Solapur University, Solapur.
Structure of (Electrical and Electronics Engineering) Part I & II
w.e.f. Academic Year 2010-11.

SE (Electrical and Electronics Engineering) Part-I

Sr No	Subject	Teaching Scheme			Examination Scheme\				
		L	P*	T	TH	TW	POE	OE	Total
1	Engineering Maths III	3	--	1	100	25	--	--	125
2	Transformers & D.C. Machines	4	2	--	100	25	50	--	175
3	Electrical Circuits Analysis	3	2	1	100	25	--	--	125
4	Analog Electronics	3	2	--	100	25	25	--	150
5	Data Structures	3	2	--	100	25	25	--	150
6	Introduction to Pspice & MATLAB	2	2	--	--	25	--	--	25
	Total	18	10	2	500	150	100	--	750
7	Environmental Science	2	--	2		--	--		--

SE (Electrical and Electronics Engineering) Part-II

Sr No	Subject	Teaching Scheme			Examination Scheme				
		L	P *	T	TH	TW	POE	OE	Total
1	Linear Algebra	3	--	1	100	25	--	--	125
2	A.C. Machines	4	2	--	100	25	50	--	175
3	Electrical Measurements	3	2	--	100	25	25	--	150
4	Signals & Systems	3	--	1	100	25	--	--	125
5	Digital Techniques	4	2	--	100	25	25	--	150
6	Computer Programming C++	3	2	--	--	25	--	--	25
	Total	20	8	2	500	150	100	--	750
7	Environmental Science	2	--	2		--	--		--

Note:
1) The batch size for the practical's/tutorials be of 20 students. On forming the batches, if the strength of remaining students exceeds 9 students, then a new batch may be formed.
2) Vocational Training to (be evaluated at B.E. Part-I) of minimum 15 days should be completed in any vacation after S.E. Part-II but before B.E. Part-I & the report should be submitted in B.E. Part-I.
3) An Industrial Visit should be arranged based on present syllabus content and a visit report should be submitted by each student.

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SE (Electrical and Electronics Engineering) Part-I

1. ENGINEERING MATHEMATICS-III

Teaching Scheme:
Lectures: 3 Hours /Week
Tutorial: 1 Hours/Week

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

SECTION-I

1. Linear Differential Equations (4hrs)
Linear Differential equations with constant coefficients (without method of variation of parameters)

2. Homogeneous Linear Differential Equations (4 hrs)
Legendre's Linear equations, Electrical Engg. Applications.

3. Partial Differential Equations (4 hrs)
Four standard forms of Partial Differential equations of first order, Solution of partial differential equations by method of separation of variables.

4. Laplace Transform: (6 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

5. Fourier series: (4hrs)
Definition, Euler's formula, Expansions of function, Change of interval, even and odd functions, half range Fourier series.

6. Fourier Transform: (4hrs)
Fourier integral, Fourier sine and cosine integral, Complex form of Fourier integral. Fourier Transform, Fourier sine and cosine transform and Inverse transform.

7. Z-Transform: (4hrs)

Z-Transform of elementary Functions, Properties of Z-Transform and Inverse Z-Transform.

8. Vector Calculus: (6hrs)

Differentiation of vectors, tangent line to the curve, velocity and acceleration, Gradient, Divergence and Curl of vector field, Solenoid, irrotational and conservative vector field.

Recommended books:

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.

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2. TRANSFORMERS & D.C. MACHINES

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
POE: 50 Marks

SECTION-I

1. DC.MACHINES:- **(5Hrs)**
Construction of D.C. machines, magnetic circuit of d.c machines, commutator and brush arrangement, EMF equation, torque equation, power flow diagram of dc machines.

2. ARMATURE WINDING :- **(3 Hrs)**
Simple lap winding and wave winding, winding diagram and tables, brush position, dummy coils.

