2	25	50	1
3.	PC653EE	Control Systems Lab	-	-	2	2	25	50	1
4	PW961EE	Summer Internship*	Six weeks during summer vacation						
			15	02	06	23	225	500	20

*Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.

L : Lecture T : Tutorial CIE : Continuous Internal Evaluation P : Practical
SEE : Semester End Examination

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SCHEME OF INSTRUCTION AND EXAMINATION

B.TECH (Electrical & Electronics Engineering)

AICTE Model Curriculum

(Applicable to the batch admitted from the Academic year 2018-19 and onwards)

VII - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	MC701AS	Technical Communication & Soft Skills	3	-	-	3	30	70	-
2.	PC701EE	Power System Operation and Control	3	1	-	4	30	70	4
3.	PC702EE	Utilization of Electrical Energy	3	-	-	3	30	70	3
5.	**Professional Elective– III**		3	-	-	3	30	70	3
	PE731EE	Digital Signal Processing							
	PE732EE	Electric Machine Design							
	PE733EE	Power Quality Engineering							
6.	**Open Elective – II**		3	-	-	3	30	70	3
	OE701BM	Micro Electro-Mechanical Systems							
	OE702CE	Green Building Technology							
	OE703CS	Information Security							
	OE704CS	Data Base Management Systems							
	OE705EC	Embedded Systems							
	OE706EC	Verilog HDL							
	OE707EC	Satellite Communication and Applications							
	OE708EE	Optimization Techniques							
	OE709EE	Non-Conventional Energy Sources							
	OE710ME	Industrial Administration and Financial Management							
Practical									
1.	PC751EE	Electrical Simulation Lab	-	-	2*	2	25	50	1
2.	PC752EE	Power Systems Lab	-	-	2*	2	25	50	1
3.	PW751EE	Project Stage-I	-	-	4	4	50	-	2
4.	PW961EE	Summer Internship*	-	-	-	-	50	-	-
			15	**1**	**8**	**24**	**300**	**450**	**17**

*The students have to undergo a Summer Internship of 6 weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

*As per the departmental requirement laboratory hours may be extended upto 30minutes

MC701AS

TECHNICAL COMMUNICATION AND SOFT SKILLS

(MANDATORY COURSE)

Instruction: 3Hrs per week *Duration of SEE: 3 hours*
CIE: 30 Marks *SEE: 70 Marks*
Credits: 0

Course Objectives

- To encourage all round development of students by focusing on soft skills
- To make the engineering students aware of the importance, the role and the content of the soft skills through instruction, knowledge acquisition, demonstration and practice
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose the students to right attitudinal, behavioral aspects and to build same through activities.

Course Outcomes: After completion of this course, the students shall be able to:

1. Effectively communicate through verbal/oral communication and through listening skills.
2. Write precise briefs or reports and technical documents.
3. Actively participate in group discussion/meetings/interviews, prepare & deliver presentations .
4. Become more effective individual through goal/target setting, self motivation and practicing creative thinking.
5. Function effectively in multi disciplinary and heterogeneous teams through knowledge of team work, inter personal relationships, conflict management and leadership quality.

UNIT-I

Technical Writing, Grammar and Editing – Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.

Unit – II

Technical Communications: Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-III

Self-Development and Assessment – Self Assessment, Awareness, Perception and Attitudes, Values and belief, personal goal setting, career planning, Self-esteem Communication and Technical Writing – Public Speaking, Group Discussion.

nit- IV

resentation Skills - Oral presentation, Interviews, Graphic presentation, Presentation aids, ersonality Development. Writing reports, project proposals, brochures, newsletters, technical articles, anuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

NIT-V

rofessional Ethics – Business ethics, Etiquettes in Social and Office settings, Email etiquettes, elephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work ulture in jobs, personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

uggested Readings:

1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, pocket Style Manual, Bedford Publicatiion, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
7. Xebec. Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

PC701EE

POWER SYSTEM OPERATION AND CONTROL

Instruction: 4Hrs per week
CIE: 30 Marks
Credits:4

Duration of SEE: 4 hours
SEE: 70 Marks

Course Objectives

- To understand the concepts and Importance of Load flow studies.
- To study the economic operation of thermal power units.
- To understand the load frequency control mechanism in a power system.
- To analyze angle stability and voltage stability of the power system.
- To study various compensation techniques in a power system.

Course Outcomes: After completion of this course, the students shall be able to:

- Analyze load flow methods, economic operation and load frequency control of power system.
- Evaluate the load distribution between generating units economically.
- Understand the effect of closed loop control of frequency of power system.
- Determine the stability of power system under various types of disturbances.
- Understand various compensation methods required in a power system.

UNIT I

Load Flow Studies: Introduction, Bus classification, Nodal Admittance matrix, Static Load flow equations, Gauss Seidel method, Newton Raphson method, Decoupled and Fast decoupled methods of load flow analysis. Comparison of methods.

UNIT II

Economic Operation of Power System: Generator input output curves, Heat rates and incremental cost curves, Economic operation neglecting transmission losses. Loss coefficients, Economic operation including transmission losses.

UNIT III

Load Frequency Control: Mathematical model of speed-governing system, Turbine models. Concept of control area, Flat Frequency control, Flat tie line frequency control, Tie line bias control. Single area load frequency control, Steady state and dynamic responses, Closed loop control, Two area load frequency control.

UNIT IV

Power System Stability: Steady State Stability, Dynamic Stability, Transient Stability, Swing equation, Equal area criterion, Application of equal area criterion, Step-by- Step solution of the swing equation, Factors affecting transient stability. Introduction to voltage stability.

UNIT V

Compensation in Power System: Loading capability, Load compensation, Line compensation, Series compensation, Shunt compensation, FACTS controllers –Principle of Operation of SVC, STATCOM, SSSC, UPFC.

Suggested Reading:

1. C.L.Wadhwa, Electric Power Systems, New Age International (P) Ltd., Third Edition 2002.
2. Nagarath and Kothari, Electrical Power Systems, Tata McGraw Hill Co., Third Edition, 2004.
3. Elgerd 0, Electric Energy System Theory, McGraw Hill, 1971.
4. Hingorani, Understanding FACTS, Standard Publishing, New Delhi, 2000.
5. Hadi Saadat, Power System Analysis, Tata McGraw-Hill Edition, 2002.

PC702EE

UTILIZATION OF ELECTRICAL ENERGY

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To introduce the students and understand Utilization of electrical energy for various applications like industrial heating, welding etc.
- To understand various types of control circuits for three phase induction motors.
- To understand the concept of illumination, and know the applications of various lamps to factory lighting, street lighting etc.
- To understand the basic principle of electric traction including speed-time curves of different traction services.
- To understand systems of train lighting and also various types of batteries.

Course Outcomes: After completion of this course, the students shall be able to:

1. Identify a suitable heating/welding scheme for a given application.
2. Design control circuits for the reliable operation of three phase induction motors.
3. Classify types of electric light sources based on nature of operation and their objectives, performance and reliability.
4. Determine the speed – time characteristics of various traction services and also estimate the energy consumption levels at various modes of operation.
5. Select proper train lighting scheme according to the requirement and analyze various batteries.

