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॥ अंतरी पेटवू ज्ञानज्योत ॥

North Maharashtra University, Jalgaon

Syllabus for Third Year Engineering Degree Course in

ELECTRICAL ENGINEERING

(w.e.f. July, 2000)

North Maharashtra University, Jalgaon

T.E. (Electrical Engineering)

(With effect from July, 2000)

Term I

Sr. No.	Subject Code	Subject	Teaching Scheme Hours / Week		Examination Scheme				
			Lectures	Practical	Paper duration Hours	Maximum Marks			
						Paper	Termwork	Practical	Oral
1		Applied Electronics II	4	2	3	100	25	25	–
2		Electrical Machines II	4	2	3	100	25	25	–
3		Power Systems I	4	–	3	100	25	–	–
4		Network Analysis	4	2	3	100	25	25	–
5		Electrical Installation Estimation and Distribution	4	4 (Drawing)	3	100	25	–	–
		Total	20	10	–	500	125	75	–
		Grand Total	30		–	700			

Term II

Sr. No.	Subject Code	Subject	Teaching Scheme Hours / Week		Examination Scheme				
			Lectures	Practical	Paper duration Hours	Maximum Marks			
						Paper	Termwork	Practical	Oral
1		Microprocessor Fundamentals and Application	4	2	3	100	25	25	–
2		Power Systems II	4	2	3	100	25	25	–
3		Industrial Organisation and Management	4	–	3	100	–	–	–
4		Electrical Measurements II	4	2	3	100	25	25	–
5		Principles of Electrical Machine Design	4	4 (Drawing)	3	100	25	–	–
6		Practical Training / Special Study / Minor Project	–	–	–	–	25	–	–
		Total	20	10	–	500	125	75	–
		Grand Total	30		–	700			

Total Marks of Term I + Term II = 1400 Marks

Term I Paper 1
Applied Electronics II

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

Op-amp applications : Waveform generators, sine, square, traingular, sawtooth, staircase; precision rectifiers; comparators; clamping; instrumentation amplifier. (10 Hrs.;20 marks)

Unit 2

Timer IC 555 : parameters, operation and applications as - astable, monostable multivibrators, free-running ramp generator, PWM modulator.

IC 565 as PLL : parameters, operations and applications such as – frequency multiplier, frequency shift keying (FSK) demodulator. Voltage controlled oscillator 566 (10 Hrs.;20 marks)

Unit 3

Shift registers : different types and operations of shift registers.

Counters : asynchronous, synchronous, decade, BCD, modulo-N, ring counters, up/down counting, operations.

A/D and D/A converters : types and principle of operation. (10 Hrs.;20 marks)

Unit 4

Commutation of an SCR—natural and forced, classification of forced commutation, class A : resonant commutation, class B : self commutation, class C : auxiliary commutation, class D : complementry commutation, class E : external pulse commutation, class F : line commutation. Circuits for gate triggering – R,RC, pulse, UJT triggering. Internal power disspation and temperature rise. Multiple connections of SCRs, series operation, triggering of series connected SCRs, parallel operation, triggering of parallel connected SCRs, string efficiency. (10 Hrs.;20 marks)

Unit 5

Full-wave controlled rectifiers, M-2 and M-6 connections, bridge circuits, single-phase B-2 connection, three-phase B-6 connection, analysis of bridge circuits, effect of source inductance.

Half-controlled bridge circuits, single-phase and three-phase, analysis, line commutated controlled rectifiers, input-output characteristics of bridge circuits, effect of source impedance, effect of load inductance. (10 Hrs.;20 marks)

References :

1. Op-Amps and Linear Integrated Circuits, second edition, Ramakant A. Gayakwad, Prentice Hall of India.
2. Modern Degital Electronics, second edition, R.P. Jain, Tata McGraw Hill.
3. An Introduction to Thyristors and their Applications, second edition, M. Ramamoorty, East-West Press.

List of Experiments :

Group A

1. Sine/square wave generator using op-amp.
2. Half-wave/full-wave precision rectifier.
3. Instrumentation amplifier.
4. Astable multivibrator using IC 555.
5. Free-running ramp generator using IC 555.
6. PWM modulator using IC 555.

Group B

7. Frequency multiplier using PLL IC 565.
8. Voltage controlled oscillator 566.
9. Decade counter.
10. A/D and D/A converters.
11. SCR commutation circuits (2 Expts.)
12. Single phase half-controlled / full-controlled bridge rectifiers.

The termwork should include a minimum of eight experiments four each from groups A & B of the above list. The termwork marks will be based on performance in theory and practicals having a weightage of 40% and 60% respectively.

