Solapur University, Solapur
Electrical Engineering
SE Part-I

ENGINEERING MATHEMATICS-III

Teaching Scheme	Examination Scheme
Lectures: 3 hrs / week	Theory: 100 marks
Tutorials: 1 hr/Week	Term Work: 25 marks

SECTION – I

Unit 1 : Linear Differential Equations [5hrs]
Linear Differential equations with constant coefficients (without method of variation of parameters)

Unit 2 : Homogeneous Linear Differential Equations [5 hrs]
Legendre's Linear equations, Electrical Engg. Applications

Unit 3: Partial Differential Equations [5 hrs]
Four standard forms of Partial Differential equations of first order Solution of partial differential equations by method of separation of variables.

Unit 4: Laplace Transform: [5 hrs]
Definition, Transform of standard function, Properties, Transform of derivative and integral Inverse Laplace Transform, Convolution Theorem, Applications to solve linear Differential Equations with constant Coefficients.

SECTION-II

Unit 5: Fourier series: [5hrs]
Definition, Euler's formula, Expansions of function, Change of interval, even and odd functions, half range Fourier series.

Unit 6: Fourier Transform: [5hrs]
Fourier integral, Fourier sine and cosine integral, Complex form of Fourier integral, Fourier Transform, Fourier sine and cosine transform and Inverse transform.

Unit 7: Z-Transform: [5hrs]
Z-Transform of elementary Functions, Properties of Z-Transform and Inverse Z-Transform

Unit 8: Vector Calculus: [5hrs]
Differentiation of vectors, tangent line to the curve, velocity and acceleration, Gradient, Divergence and Curl of vector field, Solenoid, irrotational and conservative vector field,

Textbooks:

1. A textbook of Applied Mathematics Vol. I and Vol. II by J.N. and P.N. Wartikar – Vidyarthi Grah Prakashan, Pune
2. Higher Engineering Mathematics by B.S.Grewal – Khanna Publications, Delhi.
3. Advanced Engineering Mathematics by Jaggi and Mathur-Dhapatrai and Sons, Bhopal.
4. A textbook of Applied Mathematics by N.P. Bali, Ashok Saxena and N.Ch. S.N. Iyengar – Laxmi Publications , Delhi.
5. Advanced Engineering Mathematics by Kreyzig-John Wiley & SMS,Newyork.

Solapur University, Solapur
Electrical Engineering
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ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs / week	Theory: 100 marks
Practical: 2 hrs / week	Term Work: 25 marks
	POE: 25 marks

Section - I

Unit 1 : PN Junction Diode: [3 hrs]

Diode characteristics (using Diode Equation), Effect of Temperature, AC & DC Load Line, Junction Capacitance, Ratings of Diode.

Unit 2 : PN Junction diode as Rectifier: [3 hrs]

Half wave, Full wave and Bridge Rectifier (detailed analysis includes various parameters- $I_{o\ (rms)}$, $V_{o\ (rms)}$, $I_{o\ (avg)}$, $V_{o\ (avg)}$, Ripple Factor, Efficiency, TUF, PIV), Introduction to three phase rectifiers.

Unit 3 : Special Purpose Diodes : [5 hrs]

Zener diode Characteristics, Working, Application as Voltage Regulator, Rating of Zener Diode, Design of zener voltage regulator. Construction, characteristics and applications of Tunnel Diode, Schottkey diode, Photo diode, LED.

Unit 4 : Filter: [4 hrs]

Capacitance, Inductance, LC & π Filter (Analysis includes derivation for Ripple Factor & their comparison)

Unit 5 : Design of Unregulated Power Supply : [5 hrs]

Using Rectifier & Filter (design includes selection of Transformer, Diode & Respected Filter Component), Design of Regulated power supply using three terminal IC voltage regulators 78XX and 79XX, adjustable voltage regulator IC 317 and 337

Section - II

Unit 6 : Bipolar Junction Transistor: [7 hrs]

I/O Characteristics, Current Components, Early Effect, Ac & Dc Load Line, and Ratings of Transistors.

Biasing of Transistors: Thermal Runaway, Biasing – Fixed, Collector To Base & Self Biasing, Compensation Techniques.

Hybrid Model of BJT: AC equivalent Circuit of BJT using h – parameter, Determination of Amplifier Parameters (A_v, A_i, R_i, R_o), determination of H parameters from BJT input and output characteristics.

Application of BJT as a Switch & an Amplifier

Unit 7 : Transistor Amplifier Frequency Response: [2 hrs]

Effect of C_c & C_e on Low frequency Response, Effect of Junction Capacitance at High Frequency

Unit 8 : Design of Driver Circuit using Transistors: [3 hrs]
Design of Single Stage Amplifier using BJT (CE, CE with R_e & C_e)

Unit 9 : Power Amplifiers: [5 hrs]

Classification of large signal amplifiers, circuit operation, waveforms and derivation of efficiency for Class A, Class B and Class AB amplifier

Crossover distortion and Harmonic distortion in power amplifiers

Unit 10 : Sinusoidal oscillators: [3 hrs]
Basic principle, types of oscillators, RC oscillators – phase shift and wien bridge oscillators, LC oscillators – Colpitts, Hartley and crystal oscillator

Note: - For selection of components in design Data Sheet should be referred.