UNIT I

Industrial Heating: Advantages and methods of electric heating. Description, operation and performance of resistance ovens, Design of heating element. High frequency heating, Induction Heating, Induction furnaces, Core type, Coreless furnaces, Dielectric heating. Electric Arc furnaces, Direct Arc furnace, Indirect Arc furnaces.

Electric Welding: Classification of Electric welding, welding transformer and its rating, various types of Electric arc welding and electric resistance welding.

UNIT II

Schematic Utilization and Connection Diagrams for Motor Control: Two supply sources for 3 phase Induction motors. Direct reversing, remote control operation, and jogging operating of Induction motor. Contactor control circuit. Push button control stations. Over load relays, limit switches, float switches. Interlocking methods for reversing control.

UNIT III

Illumination: Introduction, nature and production of light, Sensitivity of the eye, Units of light. The inverse square law and cosine law, Solid angle, Lighting calculations, Determination of M.S.C.P, Rousseau's construction, Discharge lamps, Sodium vapour lamps, Mercury vapour lamps, Fluorescent lamp, Starting and power factor corrections, Stroboscopic effects, Neon signs, Application to factory lighting, Street lighting and Flood lighting.

UNIT IV

Electric Traction: System of Electric Traction, Transmission of drive, Systems of track electrification, Traction mechanics, Speed time curves, Tractive effort, Power of Traction motor, Specific energy consumption, Mechanics of train movement, Coefficient of adhesion.

Traction Motors: Desirable characteristics, DC series motors, AC series motors 3-phase induction motors, DC motor series & parallel control, Energy saving.

UNIT V

Train Lighting: Systems of train lighting, Special requirements of train lighting, Methods of obtaining unidirectional polarity, Methods of obtaining constant output, Single battery system, Double battery parallel block system, Principal equipment of double battery system, Coach wiring, Dynamo.

Batteries: Lead acid batteries, SMF batteries, Construction and maintenance, Charging and rating of batteries.

Suggested **Reading:**

1. Partab H, Art and Science of Utilization of Electric Power, Dhanpat Rai & Sons, 1997.
2. K.B. Raina & S.K. Bhattacharya, Electrical Design, Estimating and Costing, Wiley Eastern Ltd., 1991.
3. Partab H, Modern Electric Traction, Dhanpat Rai & Sons, 2000.
4. B.L.Theraja, A Text Book of Electrical Technology, S.Chand & Company Ltd, Vol-I.

PE731EE

DIGITAL SIGNAL PROCESSING
(Professional Elective-III)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To apply classification, characterization, representation and analysis of signals and systems in time and frequency domain.
- To understand Discrete time signals and systems in frequency domain.
- To understand the characteristics of IIR digital filters.
- To understand the Characteristics of FIR digital filters.
- To study the digital signal processor TMS 320C5X and architecture.

Course Outcomes: After completion of this course, the students shall be able to:

1. Acquire the knowledge on Classification of discrete time signals & discrete time systems, Properties of Z-transforms, Discrete time Fourier transform.
2. Able to obtain the frequency spectrum of discrete time signals using FFT.
3. Analyze and Design IIR digital filters
4. Analyze the Design FIR digital filters.
5. Explain the Applications of DSP TMS 320C5X.

UNIT- I

Introduction to Digital Signal Processing: Sampling, Quantizing and coding, Classification of discrete time signals & discrete time systems, linear shift invariant systems, Stability and causality, Solution to Linear constant coefficient difference equations.

UNIT - II

Frequency domain analysis: Discrete time Fourier transform (DTFT), Properties, Frequency domain representation of discrete time signals and systems, DFS, Properties, Frequency domain sampling OFT, Properties, circular convolution, Linear convolution using OFT, Fast Fourier transforms (FFT), Radix-2 decimation in time(DIT) and decimation in frequency(DIF) FFT Algorithms, IDFT using FFT.

UNIT-III

IIR digital filters: Analog filter approximations, Butterworth and Chebyshev filters, Design of IIR Digital filters from analog filters using Bilinear transformation, Impulse invariant and step

invariant methods. Realization of IIR filters, Direct form-I, Direct form-II, Cascade and parallel form realizations.

UNIT- IV

FIR digital filters: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital filters using window techniques, Linear phase realization, Applications of digital signal processing to speech processing.

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion, Implementation of sampling rate conversion.

UNIT-V

Introduction to Digital Signal Processors: Introduction to programmable DSPs, Advantages of Digital signal processors over conventional Microprocessors, Architecture of TMS 320C5X-Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, Program controller, Status registers, On- chip memory and On-chip peripherals.

Suggested Reading:

1. Proakis & Manolakis - Digital Signal Processing, Principles, Algorithms and Applications, Prentice Hall of India - 3rd Edition-1994.
2. Opeinheim & Schaffter - Digital Signal Processing, PHI Publications, 2002.
3. Salivahanan Valluaraj & Gnanapriya - Digital Signal Processing- Tata McGraw Hill, 2001.
4. Anand Kumar. A - Digital Signal Processing - PHI learning Private Ltd. 2013.
5. B. Venkataramani and M. Bhaskar - Digital Signal Processors, Architecture programs and applications, Tata McGraw Hill, 2007.

PE732EE

ELECTRIC MACHINE DESIGN

(Professional Elective-III)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand various materials used in electrical systems and the construction and basic design of the electrical machines.
- To understand basic concepts of design of magnetic and thermal circuits, draw the winding diagrams of rotating machines.
- To understand the Design principles of different rotating machines.
- To acquire knowledge of electrical machine parameters such as main dimensions and the design of major parts.
- To study the design optimization of the electrical machine for industrial, agriculture and residential applications.

Course Outcomes: After completion of this course, the students shall be able to:

1. Acquire the knowledge of various electrical materials used in used in design of electrical system.
2. Analyze magnetic, thermal circuits in electrical machines and their design aspects.
3. Understand the importance of cooling and design of cooling system for various electrical machines and also able to know design AC armature windings in rotating machines.
4. Design of rotating machines and transformers.
5. Understand the computer aided design of electrical machines with various methods of approaches and flowcharts.

UNIT- I

Electrical Engineering Materials: Insulating materials: Properties of ideal insulating materials. Classification and types of insulating materials, Gaseous, liquid, Solid, fibrous and mineral insulating materials, Plastic, glass and ceramic materials. Conducting Materials: General properties materials, Super conductors.

Magnetic Materials: Classification of magnetic materials, Soft and hard magnetic materials, sheet, cold rolled steel, solid core and powder core materials.

UNIT II

Magnetic Circuit: Basic principles, magnetic circuit calculation flux density in air-gap and tooth. Carter's coefficient, ampere turns for gap and teeth, real and apparent flux density, magnetic

leakage, leakage flux from salient poles, field distribution curves, field turns, armature reaction ampere turns. Reluctance of rectangular slots.

UNIT III

Electrical Circuit: AC Single phase, three phase windings. Mesh and concentric winding, Double layer winding.

Thermal Circuit: Types of enclosures, ventilating and cooling methods in Electrical Machines-Losses, Temperature rise time curve and cooling curve. Rating of electrical machines, calculation for quantity of cooling medium.