Term I Paper 2
Electrical Machines II

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

Synchronous machines : Principles of generator action and motor action; constraction – rotating field type and rotating armature type, salient-pole and non-salient-pole type; arrangement of armature winding; E.M.F. equation; winding factors. (10 Hrs.;20 marks)

Unit 2

Three-phase synchronous generators (alternators) : alternator on no-load and on-load; effects of armature current armature reaction, resitance drop, concepts of leakage flux and leakage reactance, armature reaction as a rotating m.m.f.; production of electromagnetic torque; concept of synchronous reactance and synchronous impedance.
Voltage regulation - definition, regulation by direct loading test, short circuit ratio.
Regulation of non-salient pole alternators by synchronous impedance method (e.m.f. mnethod), m.m.f. method, Potier triangle and A.S.A. methods.
Two reaction theory for salient pole machines - direct-axis and quadrature-axis synchronous reactances their determination by slip test; phasor diagram of salient pole alternator and calculation of regulation. (10 Hrs.;20 marks)

Unit 3

Power : power angle relations for non-salient pole alternators on the basis of synchronous impedance, and for salient pole alternators on the basis of two reaction theory, losses in alternators and efficiency.
Parallel operation of alternators : alternators working single and alternator working with infinite busbars. Parallel operation of alternators; load sharing between two alternators in parallel.
Parallel-generator theorem; synchronising-lamp methods and use of synchroscope; synchronising power and synchronising torque; operating chart of alternator working with infinite busbars. (10 Hrs.;20 marks)

Unit 4

Synchronous motors : motor action, an alternator connected to infinite busbars working as motor, if its prime mover fails, phasor diagram on the basis of synchronous impedance; expression for gross mechanical power developed; power flow.
Operation with constant load and variable excitatin; locus of tip of current phasor under the above condition and 'V' curves.
Operation with constant excitation and variable load; locus of tip of current phasor circle diagram.
Starting, methods of starting; hunting, its causes and remedies; applications.

Unit 5

Synchronous induction motor : concept, action under starting and running conditions; equvalent excitation current for different secondary connections; circle diagram and tests for plotting the circle diagram.
Single-phase induction motors : construction, rotating field theory, equivalent circuit and torque-slip characteristics; tests to determine parameters of equivalent circuit.
Types, construction, connections, torque-slip characteristics, ratings and applications of each type; comparison with three-phase induction motor; Introduction to cross field theory.
Harmonics : Concept of time and space harmonics and their generation in electrical machines, effect of these harmonics on the performance of synchronous machines; remedies to eliminate and reduce the effect of these harmonics.

References :

1. Performance and Design of A.C. Machines, M.G. Say, ELBS.
2. Theory of Alternating Current Machinery, second edition, A.S. Langsdort, Tata McGraw-Hill.

2....

3. Theory and Problems of Electrical Machines, Nagrath and Kothari, Tata McGraw-Hill.
4. Performance and Design of A.C. Commutator motors, E.D. Taylor, ELBS.
5. Electrical Machines, second edition, S.K. Bhattacharya, Tata McGraw-Hill.

List of Experiments :

Group A

1. Direct loading test on three phase alternator.
2. O.C. and S.C. test on alternator : determination of its regulation by e.m.f. method and m.m.f. method.
3. Zero power factor test on alternator : regulation by Potier method and A.S.A. method.
4. Slip test on salient pole synchronous machine : determination of direct and quadrature-axis synchronous reactances and hence regulation by two reaction theory.
5. Synchronising alternators : lamp methods and use of synchroscope.

Group B

6. V-curves of synchronous motor at constant load.
7. Load test on synchronous induction motor or synchronous motor at constant excitation.
8. Study of various types of single-phase induction motors.
9. No load and blocked rotor tests on capacitor - start single - phase induction motor and determination of parameters of equivalent circuit.
10. Load test on single phase induction motor.

The termwork should include a minimum of eight experiments four each from groups A & B of the above list. The termwork marks will be based on performance in theory and practicals having a weightage of 40% and 60% respectively.

Term I Paper 3
Power Systems I

Teaching Scheme :
Lectures : 4 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks

Unit 1

Generation : types of generating plants, basic requirements, site selection; principle of working, main components and auxiliary equipment, schematic block diagram representation and role played by each block for Thermal, Hydro and Nuclear plants using conventional fuels.

(10 Hrs.;20 marks)

Unit 2

Non-conventional sources of energy : like solar, tidal, MHD, fuel-cells, geo-thermal energy, principle of working, main components and auxiliary equipment, schematic block diagram representation and role played by each block.

(10 Hrs.;20 marks)

Unit 3

Major electrical equipment in power plants : descriptive treatment of ratings, special features, field of use of equipment like alternators, transformers, busbars, exciters and excitation systems, control panels, metering and other control room equipment in generating stations.

(10 Hrs.;20 marks)

Unit 4

Transmission : Importance of 3 phase overhead transmission lines in power systems and factors to be considered while planning their layout. Resistance and skin effect. Inductance and its estimation for two-wire-single-phase, three-wire-three-phase, single and double-circuit lines, with and without transposition, equal/unequal and horizontal/vertical spacings. Capacitance and its estimations for above lines with and without earths surface on the electric fields.
Circuit representation of lines : classification of lines based on length as short, medium and long lines. Representation as 'tee' and 'pi' circuits using R,L,C, parameters. Voltage and current relations for short and medium lines.