Termwork:
The laboratory consists of any 8 experiments as given in following list.

1. Application of a diode as full wave rectifier & its analysis.
2. Performance parameters of filter.
3. V-I Characteristics of zener diode & its application as regulator.
4. Design & implementation of Un-regulated power supply using FWR & Capacitor Filter.
5. Voltage regulator using 78XX or 79XX.
6. Adjustable voltage regulators using LM317 or LM337.
7. Input & Output Characteristics of CB configuration.
8. Input & Output Characteristics of CE configuration.
9. Frequency response of single stage CE amplifier.
10. Design and implementation of relay driver circuit.
11. Performance of Power amplifier.
12. RC oscillator

Text-Books:-
1. Electronic Devices and Integrated Circuits by B P Singh, Rekha Singh, Pearson Education
2. Electronic Devices and Circuits by S Salivahanan, N Suresh Kumar, A Vallavrg, Tata McGraw Hill, 2nd Edition.
3. Electronic Devices and Circuits by Allen Mottershed, PHI Publication
4. Electronic Devices by Floyd, Pearson Education
5. Principle of Electronic Devices and Circuits (Analog & Digital), by B L Thereja, R S Sedha, S Chand.

References: -
1. Electronic Devices & Circuit Theory by Boylestad, Pearson Education
2. Electronic Design by Martin Roden, Shroff Publication
from Concept to Reality

Solapur University, Solapur
Electrical Engineering
SE Part-I

ELECTRICAL MACHINES-I

Teaching Scheme	Examination Scheme	
Lectures: 4 hrs/week	Theory:	100 marks
Practical: 2 hrs/week	Term Work:	25 marks
	POE:	50 marks

Section -I

Unit 1: Electromechanical Energy Conversion Principles: [7 hrs]
Forces and torques in magnetic field systems Energy balance, Energy in Singly-Excited magnetic field systems, Determination of magnetic force and torque from energy, Determination of magnetic force and torque from co-energy, Multiply-Excited magnetic field systems, Forces and torques in systems with permanent magnets, Energy Conversion via electrical field, Electric field energy, Dynamic equations of electromechanical systems and Analytical Techniques.

Unit 2: DC Generators: [8 hrs]

Construction of armature and field systems, Basic Principle of working, emf equation, Types of Armature windings, Characteristics and applications of different types of DC Generators, Building of emf in DC Shunt Generator and causes of failure, Armature reaction-Demagnetizing and Cross magnetizing mmfs and their estimations; Remedies to overcome the armature reaction; Commutation Process, Straight line commutation, Commutation with variable current density, under and over commutation, Causes of bad commutation and remedies; inter poles, Compensating windings.

Unit 3: D.C. Motors: [8 hrs]
Principles of working, Significance of Back emf, Torque Equation, Types, methods of excitation-Steady State Motor Circuit equation, Characteristics and Selection of DC Motors for various applications, Starting of DC Motors, Speed Control of DC Shunt and Series Motors, Braking of DC Motors- Plugging, Dynamic Braking, Regenerative Braking; Losses and Efficiency, Condition for Maximum Efficiency, Effect of saturation and armature reaction on losses; Permanent Magnet DC Motors, Type and Routine tests according to ISI Specifications.

Section-II

Unit 4: Variable-Reluctance Machines And Stepping Motors: [5 hrs]
Basic VRM Analysis, Practical VRM analysis, Current waveform for torque production, Non-Linear Analysis, Stepping Motors.

Unit 5: Single Phase Transformer: [8hrs]

Transformer construction and practical consideration, Transformer reactance's and equivalent circuits, Engineering aspects of transformer analysis, effect of load on power factor, pharos diagrams, per unit quantities, Excitation phenomenon in transformers-Switching transients, Testing-Polarity test, Open Circuit Test (O.C.), Short Circuit Test (S.C.), Sumpner's Test, Auto-Transformer.

Unit 6: Three Phase Transformers: [9 hrs]

Special constructional features, three phase transformers connections, Labeling of transformers terminals, Star/Star connection, Delta/Delta Connection, Star/Delta, Delta/Star connection, Delta/Zigzag Star, Star/Zigzag Star, Phase groups, Choice of transformers connections, Harmonics, Parallel operation of transformers, Three winding transformers and its equivalent circuits, Open Delta connection, Three/Two phase conversion (Scott connection), Three/One conversion, On-Off Load Tap changing transformers, cooling methodology, Types and Routine tests according to ISS-2026.