UNIT-IV

Transformer Design – Main dimensions-output Equations-Core Design-cooling system design. Design principles of rotating machines: output equations and main dimensions, defining of magnetic loading, design of slot field coils, estimation of air gap lengths.

UNIT-V

Computer Aided Design: Introduction, Advantages of digital computers: computer aided design-different approaches: Analysis method, synthesis method, hybrid method, optimization. General procedure for optimization, variable constraints. Computer aided design of 3 phase induction motor. List of symbols used, general design procedure.

Suggested Reading:

1. A.K. Sawhney, A course in Electrical Machines Design, Dhanpat Rai and Sons,1996
2. R.K. Agarwal, Principles of Electrical Machine Design, ESS Kay Publications, Naisarak, New Delhi,1994
3. V.N. Mittal, Design of Electrical Machines, Standard Publishers and Distributors, New Delhi,1992

PE733EE

POWER QUALITY ENGINEERING

(Professional Elective-III)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand the importance of power quality, different power quality issues and their effects in power system network.
- To understand methods of calculating the voltage sag magnitude and duration.
- To understand the types of sags and characterize the voltage sags experienced by machines.
- To acquire knowledge of harmonics, locate sources of harmonics and mitigate harmonics.
- To acquire knowledge of various measuring equipment and understand assessment of PQ measuring data.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the significance of power quality study and identify various power quality disturbances.
2. Write algorithms to calculate voltage sags magnitude and duration in power system.
3. Demonstrate the effect and also analyze the characteristics of voltage sags experienced by ASDs.
4. Evaluate THD and mitigate harmonics in distribution system.
5. Operate and use PQ measuring equipment for assessment of data.

UNIT-I

Introduction: Power Quality (PQ),PQ problems, Sags, Swells, Transients, Harmonics, Interruptions, Flicker, Voltage fluctuations, Notch. Transient Over voltages, Sources of Transient Over voltages.

Wiring and Grounding: Resources, Definitions, Reasons for Grounding, Typical wiring and grounding problems, Solutions to wiring and grounding problems.

UNIT-II

Voltage Sag Characteristics and Analysis: Voltage sag characteristics, Methodology for computation of voltage sag magnitude and occurrence, Accuracy of sag analysis, Duration & frequency of sags, Faults behind transformers, Effect of pre-fault voltage, Simple examples, Voltage dip problems, fast assessment methods for voltage sags in distribution systems.

UNIT-III

PQ in Industry: Voltage tolerance curves of computers, PLCs and process control equipment CBEMA and ITIC curves, Adjustable speed drive (ASD) systems AC and DC, Characterization of voltage sags experienced by three-phase ASD systems, Types of sags and phase angle jumps, Effects of momentary voltage dips on the operation of induction and synchronous motors.

UNIT-IV

Harmonics: Harmonic distortion, Voltage versus current distortion, Harmonics versus Transients, Harmonic Indices, Harmonic sources from commercial loads, Harmonic sources from industrial loads, Locating Harmonic sources, System response characteristics, Effects of Harmonic distortion, Inter harmonics, Devices for controlling harmonic distortion.

UNIT-V

Power Quality Monitoring: Monitoring considerations, Historical Perspective of PQ Measuring Instruments, PQ measurement equipment, Assessment of PQ measurement data, Application of intelligent systems, PQ monitoring standards

Suggested Reading:

1. Math H.J. Bollen, Understanding Power Quality Problems, IEEE Press, 1999.
2. Roger C. Dugan, MarkF. Mc Granaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, Second Edition, Tata McGraw-Hill Edition.
3. C. Sankaran, Power Quality, CRC Press, 2002.

OE70IBM

MICRO ELECTRO-MECHANICAL SYSTEMS

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To introduce to basics of Micro-electro-mechanical systems.
- To understand properties of materials involved in MEMS.
- To pertain fabrication methods involved in MEMS manufacturing.
- To apply the concepts for various applications.
- To introduce to basics of Micro-electro-mechanical systems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Elucidate basic concepts involved in MEMS technologies.
2. Realize the properties of various materials involved in MEMS technologies.
3. Apply the concepts and technologies involved in designing of MEMS.
4. Relate different manufacturing processes involved in fabrication of MEMS.
5. Recognize micro sensors, micro actuators and their applications in various fields.

UNIT-I

Introduction to MEMS: What is MEMS, Historical Background, classification, Micro-engineering, importance of micro-engineering. Technological advancements in MEMS, advantages and disadvantages of MEMS.

UNIT II

MEMS materials: Materials used in MEMS. Material properties: electrical, mechanical, thermal, chemical, biological, optical and processing. Reliability issues of materials

UNIT III

Designing of MEMS: Design and analysis process for MEMS. Initial design process, structured design process. Commonly used design flow, structured design flow. Design flow for MEMS cad design. Design and verification flow for integrated MEMS.

UNIT IV

MEMS fabrication Techniques: Photolithography, materials for micromachining, bulk micromachining Surface micromachining, High aspect-ration-micromachining, assembly and system integration.

UNIT V

MEMS structures and devices: Mechanical sensors, mechanical actuators, micro-fluidic devices, optical/photonic micro-systems, biological transducers.

Suggested Reading:

1. Adams TM, Layton RA. Introductory MEMS: Fabrication and applications, 2010.
2. Tobergte DR, Curtis S. "An Introduction to Micro-electro-mechanical Systems Engineering" Second Edition. vol. 53. 2013.
3. Kreith F, Kreider JF. :The MEMS Handbook" CRC Press 2002.
4. Reza Ghodssi · Pinyen Lin. "MEMS Materials and Processes Handbook" Springer 2013
5. Gad-el-Hak M. "MEMS applications" 2nd edition, CRC press 2006.

OE702CE

GREEN BUILDING TECHNOLOGY

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- Exposure to the green building technologies and their significance.
- Understand the judicial use of energy and its management.
- Educate about the Sun-earth relationship and its effect on climate.
- Enhance awareness of end-use energy requirements in the society.
- Develop suitable technologies for energy management.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the fundamentals of energy use and energy processes in building.
2. Identify the energy requirement and its management.
3. Know the Sun-earth relationship vis-a-vis its effect on climate.
4. Be acquainted with the end-use energy requirements.
5. Be familiar with the audit procedures of energy.

UNIT-I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

UNIT III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer

UNIT V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Reading:

1. Michael Bauer, Peter Mösle and Michael Schwarz, "Green Building - Guidebook for Sustainable Architecture", Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner, "Heating, Cooling, Lighting - Sustainable Design Methods for Architects", Wiley, New York, 2015.
3. Mike Montoya, "Green Building Fundamentals", Pearson, USA, 2010.
4. Charles J. Kibert, "Sustainable Construction - Green Building Design and Delivery", John Wiley & Sons, New York, 2008.
5. Regina Leffers, "Sustainable Construction and Design", Pearson / Prentice Hall, USA, 2009.
6. James Kachadorian, "The Passive Solar House: Using Solar Design to Heat and Cool Your Home", Chelsea Green Publishing Co., USA, 1997.