3. ARMATURE REACTION: - **(6 Hrs)**
MMF due to armature winding, flux distribution due to armature current and resultant flux distribution in a machine. Demagnetization and cross magnetization ampere turns, principle of compensation, compensating winding and its use in machines.

4. D.C. MOTORS: - **(5 Hrs)**
Concept of back emf, characteristics of d.c. motors, Method of speed controls, electro breaking, parallel and series operation of motor.

5. TESTING OF D.C. MACHINES: - **(5 Hrs)**
Losses and efficiency, Break test, swinburn's test, hopkinson's test, redardation test, Field test on d.c. series motor.

SECTION –II

6. UNIVERSAL MOTOR: - **(6 Hrs)**
Development of torque, power, rotational and transformer emf in commutator winding, commutation in universal motor, complexer diagram, circle diagram, operation on A.C. and D.C. supply, compensated winding, application.

7. SINGLE PHASE TRANSFORMER: - **(6 Hrs)**
Construction and type, EMF equation phaser diagram, equivalent circuit, efficiency, losses, regulation, Experimental determination of equivalent circuit

parameters and calculation of efficiency and regulation, parallel operation.

8. POLY PHASE TRANSFORMER: - (6 Hrs)

a) Construction, single phase bank, polarity test, transformer winding, Grouping YD1, YD11, DY11, DZ1, DZ11, YZ1, YZ11

9. PERFORMANCE OF TRANSFORMERS: (6 Hrs)

Switching inrush current, Harmonics in exciting current causes and effects, Harmonics with different transformers, connection, tertiary winding, oscillating neutral, Testing of transformers , heat run test, sumpners test, Equivalent delta test.

TERM WORK: a) Minimum **Eight** experiment based on above syllabus.
b) **Ten MATLAB** exercises on software based analysis.

LIST OF EXPERIMENTS: -

1. Speed control of dc shunt motor (i) Armature control method (ii) Field control method
2. Determination of efficiency of DC motor by swimbuns test
3. Determination of efficiency of DC motor by Hopinkinson.s test
4. Break test on shunt motor
5. Field test on series motor
6 Load test on compound motor I) cumulative ii) differential
7. To perform open circuit and short circuit test for determining equivalent circuit parameter of a single phase transformer
8 Parallel operation of single phase transformer.
9. Scott connection
10. Equivalent Delta test or Heat run Test for three phase transformer.
11. DY1 and DY11 parallel and connection
12. load test on transformer (single and three phase)
13. Polarity test on transformer (single and three phase)

RECOMMENDED BOOKS: -

1. Electrical Machines by SK Bhattacharya, Tata Mc Graw Hill, New Delhi
2. Electrical Machines by SK Sahdev, Unique International Publications, Jalandhar
3. Electrical Machines by Nagrath and Kothari, Tata Mc Graw Hill, New Delhi
4. Electrical Machines by SB Gupta, SK Kataria and Sons, New Delhi
5. Electric Machine, By Fitzerald and Kingsley (Tata McGraw Hill)
6. Alternating current Machines, By M.G. Say.

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3. ELECTRICAL CIRCUITS ANALYSIS

Teaching Scheme:
Lectures: 3 Hours /Week
Practical: 2 Hours/Week
Tutorial: 1 Hours/Week

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

SECTION-I

1. Basic Concepts: **(5 Hrs)**

Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh

2. Network Topology: **(5 Hrs)**

Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of resistive networks, Principle of duality**.**

3. Network Theorems – I: **(4 Hrs)**

Superposition, Reciprocity and Millman's theorems

4. Network Theorems - II: **(4 Hrs)**

Thevinin's and Norton's theorems; Maximum Power transfer theorem

SECTION –II

5. Resonant Circuits: **(4 Hrs)**

Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth.

6. Transient behavior and initial conditions: - **(5 Hrs)**

Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitation.