TEXT BOOKS:

- I J Nagrath, D P Kothari; " Electric Machines," Tata McGraw Hill Publication. Third Edition (Reprint) 2003.
- A.E.Fitzgerald, C.Kingsley, S.D.Umans. "Electrical Machinery" Tata McGraw Hill. Sixth Edition 2002.
- Electrical Machines-I by K Krishna Reddy, Scietech.
- Electrical Machines-II by K Krishna Reddy, Scietech

REFERENCE BOOKS:

- Nasser Syed, A "Electrical Machines and Transformers,"New York, Macmillon 1984.
- Langsdorf "DC Machines".
- E.W.Clayton "Design and performance of DC Machines".

The laboratory consists of any 8 experiments (4 each) from D.C Machine and Transformer as given in following list.

LIST OF EXPERIMENTS:

D.C. MACHINES:

1. Determination of magnetization, external and internal characteristics of a D.C. shunt generator.
2. Speed variation of a D.C. Shunt machine by- (i) armature voltage control & (ii) field current control method.
3. To study the performances of a D.C. shunt motor by Load/ Brake test.

4. To find efficiency of a D.C. shunt / compound machine by performing Swinburn's test.
5. To separate the losses in a D.C. shunt machines by performing the Retardation test.
6. Field test on two identical series machines to separate various losses and determine the efficiency of machines.
7. Hopkinsons Test.
8. Study of traditional and modern starters for DC motors

TRANSFORMERS:

1. To perform open circuit and short circuit test on single phase transformer to find its core loss, full load copper loss and constants of its equivalent circuit.
2. To operate two single-phase transformers in parallel and how they share a load under various conditions of their voltage ratios and leakage impedances.
3. To study V-connection of identical single-phase transformers for obtaining three phase transformation.
4. To study Scott-connection of single-phase transformer.
5. Sumpner's Test.
6. Study of no load current waveform of single-phase transformer.

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DATA STRUCTURE

Teaching Scheme	Examination Scheme	
Lectures: 3 hrs/week	**Theory:**	**100 marks**
Practical: 2 hrs/week	**Term Work:**	**25 marks**
Tutorials: 1 hr/Week	**POE:**	**25 marks**

Section - I

Unit 1 : Advance concepts in 'C' **[10 hrs]**
Multidimensional arrays, Bitwise operators, logical operators, Type conversion & storage classes, Structures & union, Pointers, Functions (types of function), 'C' Preprocessors, File handling in 'C'

Unit 2 : Introduction to data structure **[4 hrs]**
Information & meaning ,Abstract data type, Data types and C ,Data structures and C, Array as an ADT ,C Structure as an ADT.

Unit 3 : Stack **[6 hrs]**
Definition and Examples, Representing Stack in C, in fix, post fix, prefix (evaluation & Conversion).

Section - II

Unit 4 : Recursion **[4 hrs]**
Recursion definition & Process, Recursion in C, Recursive Programs Translation of Prefix to postfix using recursion ,Simulating recursion (Simulation of Factorial), Efficiency of recursion

Unit 5 :- Queue and lists:- **[8 hrs]**
Queue:- queue and its sequential representation, the priority queue.
Linked list:-linked list as data structure, Array implementation in list, Limitation of array implementation Allocating and freeing dynamic variables, Linked list and queue using dynamic variable, Comparison of dynamic and array implementation of list, other list structure -circular list, doubly linked list, circular doubly linked list.

Unit 6 :- Searching, Sorting, Hashing **[8 hrs]**
Types of Search – Sequential and Binary Search
Sort – Insertion sort, Merge fort, Bouble Sort, Quick Sort.
Hashing – Hash functions, open hashing closed hashing.

Text books:

1. Data structure using C by Tanenboum
2. C Programming by Kerninghan & Ritchie
3. Introduction to Data Structure in C by Ashok Kamthane, Pearson Education
4, Data Structure through C in depth by S K Shrivastav, Rupali Shrivastav, CPB Publication.

LIST OF EXPERIMENTS:

Laboratory will consists of any 12 Programs elaborating the Advance C and Data structure Concepts learned in above 6 Units.

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PULSE AND DIGITAL CIRCUITS

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/week	**Theory: 100 marks**
Practical: 2 hr/week	**Term Work: 25 marks**

Section – I

Unit 1 : Wave Shaping Circuits: **[4 hrs]**
RC Integrator & Differentiator, Diode clipper circuits, Diode Clamping circuits, Transistor clippers & Transistors clamper.
Switching characteristics of diode and transistor

Unit 2 : Multivibrators: **[5 hrs]**
Monostable, Astable and Bitable Multivibrators using BJT with wave forms and triggering schemes, Schmitt trigger

Unit 3 : Combinational Logic Circuits : **[5 hrs]**
Minimization techniques using K-Map, Half-Adder, Full-Adder and Subtractor

Unit 4 : Coding and Decoding: **[3 hrs]**
Encoders, Decoders, Error detecting and correcting codes, Multiplexing, Demultiplexing

Unit 5 : Logic Gate: **[3 hrs]**
DTL, TTL, ECL, CMOS gates, Noise immunity: Fan-in, Fan-out and other characteristics, Different IC family and their companion.