0E703CS

INFORMATION SECURITY

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To learn legal and technical issues in building secure information systems.
- To provide an understanding of network security.
- To expose the students to security standards and practices.

Course Outcomes: After completion of this course, the students shall be able to:

1. Describe the steps in Security Systems development life cycle (Sec SDLC).
2. Understand the common threats and attack to information systems.
3. Understand the legal and ethical issues of information technology.
4. Identify security needs using risk management and choose the appropriate risk control strategy based on business needs.
5. Use the basic knowledge of security frameworks in preparing security blue print for the organization.
6. Usage of reactive solutions, network perimeter solution tools such as firewalls, host solutions such as antivirus software and Intrusion Detection techniques and knowledge of ethical hacking tools.
7. Use ethical hacking tools to study attack patterns and cryptography and secure communication protocols.
8. Understand the technical and non-technical aspects of security project implementation and accreditation.

UNIT-I

Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC. Need for Security: Business Needs, Threats, Attacks, and Secure Software Development.

UNIT-II

Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.

Risk Management: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, Selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management discussion Points, Recommended Risk Control Practices.

UNIT-III

Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.

Security Technology: Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections.

UNIT-IV

Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.

Cryptography: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT-V

Implementing Information Security: Information security project management, Technical topics of implementation, Non Technical Aspects of implementation, Security Certification and Accreditation.

Security and Personnel: Positioning and staffing security function, Employment Policies and Practices, and Internal control Strategies.

Information Security Maintenance: Security management models, Maintenance model, and Digital Forensics.

Suggested Reading:

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, 2011.
2. Thomas R Peltier, Justin Peltier, John Blackley, "Information Security Fundamentals", Auerbach Publications, 2010.
3. Detmar W Straub, Seymour Goodman, Richard L Baskerville, "InformationSecurity, Policy, Processes, and Practices", PHI, 2008.
4. Mark Merkow and Jim Breithaupt "Information Security Principle and Practices", Pearson Education, 2007

0E704CS

DATABASE MANAGEMENT SYSTEMS

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To introduce three schema architecture and DBMS functional components.
- To learn formal and commercial query languages of RDBMS.
- To understand the principles of ER modeling and theory of normalization.
- To study different file organization and indexing techniques.
- To familiarize theory of serializability and implementation of concurrency control, and recovery.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the mathematical foundations on which RDBMS are built.
2. Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model,and refine the relational model using theory of Normalization.
3. Develop Database application using SQL and Embedded SQL.
4. Use the knowledge of file organization and indexing to improve database application performance.
5. Understand the working of concurrency control and recovery mechanisms in RDBMS.

UNIT-I

Introduction: Database System Applications, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries, Views, Modification of the Database, Joined Relations Data, Database Languages, Relational Databases, Database Design, Object–based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity Relationship Model, Constraints, Entity-Relationship Diagrams, Entity – Relationship Design Issues, Weak Entity Sets, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT – II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational – Algebra Operations, Extended Relational - Algebra Operations, Null Values, Modification of the Databases. Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT – III

Advanced SQL: SQL Data Types and Schemas, Integrity Constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features. Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional-Dependency Theory, Decomposition using Functional Dependencies.

UNIT – IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B– -tree Index Files, B-tree Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices. Index Definition in SQL Transactions: Transaction Concepts, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability.

UNIT – V

Concurrency Control: Lock-based Protocols, Timestamp-based Protocols, Validation based Protocols, Multiple Granularity, Multi-version Schemes, Deadlock Handling, Insert and Delete Operations, Weak Levels of Consistency, Concurrency of Index Structures. Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advanced Recovery Techniques, Remote Backup Systems.

Suggested Readings:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill International Edition, 6th Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill International Edition, 3rd Edition, 2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004

OE705EC

EMBEDDED SYSTEMS

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To gain knowledge to design embedded systems.
- To understand the processor selection criteria for Embedded System Design.
- To gain the knowledge of ARM Cortex on Zynq for embedded systems.
- To gain the knowledge of tool chain for embedded systems.
- To understand the importance of RTOS in building real time systems.

Course Outcomes: After completion of this course, the students shall be able to:

1. Design an embedded system.
2. Distinguish between RISC and CISC.
3. Use the ARM Cortex for design of embedded system.
4. Use Embedded Software Development Tools for Designing Embedded System applications.
5. Apply their understanding in building real time systems.

UNIT-I

Introduction To Embedded Systems: The Embedded Design Life Cycle - Product Specification, Hardware/Software Partitioning, Iteration And Implementation, Detailed Hardware (selection of processor) and Software Design, Hardware/Software Integration, Product Testing And Release, Maintenance and Upgradation.

UNIT-II

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM processor fundamentals, registers, current program status register, pipeline, exceptions, interrupts, and vector table, core extensions, architecture revisions, ARM processor families.

UNIT-III

Embedded processing with ARM CORTEX on Zynq: Fundamentals of FPGA, types of FPGA, case study of Xilinx FPGA, Processing System, programmable logic, programmable logic interfaces, security, Zynq 7000 family members, Zynq versus standard FPGA, Zynq versus standard processor.

UNIT-IV

Embedded Software Development Tools: Host And Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators For Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers.

UNIT-V

Introduction to Real Time Operating Systems: Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment.

Suggested Reading:

1. Arnold S Berger, Embedded Systems Design, South Asian edition, CMP Books, 2005.
2. Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide: Designing and Optimizing System Software , Elsevier, 2004.
3. Louise H Crockett, Ross.A.Elliot et al " The Zynq Book" , Edition 1, Strathclyde academic media, July 2014.
4. David E Simon, "An Embedded software primer", Pearson, 2012.

OE706EC

VERILOG HDL
(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:

- To familiarize with various modeling styles: structural, dataflow and behavioral of Verilog HDL.
- To develop combinational and sequential circuits using various modeling styles of Verilog HDL
- To design and develop Verilog HDL models of data path and control units of Central Processing Unit (CPU)
- To learn Synthesis and FPGA design flow.
- To design and develop real time applications: Booth's multiplier, Divider, hardwired control for basic CPU, FIR filter.

Course Outcomes: Student will be

1. Implement and distinguish different Verilog HDL modeling styles
2. Construct and analyze Verilog HDL models of combinational and sequential circuits
3. Design and develop Verilog HDL modeling and test bench for digital systems for the given specifications
4. Outline FPGA design flow and timing analysis

JNIT - I

ntroduction to HDL: Overview and Importance of HDLs, Differences between HLL, HDL and ALP. Design methodologies, Modules, Lexical Conventions, Number Specifications, Strings, dentifiers and Keywords Data types, System task and compiler Directives, Port declaration and port onnection rules

NIT - II

tructural and Dataflow modeling: gate-level modeling, delays, hazards, dataflow modeling: ontinuous Assignments, Delays, Expressions, Operators and Operands, Operator Types and Design xamples

NIT - III

havioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional tements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. mbinational, sequential logic modules Simulation: Types of Simulation, Event driven Simulation l Cycle Based Simulation; design examples.