7. Laplace Transformation & Applications : **(4 Hrs)**

Solution of networks, step, ramp and impulse responses, waveform synthesis

8. Two port network parameters: **(5 Hrs)**

Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets

List of Experiments: Any eight experiments to be performed from following list

1. Study of Ladder Network
2. Verification of Star Delta transformation
3. Verification of Superposition and Maximum power transfer Theorem
4. Verification of Norton's and Thevenin's Theorem
5. Study of step response of R-C , R-L and R-L-C Series circuit and verification using Pspice
6. Observation of series and parallel resonance
7. Calculations of Z, Y, ABCD and Hybrid parameters of two port network
8, 9, and 10 Three programs of Network solution based on Pspice/ MATLAB software.

Recommended Books

1. **"Network Analysis",** M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. Reprint 2002
2. **"Networks and systems",** Roy Choudhury, 2nd edition, 2006 re-print, New Age International Publications.
3. **"Engineering Circuit Analysis",** Hayt, Kemmerly and DurbinTMH 6th Edition,2002.
4. **"Network analysis and Synthesis",** Franklin F. Kuo, Wiley International Edition,
5 **"Analysis of Linear Systems"**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002
6 **"Circuits"**, Bruce Carlson, Thomson Learning, 2000. Reprint 2002

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4.ANALOG ELECTRONICS

Teaching Scheme:
Lecture-03 Hr/week
Practical-02 Hr/week

Examination Scheme:
Theory-100marks,
TW-25 marks
POE-25 marks

SECTION- I

1. Diode applications **(3hrs)**
Load line analysis, diode approximation, configuration with D.C. Inputs- parallel, series, half wave and full wave rectification, clipper and clamper circuits, computer
analysis.

2. BJT biasing **(5hrs)**
Operating point, fixed bias circuit, emitter stabilized bias, voltage divider bias, miscellaneous bias configuration, design operation, transistor switching networks, bias
stabilization, transistor as an amplifier, UJT, VI characteristics of UJT, computer analysis

3. FET biasing and MOSFET. **(4hrs)**
Fixed bias, self-bias, voltage divider bias, design, troubleshooting, The MOSFET, VI characteristics, depletion type MOSFET, enhancement type MOSFET, VMOS, CMOS, computer analysis.

4. Compound configuration **(4hrs)**
Cascade connection, cascode connection, Darlington connection, feedback pair, current source circuit, current mirror circuit, and computer analysis.

5. Power amplifiers **(2hrs)**
Types, class A and B amplifier, operation & circuits, distortion, class C, D amplifier, computer analysis.

SECTION II

6. Introduction to op-amp **(4hrs)**
General purpose op-amp, zero crossing detector, voltage level detector, computer
interfacing with voltage level detector, inverting, non inverting and differential amplifier,
signal conditioning circuit.

7. Comparators and controllers (3hrs)

I/p noise effect by positive feedback, zero crossing detector & voltage level detector
with hysteresis, Precision Comparator IC, Window Detector

8. Selected Application Of Op-Amp (5hrs)

High Resistance Voltmeter, V to I Converter, Phase Shifter, Integrator, Differentiator,
Precision Rectifier, Peak Detector, dead zone circuit, Instrumentation Amplifier

9. DC & AC Performance Of Real Op-Amp. (6hrs)

I/p Bias Current, I/p Offset Current, Drift, CMRR, PSRR, Frequency Response of Op-
Amp, Slew Rate & O/p Voltage, Noise in O/p Voltage Gain

10. Specialized IC Applications (5)

Analog Multiplier, Phase Angle Detection, IC 555 Timer, Astable & Monostable, XR-
2240 Programmable Timer Counter, Linear IC Voltage Regulator, Power Supply For
Logic Circuits +/- 15V Power Supply for Linear Applications

TERM WORK: List of experiments.

Section I

1. Design and implementation of half wave rectifier.
2. Design and implementation of full wave rectifier.
3. Study of various types clippers.
4. Study of various types clampers.
5. Study of biasing methods of BJT.
6. Study of frequency response of CE configuration of BJT.
7. Study of VI Characteristics of UJT.
8. Study of FET as an amplifier.