Section - II

Unit 6 : Flip-Flops: **[5 hrs]**
SR JK Master Slave D Type T type using NOR and NAND gates Different flip-flop IC conversion of flip-flop.

Unit 7 : Counters : **[5 hrs]**
Design of synchronous and Asynchronous counters, Up down divide by N counters decade counters different counter IC

Unit 8 : Shift Registers: **[4 hrs]**
Right shift, Left Shift Bi-directional Universal Shift Registers.

Unit 9 : Memories: **[4 Hrs]**
RAM, ROM, PROM, EPROM and PLA, Flash EPROM, Serial EPROM.

Unit 10 : Displays : **[2 Hrs]**

LED, LCD, seven segment and alphanumeric displays.

TEXT BOOKS:

1. Modern Digital Electronics by R P Jain, Tata McGraw Hill, 3rd Edition
2. Digital Electronics by Gothman
3. Pulse and Digital Circuits by G K Mittal
4. Digital Electronics by P Raja, Scietech

REFERENCE BOOKS:

1. Pulse Digital & Switching Waveform, By Mlliinum & Laub
2. Electronic Devices and Circuits, By Millman & Halkies

Term Work:
The laboratory consists of any 8 experiments as given in following list.

LIST OF EXPERIMENTS:

1. R C Low pass & High pass circuits.
2. Clipper & Clamper circuit.
3. Design of Astable Multivibrator.
4. Design of Bistable Multivibrator.
5. Operation of basic gates & half adder & Full adder using gates.
6. Design of code converter circuits.
   i) Binary to Gray and vice-versa.
   ii) BCD to excess–3 and vice–versa
7. Design of circuit using Multiplexer Demultiplexer
8. Study of S-R, J-K, T and D flip-flops.
9. Design of Synchronous counter using flip-flop.
10. Design of Asynchronous counter using flip- flop and counter.
11. Variation of ALU operation using 74181.

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Introduction with package MATLAB

Teaching Scheme **Examination Scheme**
Lectures: 2 hrs/week
Practical: 2 hrs/week **Term Work: 25 marks**

SECTION-1

Unit 1 : Introduction to MATLAB basics [5 Hrs]

The MATLAB environment, variables and arrays, initializing variables, multidimensional arrays, sub arrays, special values, displaying output data, data files, scalar and array operations, hierarchy of operations, built in MATLAB function, Introduction to plotting, debugging MATLAB programs.

Unit 2 : Branching Statements & Program Design [4 hrs]

Introduction to top down design techniques, use of pseudocode, the logical data type branches, additional plotting features

Unit 3 : Loops [4 hrs]

While loop, for loop, logical arrays & vectorization

SECTION II

Unit 4 : User Defined Functions [4 hrs]

Introduction to MATLAB functions, variable passing in MATLAB : the pass by value scheme, optional arguments, sharing data using global memory, preserving data between calls to a function, function functions, sub-functions, private functions and nested function.

Unit 5 : Additional Data Types [4 hrs]

Complex data, sting operations, multidimensional arrays, additional data types, additional two dimensional plots, three dimensional plots,

Unit 6 : Handle Graphics & Graphical User Interface [4 hrs]

The MATLAB graphics system, object handles, Examining and changing object properties, Using set to list Possible Property values, User defined data, finding objects, selecting objects with the mouse, position & units, graphic object property, how a graphical interface works, creating & displaying a graphical user interface.

Reference books –

1. MATLAB Programming for Engineers by Stephan J Chapman, Thomson Publication.
2. Matlab & its Application in Engineering by Rajkumar Bansal, Ashok Kumar Goyal, Manojkumar Sharma, Pearson Education, Version 7.5
3. Matlab & Simulink by Partha, S Mallick, Scietech, 2nd Edition

Term work (Minimum 10 Experiments).

Experiments based on MATLAB covering above syllabus.

Solapur University, Solapur
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Linear Algebra

Teaching Scheme
Lectures: 3 hrs/week
Tutorials: 1 hr/Week

Examination Scheme
Theory: 100 marks
Term Work: 25 marks

Section -I

Unit 1: Linear Equations & Matrix Theory. [6 hrs]

Echelon forms, vector equations, the matrix equations Ax = b and Ax = 0, linear independence, linear transformations, applications of linear models, characterization of invertible matrices, partitioned matrices, matrix factorization.

Unit 2: Vector spaces [6 hrs]

Vector spaces and subspaces, null spaces, column spaces and linear transformations, linearly independent sets and bases, co ordinate systems, the dimension of a vector space, rank, change of bases, applications to difference equations.