UNIT - IV

Synthesis and Verification: Tasks and Functions: Differences between Tasks and Functions, Tasks and Functions. Verilog HDL synthesis, synthesis, Application Specific IC (ASIC) and Field Programmable Gate Array (FPGA) design flow. Verification: Timing analysis and Test bench design. Design examples.

UNIT - V

Real time implementations: Fixed-Point Arithmetic modules: Addition, Multiplication, Division, Arithmetic and Logic Unit (ALU), Timer, Universal Asynchronous Receiver and Transmitter (UART), DSP modules: FIR and IIR filters, CPU design: Data path and control units.

Suggested Reading:

1. Samir Palnitkar, *"Verilog HDL A Guide to Digital Design and Synthesis,"* 2nd Edition, Pearson Education, 2006.

2. Ming-Bo Lin, "*Digital System Designs and Practices: Using Verilog HDL and FPGA,"* Wiley India Edition, 2008.

3. J. Bhasker, *"A Verilog HDL Primer*," 2nd Edition, BS Publications, 2001.

OE707EC

SATELLITE COMMUNICATION AND APPLICATIONS

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives:

- To familiarize with basic concepts related to satellite Communication.
- To understand Sub-Systems of Satellites and Launches.
- To design the Earth Station antennas.
- To know about the parameters affecting the Satellite System Performance.
- To understand the applications of satellites.

Course Outcomes: Student will be

1. Able to have knowledge about the Satellite communications Principles and Properties.
2. Able to know about the Space craft subsystems and Launch vehicles.
3. Able to design the Satellite Earth station antennas
4. Able to analyze the effects of various parameters on Satellite System performance.
5. Able to understand the applications of Satellite Communication.

UNIT–I

Origin of Satellite communications, A Brief History of Satellite Communication, Basic principles and properties of satellite communication. Earth segment, Space segment, Interpretation of Kepler's Laws. Orbital Mechanics: The Equation of the Orbit, Describing the Orbit, Locating the Satellite in the Orbit, Orbital effects in communication system Performance: Doppler shift, Range variation, Eclipse and Sun-Transit Outage.

UNIT– II

Space craft sub systems, Equipment Reliability and Space Qualification: Space Qualification, Reliability, and Redundancy, Satellite launch and launch vehicles and Mechanics of Launching a Synchronous Satellite.

UNIT– III

Earth Stations: Earth Station Design for Low System Noise Temperature, Design of large antennas and small earth station antennas. Low noise amplifiers and High power Amplifiers for Satellite communication.

UNIT– IV

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T ratio: Noise Temperature, calculation of System Noise Temperature, Noise Figure and Noise Temperature, Propagation on Satellite-Earth paths: Attenuation, depolarization, atmospheric absorption, Tropospheric Multipath effects and Land and Sea Multipath, Multipath Effects in System Design, Faraday rotation in the Ionosphere, Ionospheric scintillations, Rain and ice effects.

UNIT– V

Satellite Navigation Applications: Global and Regional Satellite Navigation Systems- Operating Principles, Advantages, Limitations, Current Status and Applications, Remote Sensing Satellites.

Suggested Readings:

1. Wilbur L. Pitchand and Henri G. Suyderhoud, Robert A. Nelson, "*Satellite Communication Systems Engineering*", 2nd edn.3rd Impression, Pearson Education.2008.

2. Timothy Pratt and Charles Nestian. W, "*Satellite Communication*", John Wiley and Sons, 1988.

3. Tri T. Ha, "*Digital Satellite Communication*", Tata McGraw- Hill, Special Indian Edition2009.

OE708EE

OPTIMIZATION TECHNIQUES

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand the need and basic concepts of operations research and classify the optimization problems.
- To study about the linear programming and non-linear programming concepts and their applications
- To understand various constrained and un-constrained optimization techniques and their applications.
- To understand the concepts and implementation of Genetic Algorithms to get the optimum solutions
- To study the concepts of Metaheuristics Optimization techniques

Course Outcomes: After completion of this course, the students shall be able to:

1. Analyze any problem of optimization in an engineering system and able to formulate a mathematical model to the problem and solving it by the techniques that are presented.
2. Solve problems of L.P. by graphical and Simplex methods
3. Apply various constrained and un-constrained optimization techniques for the specific problems.
4. Could able to implement the Genetic Algorithms to solve the for optimum solution
5. Understands the concepts to use the Metaheuristics Optimization techniques

UNIT-I

Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Condition

UNIT-II

Linear Programming: Definitions and Formulation of the LPP, Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems. Artificial Variables, solution by the Big-M method, Duality principle, Dual problems and numerical problems.

UNIT-III

Random Search Methods concepts: Direct Search Methods - Univariate Method, Gradient of a Function, Indirect Search Methods - Gradient of a Function, Steepest Descent (Cauchy) Method, Newton's Method.

UNIT-IV

Binary Genetic Algorithm: Genetic Algorithms Natural Selection on a Computer, Components of a Binary Genetic Algorithm. Selecting the Variables and the Cost Function. Variable Encoding and Decoding, The Population, Natural Selection, Selection, Mating. Mutations, the Next Generation and Convergence, Components of a Continuous Genetic Algorithm.

UNIT-V

Metaheuristics Optimization: Concepts of Simulated Annealing, Theoretical approaches, Advantages and disadvantages, applications, Ant Colony Algorithms - Introduction, Collective behavior of social insects, Formalization and properties of ant colony optimization.

Suggested Reading:

1. Rao, S.S. (2009). "Engineering Optimization: Theory and Practice." John Wiley & Sons, Inc.
2. Taha, H.A. (2008). "Operations Research, Pearson Education India." New Delhi, India.
3. Randy L. Haupt and Sue Ellen Haupt, "Practical genetic algorithms" second edition, a John Wiley & sons, inc., publication -2004.
4. Sharma J.K. (2013). "Operation Research: Theory and Applications." Fifth Edition, Macmillan Publishers, New Delhi, India.
5. J. Dreo A. Petrowski, P. Siarry E. Taillard. "Metaheuristics for Hard Optimization" Springer.

OE709EE

NON-CONVENTIONAL ENERGY SOURCES

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand the different types of energy sources
- To Understand the need of non-conventional energy sources and their principles
- To understand the limitations of non-conventional energy sources
- To outline division aspects and utilization of renewable energy sources for diriment application.
- To analyze the environmental aspects of renewable energy resources

Course Outcomes: After completion of this course, the students shall be able to:

1. Know the different energy resources and need of renewable energy resources
2. Understand the concepts of working of fuel cell systems along with their applications
3. Describe the use of solar energy and the various components and measuring devices used in the energy production and their applications
4. Appreciate the need of Wind Energy and their classification and various components used in energy generation and working of different electrical wind energy system
5. Understand the concept of OTEC technology, Biomass energy resources and different types of biogas Plants used in India

UNIT-I

Review of Conventional and Non-Conventional energy sources, Need for non-conventional energy sources Types of Non-conventional energy sources, Fuel Cells, Principle of operation with special reference to H2O2 Cell, Classification and Block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, Solid oxide electrolyte cells, Regenerative system, Regenerative Fuel Cell, Advantages and disadvantages of Fuel Cells, Polarization, Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy, Solar radiation and its measurements, Solar Energy collectors, Solar Energy storage systems, Solar Pond, Application of Solar Pond, Applications of solar energy.