Minimum Five Experiments of section I & Simulation By PSPICE/Circuit maker Software

Section II

1. Study of op-amp as an inverting & non-inverting amplifier.
2. Study of op-amp as differentiator & integrator.
3. Study of op-amp as zero crossing detector & peak detector.
4. Study of op-amp as phase shifter.
5. Study of op-amp as precision rectifier.
6. Study of op-amp as instrumentation amplifier.
7. Study of IC 555 in different modes- astable, monostable.

Minimum Five Experiments of section II & Simulation By PSPICE/Circuit maker Software

Recommended Books-

1. Electronic Devices & Circuits by-Allen Mottershed (PHI)
2. Electronic Devices & Circuits by- Boylsted (Pearson)
3. Op-Amp& Linear IC- R Gaikwad (PHI)
4. Op-Amp& Linear Integrated Circuits- Coughlin & Driscoll (PHI)

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5. DATA STRUCTURES

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

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

SECTION-I

1. Advance concepts in 'C' **(8 hrs)**
Multidimensional arrays, Bitwise operators, logical operators, Type conversion & storage classes, Structures & union, Pointers, Functions (types of function), 'C' Preprocessors, File handling in 'C'

2. Introduction to data structure **(5 hrs)**
Information & meaning, Abstract data type, Data types and C, Data structures and C, Array as an ADT ,C Structure as an ADT.

3. Stack **(5 hrs)**
Definition and Examples, Representing Stack in C, In fix , post fix, prefix (Evaluation & Conversion).

SECTION-II

4. Recursion **(5 hrs)**
Recursion definition & Process, Recursion in C, Recursive Programs Translation of Prefix to postfix using recursion, simulating recursion Simulation of Factorial), Efficiency of recursion

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.

6. Searching, Sorting, Hashing **(5 hrs)**
Types of Search – Sequential and Binary Search
Sort – Insertion sort, Merge sort, Bouble Sort, Quick Sort,
Hashing – Hash functions, open hashing closed hashing.

Recommended books:

1. Data structure using C - Tanenboum
2. C Programming - Kerninghan & Ritchie
3.Fundamentals of Data Structure- ELLIS Horowitz,Sartaj Sahani(Galgotic Book Source)
4.Data Structure &Programme Design- Robert L. Kruse(PHI)

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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6. INTRODUCTION TO PSPICE & MATLAB

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

Examination Scheme:
T.W.: 25 Marks

SECTION-I

1. Introduction to Matlab :- **(4 hrs)**
Matlab environment, different windows in matlab, getting help, Important Commands, matlab as scratchpad, different types of files in matlab, complex Variables and operations, plot commands

2. Matrices & vectors :- **(6 hrs)**
Matrix manipulation, matrix and array operations, arithmetic operators, Relational operators, logical operators, solution of matrix equation Ax= B, Gauss elimination, inverse of matrix Eigen values and Eigen vectors, Determinant, least square solutions

3. Branching statements, loops and programming design: - **(2 hrs)**
If statements, for loops, while, switch, Break and continue, nesting loops, if else with logical arrays, function programming

SECTION II

4. Symbolic manipulation:- **(3hrs)**
Calculus – limit, continuity, differential calculus, differential equation, integration, integral transforms, Taylor series

5. Signals manipulations: - **(3 hrs)**
Plotting standard signals, continuous and discrete such as step, ramp, sine, Generating signals from combination of different signals and manipulation of signals.