Unit 3: Eigen values and Eigen vectors. [6 hrs]

Eigen values and Eigen vectors, the characteristic equation, diagonalization, Eigen vectors and linear transformations, complex eigen values, discrete dynamical systems, application to differential equations, iterative estimates for eigen values.

Section -II

Unit 4: [6 hrs]

Orthogonality, symmetric matrices, and quadratic forms Inner product and orthogonality, orthogonal sets, least square problems, diagonalization of symmetric matrices, quadratic forms.

Unit 5: Complex Variable [6 hrs]

Functions of complex variable, derivative, Analytic function, Cauchy Riemann equations, conformal and bilinear transformations, Cauchy integral formula for derivatives.

Unit 6: Statistics [6 hrs]

Coefficient of correlation & lines of regression of bivariate data

Reference books:

1) David C Lay- Linear Algebra & its applications 3rd Edition 2003 Pearson Education Inc

2) Higher Engineering Mathematics by B S Grewal 39th edition 2005. Khanna Publishers

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SIGNALS AND SYSTEMS

Teaching Scheme
Lectures: 3 hrs/week
Tutorial: 1 hr/week

Examination Scheme
Paper: 100 Marks
T.W.: 25 Marks

Section - I

Unit 1 : Introduction to Signals & Systems: [7hrs]

Definition of signals. Properties of signals: Periodicity, absolute integrability, determinism, stochastic character .Types of signals : continuous time, discrete time , periodic a periodic signals. Some special signals of importance : Unit step ,Unit impulse, Sinusoidal, Complex exponential .Some special time limited signals : Continuous time & discrete time ;continuous & discrete amplitude signals .Energy and power signals. Concept of random signals. Definition of system. System properties: Linearity, additivity, & homogeneity, Shift invariance, stability, realizability. Examples. Continuous time, Discrete time, LTI, LSI in detail: The impulse response, step response, behavior with a periodic convergent input characterization of causality & stability of LSI systems.

Unit 2 : Representation of Signals & Systems: [6hrs]

Time domain Signal representation: The impulse function .Convolution, Properties of Convolution. Convolution of continuous and discrete signals. Input output modeling using convolution integrals and sums; responses to step, impulses and pulses. System representation through differential & difference equation. System realization through block diagram representation, system interconnection. SISO, MIMO Systems. State space representation, State space representation. Solution of state equation, State transition matrix and its role.

Unit 3: **Analysis of Continuous Time System : [7hrs]**

Laplace Transform for continuous time signals and systems. Notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence. System functions, poles and zeros of system functions and signals. Laplace domain analysis, Solution of differential equation& system behavior. Parse Val's Theorem.

Section- II

Unit 4 : Analysis of Discrete Time Signals And Systems : [7hrs]
Eigen function . Region of convergence. Z transform for discrete time signals & systems. System function s. Poles and zeros of the systems and sequences , Z domain analysis. Generalization of Parseval's Theorem .

Unit 5 : Analysis of Signals and Systems in frequency domain : [7hrs]

Notion of frequency response & it's relation to the impulse response. Fourier Transform, Convolution /Multiplication & their effects in frequency domain. Magnitude & phase response. DTFT, DFT, FFT. The idea of signal space and orthogonal base of signals.

Unit 6: Sampling: [6hrs]

Sampling theorem and it's implications. Spectra of sampled signals Reconstruction. Ideal interpolator ZOH, Aliasing and it's effects. Relation between continuous system and discrete time systems. Applications of signals and systems in communication, control system, filtering and so on. Time frequency representation and uncertainty principle, Short time Fourier transform and wavelet transform.

TEXT BOOKS:

- A.V. Oppenheim ,A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,2000
- R.F. Ziemer ,W.H. Tranterand and D.R.Fannin, "Signals and Systems-Continuous and Discrete ",4th Edition , Prentice Hall ,1998.
- Signals and Systems, by P Rameshbabu, Aananda Nagraj, Scietech, 3rd Edition
- An Introduction to Signals and Systems by Jhon Allan Staller, Cengege Learning Publication
- Signals and Systems by H P HSU, Sehaum Outlines, Tata McGraw Hill, 2nd Edition

REFERENCE BOOKS:

- F.J.Taylor , "Principals of signals and systems" , MC Graw Hill ,1994
- M. J. Robert , " Signals and Systems – Analysis using Transform methods and MATLAB" ,Tata Mcgraw HillEdition 2003.
- I.J.Nagarath , S.N. Sharan ,R.Ranjan and S. Kumar, "Signals and Systems" Tata Mcgraw hill publishing Company Ltd., New Delhi, 2001
- B.P. Lathi, "Signal Processing and linear systems", ' Oxford University press,c1998.