UNIT-III

Wind energy, Principles of wind energy conversion systems, Nature of wind, Power in the Wind, Basic components of WECS, Classification of WECS, Site selection considerations, Advantages and disadvantages of WECS, Wind energy collectors, Wind electric generating and control systems, Applications of Wind energy, Environmental aspects.

UNIT-IV

Energy from the Oceans, Ocean Thermal Electric Conversion (OTEC) methods, Principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and disadvantages of wave energy, Geo-thermal Energy, Types of Geo-thermal Energy Systems, Applications of Geo-thermal Energy.

UNIT-V

Energy from Biomass, Biomass conversion technologies / processes, Photosynthesis, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifies.

Suggested Reading:

1. Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 1999.
2. M.M.El-Wakil, Power Plant Technology. McGraw Hill, 1984.

0E710ME

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

(Open Elective-II)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- Aware about types of business forms, organization structures, plant layouts, merits, demerits and application.
- Understand method study procedure, PME, time study techniques and wage incentives.
- Importance of PPC and improving quality by control charts and sampling plants.
- Optimization of inventory to minimize total cost and other optimization techniques like LPP, project management techniques.

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand business forms, organization structures and plant layouts
2. Implementation of method study and estimation of standard time
3. Understand types of production, functions of PPC, quality control by charts and sampling
4. Implement optimization techniques like LPP, assignment and project management techniques
5. Understand BEA, estimation of depreciation, selling price of product and capital budget techniques.

UNIT – I

Industrial Organization: Types of various business organizations. Organization structures and their relative merits and demerits. Functions of management.

Plant location and layouts: Factors affecting the location of plant and layout. Types of layouts and their merits and demerits.

UNIT – II

Work study: Definitions, Objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time– by– time study and work sampling.

Performance rating factor, Types of ratings Jobs evaluation and performance appraisal, Wages, incentives, bonus, wage payment plans

UNIT – III

Inspection and quality control: Types and objectives of inspection S.Q.C., its principles quality control by chart and sampling plans. Quality circles, introduction to ISO. **Production planning and control:** Types of manufacture. Types of production. Principles of PPC and its function, Production control charts.

UNIT – IV

Optimization: Introduction to linear programming and graphical solutions. Assignment problems,

Project Management: Introduction to CPM and PERT. Determination of critical path **Material Management:** Classification of materials. Materials planning, Duties of purchase manager, Determination of economic order quantities. Types of materials purchase.

UNIT – V

Cost accounting: elements of cost, various costs, Types of overheads, Depreciation. Methods of calculating depreciation fund. Nature of financial management, Time value of Money, Cost of Capital, Operating Leverage, Financial Leverage, Composite Leverage.

Suggested Reading:

1. Pandey I.M., "Elements of Financial Management", Vikas Publ. House, New Delhi, 1994
2. Khanna O.P., "Industrial Engineering and Management", Dhanapat Rai & Sons
3. Everrete E Admaa & Ronald J Ebert, "production and Operations Management", 5thEd , PHI , 2005.
4. S N Chary, "Production and Operations Management", 3rdEd. , TataMcGraw Hill, , 2006
5. Pannerselvam, "production and Operations Management", Pearson Education, 200

PC751EE

ELECTRICAL SIMULATION LAB

Instruction: 2Hrs per week
CIE: 25 Marks
Credits: 1

Duration of SEE:2 hours
SEE: 50 Marks

Simulation experiments should be conducted in the following areas using MATLAB / Simulink (with DSP Tool Box, Control System Tool Box & Power System Tool Box) PSpice/PSCAD / SABER / EDSA/ MOTORPRO / CASPOC / PSSE.

1. Verification of Network theorems
   a. Thevenin's theorem
   b. Super position theorem
   c. Maximum power transfer theorem.
2. Transient responses of Series RLC, RL and RC circuits with Sine and Step inputs.
3. Series and Parallel resonance.
4. Bode plot, Root-Locus plot and Nyquist plot.
5. Transfer function analysis (i) Time response for Step input (ii) Frequency response for Sinusoidal input.
6. Design of Lag, Lead and Lag – Lead compensators.
7. Load flow studies.
8. Fault analysis.
9. Transient stability studies.
10. Generation of Basic signals using DSP.
11. Calculation of DFT using different methods.
12. Design of filters (Low pass filter).
13. Chopper fed dc motor drives.
14. VSI /CSI Fed induction motors drives. Doubly fed Induction motor, PWM.
15. Phase Control I Chopper control on DC motor Drives.
16. Control of BLDC motor.

Note: At least ten experiments should be conducted.

With effect from the academic year 2021-2022, UCE&T ,MGU

PC752EE

POWER SYSTEMS LAB

Instruction: 2Hrs per week
CIE: 25 Marks
Credits: 1

Duration of SEE: 2 hours
SEE: 50 Marks

List of Experiments

1. Performance characteristics of 3-phase transmission line model
2. Determination of A B C D parameters of 3-phase transmission line model.
3. IDMT Characteristics of an over current (Electromagnetic)Relay.
4. Differential Protection of 1-phasetransformer.
5. Determination of positive, negative, zero sequence impedances of 3-phasetransformer.
6. Determination of positive, negative, zero sequence impedances of 3-phasealternator.
7. Transient stability analysis using MATLAB Simulink
8. Fault analysis on an un-loaded 3-phasealternator.
9. Load Frequency control of a single Area system using MAT LAB Simulink
10. Load Frequency control of two area system using MAT LAB Simulink
11. Economic load dispatch using power world simulator/software
12. Fault analysis using PSCAD
13. Operating Characteristics of Directional Over Current Relay
14. Characteristics of different relays using relay protection test set.

Note: At least ten experiments should be conducted.

PW751EE

PROJECT STAGE - I

Instruction: 4 Periods per week
CIE: 50 Marks
Credits: 2

Course Objectives:

- To enhance practical and professional skills.
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and team work.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
2. Grouping of students (max 3 in a group) Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

With effect from the academic year 2021-2022, UCE&T, MGU

EE

SUMMER INTERNSHIP

struction: 6 weeks
E: 50 marks
edits: 0

ourse Objectives:

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

ourse Outcomes: At the end of the course, students will be able to

1. Design/develop a small and simple product in hardware or software.
2. Complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
3. Learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
4. Implement the selected solution and document the same.
5. Able to write a technical report and present it to appropriate audience

Summer Internship is introduced as part of the curricula for encouraging students to work on roblems of interest to industries. A batch of two or three students will be attached to a person from n Electronics Industry / R & D Organization / National Laboratory for a period of 8 weeks. This will e during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the industry guide. After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department.

Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co - ordinate the overall activity of Summer Internship. *Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester

With effect from the academic year 2021-2022, UCE&T, MGU

SCHEME OF INSTRUCTION AND EXAMINATION

B.TECH (Electrical & Electronics Engineering)

AICTE Model Curriculum

(Applicable to the batch admitted from the Academic year 2018-19 and onwards)

VIII - SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction			Contact Hours / Week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
Theory									
1.	**Professional Elective– IV**		3	-	-	3	30	70	3
	PE741EE	High Voltage DC Transmission							
	PE742EE	High Voltage Engineering							
	PE743EE	Smart Electric Grid							
2.	**Professional Elective– V**		3	-	-	3	30	70	3
	PE854EE	Electric Drives and Static Control							
	PE855EE	Control Systems Design							
	PE856EE	Energy Management Systems							
Practical									
1.	PW851EE	Project Work – II / Industrial Internship	-	-	12	12	50	100	6
			6		**12**	**18**	**110**	**240**	**12**

'E741EE

HIGH VOLTAGE DC TRANSMISSION

(Professional Elective-IV)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

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

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

UNIT – I

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 harmonics Filters: Types of AC filters, Design of Single tuned filters –Design of High pass filters.

Suggested Reading:

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, 3 rd Edition 1999.

3. "Jos Arrillaga", HVDC Transmission, The institution of electrical engineers, IEE power & energy series 29, 2nd edition 1998.

4. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1, 1971. 3. "E. Uhlmann", Power Transmission by Direct Current, B. S. Publications, 20092. "E. W. Kimbark", Direct Current Transmission, John Wiley and Sons, volume 1,

PE742EE

HIGH VOLTAGE ENGINEERING

(Professional Elective-IV)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

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

1. Acquire knowledge on, basics of high voltage engineering
2. understand break-down phenomenon in different types of dielectrics
3. understand generation and measurement of high voltages and currents
4. understand the phenomenon of over-voltages, concept of insulation co-ordination
5. know testing of various materials and electrical apparatus used in high voltage engineering

UNIT – I

Introduction To High Voltage Technology And Applications: Electric Field Stresses, Gas Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Estimation and Control of Electric Stress, Numerical methods for electric field computation, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT – II

Break Down In Gaseous And Liquid Dielectrics: Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law - Liquid as insulator, pure and commercial liquids - breakdown in pure and commercial liquids. Break Down In Solid Dielectrics: Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice

UNIT – III

Generation of High Voltages And Currents: Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators. Measurement Of High Voltages And Currents: Measurement of High Direct Current voltages, Measurement of High Voltages

alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT – IV

Non-Destructive Testing of Material and Electrical Apparatus: Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements. High Voltage Testing of Electrical Apparatus: Testing of Insulators and bushings, Testing of Isolators and circuit breakers, testing of cables, Testing of Transformers, Testing of Surge Arresters, and Radio Interference measurements.

UNIT – V

Over Voltage Phenomenon and Insulation Co-Ordination: Natural causes for over voltages,Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Suggested Reading:

1. M. S. Naidu and V. Kamaraju, High Voltage Engineering by– TMH Publications, 4th Edition 2009. 2. E. Kuffel, W. S. Zaengl, J. Kuffel, High Voltage Engineering: Fundamentals by Elsevier, 2nd Edition 2000.

3. C. L. Wadhwa, High Voltage Engineering by, New Age Internationals (P) Limited, 1997.

4. Ravindra Arora, Wolfgang Mosch, High Voltage Insulation Engineering by, New Age International (P) Limited, 1995.

5. "Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy and Roshdy Radwan", High Voltage Engineering, Theory and Practice, CRC Press, 2nd Edition 2000.

With effect from the academic year 2021-2022, UCE&T, MGU

PE743EE

SMART ELECTRIC GRID

(Professional Elective-IV)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

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: Upon the completion of the subject, the student will be able to

1. Recite the structure of an electricity market in either regulated or deregulated market conditions.
2. Understand the advantages of DC distribution and developing technologies in distribution3
3. Discriminate the trade-off between economics and reliability of an electric power system, differentiate various investment options (e.g. generation capacities, transmission, renewable, demand-side resources, etc) in electricity markets
4. Analyze the development of smart and intelligent domestic systems.

UNIT – I

Introduction: Introduction to smart grid- Electricity Network-Local energy networksElectric transportation- Low carbon central generation-Attributes of the smart grid- Alternate views of a smart grid. Smart Grid to Evolve a Perfect Power System: Introduction- Overview of the perfect power system configurations- Device level power system- Building integrated power systems- Distributed power systems- Fully integrated power system-Nodes of innovation.

UNIT – II

DC Distribution and Smart Grid: AC vs DC sources,Benefits of and drives of DC power delivery systems,Powering equipment and appliances with DC-Data centers and information technology loads-Future Neighbourhood-Potential future work and research. Intelligrid Architecture for the Smart grid: Introduction- Launching intelligrid- Intelligrid today- Smart grid vision based on the intelligrid architecture-Barriers and enabling technologies. SCADA, synchro phasors (WAMS)

NIT – III

ynamic Energy Systems Concept: Smart energy efficient end use devices-Smart distributed ergy resources-Advanced whole building control systems- Integrated communications chitecture-Energy management-Role of technology in demand responseCurrent limitations to namic energy management-Distributed energy resources-Overview of a dynamic energy anagement-Key characteristics of smart devices- Key characteristics of advanced whole ilding control systems-Key characteristics of dynamic energy management system.

NIT – IV

nergy Port As Part Of The Smart Grid: Concept of energy -Port, generic features of the ergy port. Policies and Programs to Encourage End – Use Energy Efficiency: Policies and ograms in action -multinational - national-state-city and corporate levels. Market nplementation: Framework-factors influencing customer acceptance and response - program lanning-monitoring and evaluation.

JNIT – V

Efficient Electric End – Use Technology Alternatives: Existing technologies – lighting - pace conditioning - Indoor air quality - Domestic water heating - hyper efficient appliances - Ductless residential heat pumps and air conditioners - Variable refrigerant flow air conditioning- Heat pump water heating - Hyper efficient residential appliances - Data center energy efficiency- LED street and area lighting - Industrial motors and drives - Equipment retrofit and replacement Process heating - Cogeneration, Thermal energy storage - Industrial energy management rograms - Manufacturing process-Electro-technologies, Residential, Commercial and industrial ectors.

Suggested Reading:

1. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.

2. Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grids", Wiley-ISTE, IEEE Press, May 2012.

3. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong. Wu, Akihiko Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

4. James Momoh, "Smart Grid: Fundamentals of Design and Analysis"-Wiley, IEEE Press, 2012. R16 B.T

ELECTRIC DRIVES AND STATIC CONTROL

(Professional Elective- V)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand the concepts and classification of motor-load combination.
- To study the concepts and characteristics of starting and braking methods of DC & AC motors.
- To study the static control methods of DC motor and four quadrant operations by dua converters
- To study the speed control, variable frequency control of induction motor and slip power recovery schemes.
- To study the various modes of Self-controlled and separately controlled synchronous motor drives

Course Outcomes: After completion of this course, the students shall be able to:

1. Understand the concepts of electrical drives and analyze the motor-load combination.
2. Analyze the starting and braking techniques of DC and AC motors.
3. Design the drive circuits for single phase and three phase, controlled rectifier fed DC motor drives.
4. Implement speed control for Induction motors using variable frequency sources and slip power recovery schemes.
5. Analyze the various modes of variable frequency control, linear induction motor and Permanent Magnet Synchronous Motor drives.