6. Transforms and simulink: - **(3 hrs)**
Laplace, Z and Fourier transform, Inverse transforms, transfer function, partial fraction expansions, introduction to simulink, simulation of linear system in transfer domain and ordinary differential equation domain

7. Introduction to PSPICE: - (3 hrs)

Recommended Books-

1. Matlab programming for Engineers by Stephen Chapman Pub Thomson Learning 2nd edition, 2002
2. Getting started with MATLAB by Rudra Pratap Pub Oxford University press
3. Contemporary linear systems using MATLAB by Robert Strum and Donald Kirk Pub Thomson Learning.
4. Mastering MATLAB by Duane Hanselman & Bruce Little field Pub Pearson Education 2005
5. A guide to MATLAB by Brain R. Hunt, Ronald L. Lipsman & Jonathan M. Rosenberg Pub Cambridge University Press 2002
6. Linear Algebra and differential Equations using MATLAB by Martin Golubitsky, Michael Dellnitz Pub, International Thomson 1999
7. SPICE for Circuits and Electronics using PSpice by Muhammad Rashid pub PHI 2nd Edition 2003.

LIST OF EXPERIMENTS:

1. Introduction to MATLAB Environment
2. To study simple matrix and array manipulations using Matlab
3. Programming using MATLAB
4. Calculus using MATLAB
5. To plot signals discrete and continuous using MATLAB
6. Function programming and Matlab
7. Calculation of Laplace, Z, Inverse Laplace, Z, Partial fraction expansion and Transfer function using Matlab
8. Signal Manipulation using Matlab.
9. Simulation of linear system using Matlab
10. Introduction to PSpice.

Note: Minimum Eight experiments are to be conducted based on the above list.

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1. LINEAR ALGEBRA

Teaching Scheme:
Lectures: 3 Hours /Week
Tutorial: 1 Hours/Week

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

SECTION-I

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.

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.

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

4. (7 hrs)
Orthogonality, symmetric matrices, and quadratic forms Inner product and orthogonality, orthogonal sets, least square problems, diagonalization of symmetric matrices, quadratic forms.

5. Complex Variable (7 hrs)
Functions of complex variable, derivative, Analytic function, Cauchy Riemann equations, conformal and bilinear transformations, Cauchy integral formula for derivatives.

6. Statistics (4 hrs)
Coefficient of correlation & lines of regression of bivariate data

Recommended Books-

1) David C Lay- Linear Algebra & its applications 3rd Edition 2003 Peasson Education Inc.
2) Higher Engineering Mathematics by B S Grewal 39th edition 2005. Khanna Publishers.

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2. A.C. MACHINES

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
POE: 50 Marks

SECTION-I

1. THREE PHASE INDUCTION MOTOR: (6 hrs)

A) Construction, Principle of operation, phaser diagram, equivalent circuit, analysis based on approximate equivalent circuit,, Torque equation, speed equation, speed torque curve, No load test, Blocked rotor test, and circle diagram, starting and types of starter, ratio of starting torque to full load torque.

B) Slip ring Induction Motor: (5 hrs)

Effect of increase in rotor resistance, starting, speed control of motor. Double Cage Induction Motor (D.C.I.M.), Construction, Characteristics and equivalent circuit.

C) Speed control of Induction Motor: (4 hrs)

Change of supply frequency, pole changing, cascading, Injection of EMF in secondary

D) Application and Testing: (4 hrs)

Testing as per I.S.S., Industrial applications of induction Motor.

Synchronous Induction Motor: Construction, Circle Diagram, Phaser diagram

2. SINGLE PHASE INDUCTION MOTOR: (5 hrs)

Types, Construction, Principle of operation, phaser diagram, equivalent circuit, Experimental determination of parameter, application

SECTION-II

3. SYNCHRONOUS GENERATOR: (6 hrs)

Construction, Principle of operation, EMF equation, leakage reactance, armature reaction, armature resistance and reactance, field excitation system, damper winding

4. THREE PHASE WINDING: (4 hrs)

Single layer, double layer, Integral and fractional slot winding, distribution factor, pitch factor , Elimination of harmonics voltage.

5. PERFORMANCE OF SYNCHRONOUS GENERATOR: (8 hrs)

Calculation of voltage regulation by synchronous Impedance method, Zero power factor method, MMF method, experimental setup for above method, rating, efficiency and losses, method of synchronizing. , synchronizing power, hunting, damping operation single and Infinite bus, power angle equation, short circuit ratio and its significance.