Solapur University, Solapur
Electrical Engineering
SE Part-II

BASIC CIRCUIT THEORY

Teaching Scheme
Lectures: 4 hrs/week

Examination Scheme
Theory: 100 Marks
Term Work: 25 Marks

SECTION- I

Unit 1: Network Topology: [6 hrs]

Concept of graph, tree and co-tree, cut set matrices and Kirchhoff's laws to network analysis, Choice between loop and nodal analysis, Concept of super loop and super mesh, Dot convention for coupled circuits, concept of duality and dual networks.

Unit 2: **Solutions of A.C. Network equations and Network theorems: [8 hrs]**

A.C. Circuit Analysis by: Thevenins theorem, Norton's theorem, Superposition theorem. Maximum power transfer theorem, Reciprocity Theorem, Tellengen's Theorem, compensation Theorem. Classical solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, Initial and final conditions in Network Elements, Forced and free response, time constants,

Unit 3:*Network Functions:* **[6 hrs]**

Terminal pairs, Network Functions for one port and two port, Calculations of network functions for ladder and general network, Poles and zeros, Restrictions on pole and zero locations for driving point and transfer functions, Time domain behavior from pole and zero plot, stability of active network, Relationship of two port variables, Z, Y and transmission parameters, Hybrid parameters, parallel connections of two port networks,

SECTION -II

Unit 4: *The Laplace Transformation:* **[7 hrs]**

Definition and properties (basic theory), partial fraction expansion, Heavisides expansion thermo, inverse Laplace transform, Transformed network with initial conditions, Shifted and singularity functions, waveform synthesis, analysis of electrical network with and without initial conditions by Laplace transform for step, impulse and ramp functions.

Unit 5: Sinusoidal Steady State Analysis: [8 hrs]

The Sinusoidal Steady state, Sine function oppositely rotating phasor, Steady state response using phasor, Frequency response plot of electrical network, Parts of a network functions, magnitude and phase plot, complex loci, S plane phasor, power transfer and insertion loss of two port network, Effective or RMS values, Average power and complex power, Problems in optimizing power transfer.

Unit 6: Fourier series: **[5 hrs]**

Fourier series, Evaluations of Fourier Coefficients, Waveform Symmetries as related to Fourier Coefficients, Convergence in Truncated Series, Exponential form of Fourier series.

TEXT BOOKS:

- Network Analysis - M.E.Van Valkenburg Prentice Hall , Third Edition
- Engineering Circuit Analysis - William H. Hayt, Jack E. Kemmerly McGraw Hill International Sixth Edition.
- Network Analysis - C L Wadhawa, New Age International Publication
- A Circuit Analysis - D Roy Choudhary
- Electrical Circuit Analysis - P Rameshbabu, Scietech.

REFERENCE BOOKS:

- Kelkar Pandit, “Linear Network Theory”.
- Kuo F.F , John Wiley “Network Analysis”.
- V.K.Aatre, “Network Theory and Filter design”, Wiley 1980.

Solapur University, Solapur
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ELECTRICAL MACHINES-II

Teaching Scheme
Lectures: 3 hrs/week
Practical: 2 hr/week

Examination Scheme
Theory: 100 marks
Term Work: 25 marks
POE: 50 marks

Section – I

Unit 1: Introduction to A.C. Machines- [6 hrs]
Classification of A.C. Machines, principle of operation, construction details- stator, rotor- salient and non-salient type, rotating field type and rotating armature type. Rotating mmf waves in A.C. Machines, generated voltages. Three phase winding, winding factors, emf equation. Synchronous Machines-circuit model, prime movers for synchronous generators, concept of synchronous reactance and synchronous impedance.

Unit 2: (A) Non- salient pole Synchronous Generators [8 hrs]
Steady state operation of non-salient pole generators, steady state operating and power angle characteristics, excitation required for constant terminal voltage output, equations for power generated and power output, voltage regulation, saturation and it's effects.

(B) Salient pole Synchronous Generator
Armature reaction, effect of saliency, introduction to direct and quadrature axis theory, direct and quadrature axis reactance, their determination by slip test, phasor diagrams and calculation of regulation, losses and efficiency. Synchronous generator on infinite bus bars.

Unit3: Synchronous Motors [6 hrs]
Principle of operation, methods of starting, performance characteristics, phasor diagrams, V and inverted V curves, hunting- its causes and remedies, machine dynamics- sudden load change.

Use of synchronous motor as synchronous condenser.

Section – II

Unit4: Polyphase Induction Motors [7 hrs]
Construction production of rotating magnetic filed, principle of working, slip, torque slip characteristics, maximum torque and maximum power. Relation between starting torque, full load torque and maximum torque. Equivalent circuit. Circle diagram, Determination of performance from circle diagram.