UNIT-I

Electric Drives: Concept and classification Dynamics of Electrical Drives: Types of loads, Torque characteristics of load. Characteristics of Motor-Load combination, Dynamics of Motor Load combination. Steady-State and Transient stability of Electric Drive. Characteristics of Electric Drives: Modified Speed-Torque characteristics of D.C. Shunt motors, D.C series motors and Induction motors.

UNIT II

Starting of Electric Motors: Methods of Starting Electric Motors, Acceleration time, Energy relations during starting, D. C Shunt & Series motors and Induction motors, Methods to reduce the energy loss duringstarting.

Electric Braking: Types of Braking, Braking of D.C and A.C motors, Energy relation and Dynamics of Braking. Rating of Motors: Heating effects, Load conditions and classes of duty, Determination of power rating. Effect of load inertia and load equalization.

UNIT III

D.C Motor Control: Single-phase controlled rectifier and Chopper circuit arrangement for Continuous armature current operation. Dual converter control, circulating current and Non-Circulating current modes of operation, Principles of closed loop control for D.C drives.

UNIT IV

Induction Motor Control: Speed control of 3 phase Induction motor with A.C voltage regulators, Voltage sources inverters and Cyclo - converters, Static rotor resistance control, Slip power recovery schemes: Static Krammer drive and Scherbius drive, Variable frequency drives.

UNIT V

Synchronous Motor Control: Self-controlled and separately controlled synchronous motors, linear induction motors, Permanent magnet synchronous motor drives and Applications.

Suggested Reading:

1. S.K. Pillai, A First Course in Electrical Drives, New Age International (P) Limited, Publishers, 2000.
2. G.K.Dubey, Power Semi-Converter Controlled Drives, Prentice Hall, Eaglewood, liffs, 1989.
3. M.D.Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill Publishing Company Ltd., 2000.
4. Bimal. K. Bose, Modern Power Electronics and AC Drives, Pearson Education Asia, 2002.

55EE

CONTROL SYSTEMS DESIGN

(Professional Elective- V)

struction: 3Hrs per week
E: 30 Marks
redits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

urse Objectives

- Illustrating the steps involved in the design problem
- Need to design a controller is discussed. Explaining the time domain and frequency domain specifications and their physical relevance
- Design problems are solved in both time domain and frequency domain.
- Design PID controller and their effect on system performance.
- Design in state space: pole placement design and design of state observer.

ourse Outcomes: After completion of this course, the students shall be able to:

1. Define a design problem and formulate different steps involved.
2. Understand the time domain and frequency domain specification and their physical relevance
3. Design lead, lag and lead-lag compensators in both time domain and frequency domain
4. Design PID controller for specific problem.
5. Design pole placement through state feedback and state observers.

JNIT-I

Design Specifications: Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.

UNIT-II

Design of Classical Control System in the time domain: Introduction to compensator. Design of Lag, lead lag-lead compensator in time domain. Feedback and Feed forward compensator design. Feedback compensation. Realization of compensators.

UNIT-III

Design of Classical Control System in frequency domain: Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.

UNIT-IV

Design of PID Controllers: Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.

UNIT-V

Control System Design in State Space: Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback. Ackerman's Formula for feedback gain design. Design of Observer. Reduced order observer. Separation Principle. Various types of non-linearities. Effect of various non-linearities on system performance. Singular points. Phase plot analysis.

Suggested Reading:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
4. Karl Johan Astrom and T. Hagglund, "Automatic Tuning of PID Controllers", Instrument Society of America 2nd Edition, 1995.

856EE

ENERGY MANAGEMENT SYSTEMS

(Professional Elective- V)

Instruction: 3Hrs per week
CIE: 30 Marks
Credits: 3

Duration of SEE: 3 hours
SEE: 70 Marks

Course Objectives

- To understand the functions of energy management systems.
- To understand the intricacies of power generation scheduling.
- To understand the components, requirements and applications of SCADA.
- To acquire knowledge about functioning of SCADA.
- To study about communication requirements of SCADA.

Course Outcomes: After completion of this course, the students shall be able to:

1. Outline energy management systems and unit commitment and its solution techniques.
2. Discuss power generation scheduling with limited energy.
3. Describe the architecture, functions and applications of supervisory control and data acquisition (SCADA).
4. Apply SCADA in power system automation and communications.
5. Understand SCADA communication requirements and protocols.

UNIT-I

Introduction to Energy Management Systems: Energy management centers: Energy management centers and their functions, architectures, recent developments, characteristics of power generating units and economic dispatch, unit commitment (spinning reserve, thermal, hydro and fuel constraints), solution techniques of unit commitment.

UNIT-II

Power Generation Scheduling: Generation scheduling: Generation scheduling with limited energy, energy production cost models, budgeting and planning, practical considerations, interchange evaluation for regional operations, types of interchanges, exchange costing techniques.

UNIT-III

Introduction to SCADA: Supervisory control and data acquisition - Introduction to supervisory control and data acquisition, SCADA functional requirements and components. SCADA Application: General features, functions and applications, benefits of SCADA, architectures of SCADA, applications of SCADA.

INIT-IV

Configurations of SCADA: SCADA and power systems: Configurations of SCADA, RTU (remote terminal units) connections, power systems SCADA and SCADA in power system automation.

UNIT-V

SCADA Communication: SCADA communication requirements, SCADA communication protocols: past present and future, structure of a SCADA communications protocol.

Suggested Reading:

1. Handschin E, Energy Management Systemsl, Springer Verlag, 1st Edition, 1990.
2. Handschin E, Real Time Control of Electric Power Systems, Elsevier, 1st Edition, 1972.
3. John D Mc Donald, Electric Power Substation Engineering, CRC press, 1stEdition, 2001.
4. Wood, A J and Wollenberg, B F, Power Generation Operation and Control, John Wiley and Sons, 2ndEdition 2003.
5. Green, J N Wilson, R, Control and Automation of Electric Power Distribution Systems, Taylor and Francis, 1stEdition, 2007.
6. Turner, W C, Energy Management Handbook, Fairmont Pres, 5thEdition, 2004.

351EE

PROJECT WORK– II / INDUSTRIAL INTERNSHIP

uction: 12 Periods per week *SEE: 100 Marks*
50 Marks
lits: 6

urse Objectives

- To enhance practical and professional skills
- To familiarize tools and techniques of systematic Literature survey and documentation.
- To expose the students to industry practices and teamwork.
- To encourage students to work with innovative and entrepreneurial ideas.

Course Outcomes: After completion of this course, the students shall be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Effectively plan a project and confidently perform all aspects of project management.
4. Demonstrate effective written and oral communication skills.

The aim of project stage –II is to implement and evaluate the proposal made as part of project tage - II. Students can also be encouraged to do full time industrial internship as part of roject stage -II based on the common guidelines for all the departments. The students placed n internships need to write the new proposal in consultation with industry coordinator and roject guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project work-I

2. Re-Allotment of internship students to project guides Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII-Semester so that

students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.