Two reaction Theory: Phaser diagram, slip test, power angle equation, saliency power.

6. SYNCHRONOUS MOTOR: (6 hrs)

Method of starting, phaser diagram, torque and torque angle equation, V- curves and experimental setup, hunting and damping , synchronous condenser.

TERM WORK:

A) Minimum Eight experiment based on above syllabus.
B) Ten MATLAB exercises on software base analysis

LIST OF EXPERIMENTS:

1. No load and Blocked rotor test on induction motor and performance of I.M. from circle diagram
2. Study of A.C. Machines.
3. Study of starters.
4. Speed control of Induction Motor
5. Parameter calculation of single phase induction motor from No load and Blocked rotor test
6. Determination of voltage regulation of alternator using Synchronous Impedance method.
7. Determination of voltage regulation of alternator using MMF method
8. Determination of voltage regulation of alternator using Zero power factor method.
9. Synchronization of alternator with bus bar
10. Parallel operation of alternator.
11. V-Curves of Synchronous motor.
12. Study of starting method of synchronous motor.

Recommended Books-

1 Electrical Machine -3/E –S.J.Chapman –Mc Graw Hill
2 Performance and design of A.C.Machines – M.G.Say
3 Performance and design of A.C Commutator motors – O.E.Taylor.

4 Theory of A.C. Machines – Langes dorf
5 A.C. Machines -Puchastein Lioyd and Conard.
6 Electrical Technology – H.Cotton.

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3. ELECTRICAL MEASUREMENTS

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

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

SECTION-I

1. **(a)Units and Dimensions:**
   Review of fundamental and derived units. S.I. units. Dimensional equations, problems. **(2 Hrs).**

   (b)Measurement of Resistance, Inductance, and Capacitance:
   Wheatstone's bridge — sensitivity analysis, limitations. Kelvin's double bridge. **(2 Hrs).**

2. **(a)** Earth resistance measurement using Megger. Measurement of earth resistance by fall of potential method, Anderson's bridge, Schering bridge. Sources and detectors, Schielding of bridges Problems **(4 Hours).**

3. **Extension of Instrument Ranges:**
   Shunts and multipliers, Construction and theory of instrument transformers, Equations for ratio and phase angle errors of C.T. and P.T (derivations excluded). Turns compensation, illustrative examples (excluding problems on turns compensation) — **(5 Hours).**

4. **Measurement of Power and Related Parameters:** Dynamometer wattmeter. LPF wattmeter. Measurement of real and reactive power in three-phase circuits. Induction type energy meter — construction, theory, errors, adjustments and calibration. Principle of working of electronic energy meter. — **(5 hrs).**

SECTION-II

5. (a) Construction and operation of electro-dynamometer single-phase power factor meter. Weston frequency meter and phase sequence indicator. – **(2 hrs).**

(b) Electronic Instruments: Introduction, True RMS responding voltmeter. Electronic multimeters, Digital voltmeters, Q meter. **(2 hrs).**

2. **Dual trace oscilloscope** — front panel details of a typical dual trace oscilloscope. Method of measuring amplitude, phase, frequency, period. Use of Lissajous patterns. Working of a digital storage oscilloscope. **(5 hrs).**

3. **Transducers:** Classification and selection of transducers. Strain gauges. LVDT. Temperature measurements. Photo conductive and photo-voltaic cells. **(5 hrs).**

8. (a) Interfacing resistive transducers to electronic circuits. Introduction to data acquisition systems. – (**2 Hours - 8 Marks)**

(b) Display Devices and Signal Generators: X-Y recorders. Nixie tubes. LCD and LED displays. Signal generators and function generators. **(4 hrs).**

TERM WORK:

Minimum Eight experiment from following list.