Methods of starting slip ring and squired cage motors. various types of starters, motors with high starting torque. Automatic semi-automatic staters-power and control circuits.
Cogging, crawling and single phase operation, single phasing preventers. Noise production. Speed and power factor control, principals of control, modern methods of speed and power factor control.
Industrial applications of different types of induction motors. Induction voltage regulators, induction generator. Testing induction motors as per I S S.

Unit5: Single phase Induction Motor [7 hrs]

Principle of operation, constructional details, double revolving field theory, equivalent circuit and its parameter determination. Types of single-phase induction motor, their characteristics, typical applications.

Unit 6: Special topics in A.C. Machines [6 hrs]

(A) Starting, braking and speed control of A C Machines.
(B) Excitation systems for synchronous machines.
(C) Parallel operation of Synchronous Generators.

Text Books:

- 'Electric Machinery' by A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans, Tata McGraw Hill Publication, sixth edition 2002.
- 'Electric Machines' by I. J. Nagrath, D. P. Kothari;, Tata McGraw Hill Publication, second edition, reprint 2003.
- Electrical Machines-III by K Krishna Reddy, Scietech.
- Electrical Machines by M V Deshpande

Reference Books:

- 'Performance and design of A.C. Machines' by M.G.Say, E.L.B.S.Publication
- 'Principles of Electric Machines and Power Electronics' by P.C. Sen, John Wiley and Sons Publication, 2nd edition,1997.
- 'Theory of Alternating current Machinery' by A.S. Langsdorf, Tata McGraw Hill Publication, 2nd edition,1981.

The laboratory consists of any 8 experiments from following list.

LIST OF EXPERIMENTS:

1. Study of 3-ph induction Motor
2. Load test on 3-ph induction Motor
3. Study of synchronous Machines
4. Regulation of Alternator by EMF and MMF method.
5. Regulation of Alternator by Zero P.F. Method.
6. Parallel operation of Alternators.
7. Determination of X d and X q by slip test.
8. V-curves on Synchronous motor.
9. Load test on Synchronous motor.

Solapur University, Solapur
Electrical Engineering
SE Part-II

COMPUTER PROGRAMMING C++

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/week	Theory: 100 marks
Practical: 2 hr/week	Term Work: 25 marks

Section - I

Unit 1: Introduction to Object Oriented Programming Concepts and starting with C++: [6 hrs]

Object oriented Programming (OOP) Paradigm, Basic Concepts of OOP, applications of OOP, C++ Programming Basics: Basic Program Construction, Program Statements, Pre-Processor Directives, Integer and Character Variables, Input/Output, Operators, Functions, Loops, Decisions, Logic operators, Simple C++ Programs.

Unit 2: Structures and Functions: [6 hrs]

Structures-Simple Structures, Specifying the Structures, Defining a Structure Variable, Structure Members, Other Structure Features. Functions- Function Declaration and Definition, Calling the Function, Passing arguments to Functions, Returning values from Functions, Arguments-Reference, Default, Overloaded functions, Inline Functions.

Unit 3: Objects and Classes: [7 hrs]

Specifying the Class, C++ Objects as Physical Objects and Data Types, Constructors, Destructors, Overloaded Constructors, Objects as function arguments, Member Functions, Memory allocation objects.

Section – II

Unit 4: Arrays and Operator Overloading: [6 hrs]

Array Fundamentals, Arrays as Class Member Data, Arrays of Objects, Strings, Overloading Unary Operators and Binary Operators, Data Conversion, Rules for Overloading Operators.

Unit 5: Inheritance: [6 hrs]

Derived Class and Base Class, Derived Class Constructors, Class Hierarchies, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance.

Unit 6: Pointers, Virtual Functions: [7 hrs]

Addresses and pointers, Pointers and Arrays, Pointers and Functions, Pointers and Strings, Memory Managements, Pointers to Objects, Pointers to Derived Classes, Pointers to Pointers. Virtual Functions, Friend Functions, Static Functions, Assignment and Copy-Initialization, 'this' Pointers.

TEXT BOOKS:

- E Balguruswamy, “Object Oriented Programming with C++” Tata Mc Graw Hill.
- Robert Lafore, “Object Oriented Programming with Turbo C++” Galgotia Publications.

LIST OF EXPERIMENTS:

Laboratory will consists of any 12 Programs elaborating the Object Oriented Programming Concepts in C++ learned in above 6 Units.

Solapur University, Solapur
Electrical Engineering
SE Part-II

Electrical Measurement

Teaching Scheme:
Lectures: 3 Hours/Week
Practical: 2 Hours/Week

Examination Scheme:
Theory: 100 Marks
POE: 25 Marks
Term Work : 25 Marks

Section- I

Unit 1: Introduction of standards & errors in measurements [4 Hrs]

International standards, primary standards, secondary standards, working standards. Types of errors- gross errors, systematic errors, instrumental errors, environmental errors, observat ional errors, random errors.