LIST OF EXPERMENTS:

1. Measurement of power by two wattmeter method
2. Measurement of reactive power.
3. Calibration of single phase and three phase Energy meter.
4. Measurement of inductance by using bridges
5. Measurement of capacitance by using bridges
6. Study of measuring instruments (M.I., PMMC)
7. Measurement of power by ammeter and voltmeter.
8. Measurement of KVAR, KVA, KW by using Trivector meter.
9. Measurement of high resistance by loss of charge method.
10. Study of digital meters
11. Study of C.T. and P.T
12. Study of Harmonic distortion analyzer

Recommended Books-

1. **"Electrical and Electronic Measurements and Instrumentation",** A. K. Sawhney, Dhanpatrai and Sons, New Delhi.
2. **"Modern Electronic Instrumentation and Measuring Techniques",** Cooper D. and A.D. Heifrick, P.H.I.
3. **"Instrumentation Devices & Systems"** -- Rangan, Mani, Sharma
4. **"Process Control Instrumentation Technology"** – Johnson
5. **"Industrial Instrumentation and Control"** – S.K.Singh
6. **"Electrical measurement and measuring Instrumentation"** - G.P.Gupta
7. **"Electrical Measurements and Measuring Instruments",** Golding and Widdies, Pitman.
8. **"Electronic Instrumentation and Measurement",** David A. Bell, 2nd Edition, P.H.I., 2006.
9. **"Electric Measurements",** Harris, John Wiley.

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4. SIGNALS & SYSTEMS

Teaching Scheme:
Lectures: 3 Hours /Week
Tutorial: 1 Hours/Week

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

SECTION-I

1. Introduction to Signals & Systems : (8hrs)

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, Sinusoid, 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.

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.

3. Analysis of Continuous Time System: (4hrs)

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

4. Analysis of Discrete Time Signals And Systems: (4hrs)

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.

5. Analysis of Signals and Systems in frequency domain: (6hrs)

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.

6. Sampling: (8hrs)

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.

Recommended Books-

1. **"Signals and Systems"-** Ramesh Babu Scitech Publications.
2. **"Signals and Systems"** A.V. Oppenheim ,A.S. Willsky and I.T. Young, , Prentice Hall - 2000.
3. **"Signals and Systems-Continuous and Discrete"** R.F. Ziemer ,W.H. Tranterand and D.R.Fannin, ,4th Edition , Prentice Hall ,1998.
4. **"Principles of signals and systems"** F.J.Taylor,MC Graw Hill ,1994
5. **"Signals and Systems – Analysis using Transform methods and MATLAB"** M. J. Robert , Tata Mcgraw HillEdition 2003.
6. "**Signals and Systems"** I.J.Nagarath , S.N. Sharan ,R.Ranjan and S. Kumar,Tata Mcgraw hill publishing Company Ltd., New Delhi, 2001.
7. **"Signal Processing and linear systems"** B.P. Lathi, 'Oxford University press,c1998.

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SE (Electrical and Electronics Engineering) Part-II

5. DIGITAL TECHNIQUES

Teaching Scheme:
Lectures: 4 Hours /Week
Practical: 2 Hours/Week

Examination Scheme:
Paper: 100 Marks
T.W.: 25 Marks
P.O.E.: 25 Marks

SECTION-I

1. Combinational Logic Circuits (10 hrs)

Codes- BCD, Gray, Seven segment. Principles of combinational logic: Standard representation for Logical Function, canonical forms, don't care conditions, minimization techniques(K-map up to 4 variables only),static and dynamic Hazards, design examples, Adder substractors, code converters (binary to gray & gray to binary, BCD to 7 segment, IC 7447, 7448). MUX, DEMUX(Tree), encoder, decoder.

2. Combinational Design using MSI Circuits (4 hrs)

Design procedure of Multiplexer and Demultiplexer(Tree), comparator, adder look ahead carry generator, ALU(74181), Parallel adder(7483).

3. Logic Families (4 hrs)

Parameter definitions -noise margin, power dissipation, voltage and current parameters, propagation delay. Typical values for TTL, CMOS & ECL. Input/output profile for TTL & CMOS. TTL logic families-standard TTL, Totem-pole, open collector, tri-state (concept & application). Significance of TTL sub families (L, H, LS, S) & MOS family-importance of (C,HC), PMOS, NMOS(inverter only), CMOS (inverter, AND & NOR). CMOS-TTL interfacing, comparison of TTL & CMOS.TTL compatible high speed CMOS series.

4. Flip-Flops (6 hrs)

Study of flip-flop, 1 bit latch, clocked S-R, J-K, M/S J-K, T and D F/F, race around condition, flip-flop truth table, excitation table, flip-flop conversion, flip-flop characteristics.

Section II

5. Sequential Logic Design (10 hrs)

Design of ripple counter using flip-flop (IC 7490, 7493) 4 bit up/down counter (positive / negative edge triggered). Shift register (modes of operation), 4 bit bi-directional shift register using D/ J-K, universal shift registers, application of shift registers (Ring counter, Sequence generator, Johnson's counter) IC

7495/74195. Design of Synchronous counter using Flip-Flop & IC 74191, 4 bit Up/down mod-n counters.

6 Synchronous Sequence Machines (10 hrs)

Moore/Mealy machines, representation techniques, state diagram, state reduction, state assignment, implementation using flip flop. Application like sequence generator & detection.

5. PLD's (4 hrs)

Programmable Logic Devices: Detail architecture, study of PROM, PAL, PLA, designing combinational circuits using PLDs.

Recommended Books-

1. M. Morris Mano - Digital Design - PHI (3rd Edition)
2. R.P. Jain - Modern Digital Electronics – TMH (3rd Edition)
3. Digital Principles & Applications – Leach, Malvino, (6th Edition).
4. Digital Design Principles and Application - Wakerly – (Pearson Education)
5. Digital Electronics - Gothman - (PHI)
6. Digital logic and computer design - Morris Mano - (PHI)
7. Texas Instruments incorporated designing with TTL IC's - International Students edition
8. Alan Clements (Low Price 2000) The Principles of Computer hardware (Third Edition), Oxford Press.

List of Practicals

Minimum 10 experiments must be conducted from above list.

1. Verification of truth table of Basic and Universal Gates
2. Implementation of Universal Gates using Basic Gates
3. Code conversion using logic ICs: BCD to Binary BCD to Gray Gray to BCD
4. Design and implementation of 2 bit digital comparator using logic gates and functional verification of 4 bit digital comparator 1C 7485.
5. Design & implementation of 1 digit BCD adder using 1C 7483.
6. A) Verification of functionality of multiplexer and demultiplexer Ics
   B) Design and implement combinational function using multiplexer and demultiplexer.
7. A) Design & implementation of 3 bit bi directional shift register using D flip flop.

B) Design and implementation of Johnson counter using above shift register

8. A) Functional verification of universal shift registers 1C 7495/194.

B) Design and implementation of pulse train generator using above 1C

9. Design and implementation of 3 bit up down ripple counter using flip-flop
10. Functional verification of ripple counter IC 7490 & synchronous counter IC 7491
11. Design of 3 bit counter using Flip Flop
12. Design of synchronous sequence generator using MS JK flip-flop.

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6. COMPUTER PROGRAMMING C++

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

Examination Scheme:
T.W.: 25 Marks

SECTION-I

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.

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.

3. Objects and Classes: (6 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

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.

5. Inheritance: (6 hrs)

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

6. Pointers, Virtual Functions: (6 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.

LIST OF EXPERIMENTS:

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

Recommended Books-

1. E Balguruswamy, "Object Oriented Programming with C++" Tata Mc Graw Hill.
2. Robert Lafore, "Object Oriented Programming with Turbo C++" Galgotia Publications.