Unit 2: Anolag ammeter, voltmeter & ohmmeter [10 Hrs]

Operating forces, types of supports, torque/weight ratio, control systems, damping systems in electromechanical indicating instruments.

Permanent magnet moving coil instruments- torque equation, shunts, multipliers, effect of temperature, multi-range DC ammeter & voltmeter, ratio-meter ohmmeter, megger

Moving iron instrument- torque equation, attraction type, repulsion type, shunt & multiplier, errors.

Electro-dynamometer instrument- operating principle, torque equation, errors, shape of scale, measurement of AC & DC current, voltage & power, three phase wattmeter.

Unit 3: Measurement of energy & industrial metering [4 Hrs]

Single phase induction type watt-hour meter, lag adjustment devices, compensation for friction, creep, overload, overvoltage, temperature. Errors & adjustments. Two element energy meter, industrial metering & tariffs, maximum demand indicator.

Unit 4: Measurement of phase and frequency [4 Hrs]

Single phase & three phase electrodynamometer power factor meter, moving iron power factor meter, electrical resonance type frequency meter, weston type frequency meter, ratio type frequency meter, synchroscope.

Section- II

Unit 5: AC/DC Potentiometers & bridges [7Hrs]

Basic DC potentiometer circuit, laboratory type (crompton's) potentiometer, volt ratio box, applications. AC potentiometer, standardizing of AC potentiometer, Drysdale, Gall-Tinsley potentiometers, applications. DC bridges- Weatstones, Kelvin's double bridge.AC bridges- Maxwell's, Hay's, Andernson's bridges for inductance measurement, De-sauty, Schering bridges for capacitance measurement.

Unit 6: Cathode Ray Oscilloscope [3 Hrs]

Introduction, Cathode ray tube, screens for CRO, time base generator, signal synchronization, time, frequency, phase angle, measurement using CRO.

Unit 7: Electronic instruments [4 Hrs]

Digital voltmeter, digital multimeter, electronic counter, digital measurement of frequency.

Unit 8: Instrument Transformer [4 Hrs]

Introduction, use, current transformer & potential transformer - operation, errors, reduction of errors, testing,

Text-books:

1. Electrical & Electronic Measurement by A. K. Sawhney ,Dhanpat Rai & Co Reprint 2007 (Seventeenth edition)
2. Electronic Instrumentation by H. S. Kalsi ,Tata Mc Groaw Hill ,Second edition
3. Electrical & Electronic Measurement & Instrumentation by R K Rajput, S Chand.

Reference Books:

1. Modern Electronic Instrumentation & Measurement Techniques by Albert D. Helfrick, William D. Cooper, Pearson Education, Second impression 2007.

2. Electrical Measurement & Measuring Instruments by E. W. Golding, Wheeler publishing
F. C. Widdis Fifth

List of Experiments:-

The term work shall consist of minimum eight experiments from the following -

1. Study of PMMC & Moving Iron instruments.
2. Kelvin's double bridge for measurement of low resistance.
3. Wheatstone's bridge for measurement of resistance.
4. Maxwell's bridge for measurement of inductance.
5. Measurement of capacitance using Schering Bridge.
6. Calibration of single and three phase energy meters.
7. Measurement of power in 3-phase circuit by 2-wattmeter method.
8. C T and P T testing.
9. Testing of transformer oil as per I S
10. To measure the insulation resistance by Megger
11. To measure the power factor of single phase and three phase load by PF meter and verifying through current, voltage and power measurement.

Solapur University, Solapur
Electrical Engineering
SE Part-II

Familiarization with advanced packages of MATLAB(Simulation)

Teaching Scheme **Examination Scheme**
Lectures: 1hrs/week
Practical: 2 hr/week **Term Work: 25 marks**

Section –I

Unit – I **(2 hrs)**
Introduction to simulation , Importance of simulation in Electrical Engineering, Understading the various toolboxes and blocksets. Creating a Model file.

Unit – II **(5 hrs)**
Introduction to simulink toolbox: continuous, discrete, logic and bit operation, lookup tables, Math operation, Model verification, Port and subsystem, signal attributes, signal routing, sinks, sources.

Section –II

Unit – III **(2 hrs)**

Study and understanding of every blockset of simpower: electrical sources, elements, Machines, Measurment, phasor elements.

Unit-IV **(5 hrs)**
Creating a model file using Machine blockset of simpower and analyze the performance of DC shunt and series motor. Creating a model file using induction motor and single phase motors.

Reference books –

1. MATLAB Programming for Engineers by Stephan J Chapman, Thomson Publication.
2. Matlab & its Application in Engineering by Rajkumar Bansal, Ashok Kumar Goyal, Manojkumar Sharma, Pearson Education, Version 7.5
3. Matlab & Simulink by Partha, S Mallick, Scietech, 2nd Edition

Term Work:

At least 15 model file should be based on above topics, and practical hours should be given more importance to the students.