(10 Hrs.;20 marks)

Unit 5

Generalised circuit constants and circle diagram : representation of 'tee' and 'pi' models of lines as two-port networks. Evaluation and estimation of ABCD constants for both the models in series and parallel combination of models for short

3....

and medium lines.
Construction of receiving-end, sending-end and universal circle diagrams and their use for estimation of performance characteristics of short and medium lines.
Introduction to working principle, equipment used and comparison with A.C. transmission of H.V.D.C. transmission. (10 Hrs.;20 marks)

References :

1. Elements of power system analysis, fourth edition, William Stevenson, McGraw-Hill International edition.
2. Modern Power System Analysis, second edition, I.J. Nagrath, D.P. Kothari, Tata McGraw-Hill.
3. Power System Analysis and Design, B.R. Gupta.
4. Power System Design, M.V. Deshpande, Pitman edition.
5. Transmission and Distribution, J.B. Gupta, S.K. Kataria and Sons, New Delhi.
6. Electric Energy Systems Theory, second edition, Olle I. Elgerd, Tata McGraw-Hill.

Term I Paper 4
Network Analysis

Teaching Scheme :
Lectures - 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

Topological description of networks : graph, oriented graph, branches, nodes, planar and non-planar graphs, subgraph, trees and chords.
Network equations : number of network equations, source transformations, formulation of network equations, loop variable analysis, node varaible analysis, Determinants – minors and Gauss elimination method; duality; state variable analysis.
Initial conditions in networks : initial conditions in elements, procedure for evaluating initial conditions, Initial state of a network. (10 Hrs.;20 marks)

Unit 2

Second order differential equation – internal excitation, solution and initial conditions; networks excited by external energy sources, solution and initial conditions.
Laplace transformation : transforms of linear combinations, transforms of derivatives, transforms of integrals; solution of problems with Laplace transformation; partial fraction expansion, Heaviside's expansion theorem, Examples of solution by Laplace transformation; Laplace transforms of standard functions, shifted waveforms-unit step, ramp, impulse; initial and final value of f(t) from F(s). (10 Hrs.;20 marks)

Unit 3

Impedance functions and network theorems : concepts of complex frequency, transform impedance and transform circuits, series and parallel combinations of elements; super position and reciprocacity; Thevenin's theorem and Norton's theorem, Examples.
Network functions; poles and zeroes : terminal pairs or ports, network functions for one port and two-port, driving-point impedance (or admittance), voltage transfer function, current transfer function, transfer impedance (or admittance), calculation of network function, ladder networks, bridged-T, parallel-T and lattice networks, Examples; poles and zeroes of network functions, restrictions on pole and zero locations for driving-point function, restrictions on pole and zero locations for transfer functions; time-domain behaviour from the pole and zero plot. (10 Hrs.;20 marks)

Unit 4

Two-port parameters : Z parameters, Y parameters, transmission parameters (A,B,C,D,), relationship between parameter sets; parallel connection of two-port networks.
Fourier series and single spectra : Fourier series, evaluation of Fourier coefficients, waveform symmetries as related to Fourier coeffients; Exponential form of Fourier series. (10 Hrs.;20 marks)

Unit 5

Sinusoidal steady-state analysis : Sinusoidal steady state, sinusoid and $e^{\pm j\omega t}$, solution using $e^{\pm j\omega t}$, phasors and phasor diagrams, analysis of series and parallel R-L-C circuits.

4....

Input power, power transfer and insersion loss : energy and power, average and complex power, optimizing power transfer, insersion loss, Tellegen's theorem. (10 Hrs.;20 marks)

References :

1. Network Analysis, third edition, M.E. Van Valkenberg, Prentice-Hall of India.
2. Engineering Circuit Analysis, fifth edition, William Hayt, Jack Kemmerly, McGraw Hill International edition.
3. Networks and Systems, D. Roy Choudhary, New Age International.

List of experiments :

1. Verification of Thevenin's theorem for a two-port reactive network.
2. Verification of Norton's theorem for two-port reactive network.
3. Pole and zero plot of a one-port network.
4. Measurement of Z-parameters of a two-port network.
5. Measurement of Y-parameters of a two-port network.
6. Measurement of transmission parameters (A,B,C,D) of a two-port network.
7. To plot the amplitude and phase response of an all-pass network.
8. To plot the frequency response of a series R-L-C circuit.
9. To plot the frequency response of a parallel R-L-C circuit.
10. To study power tansfer and insersion loss.

The termwork should include a minimum od eight experiments from the above list. The termwork marks will be based on performance in theory and practicals having a weightage of 40% and 60% respectively.

Term I Paper 5
Electrical Installation, Estimation and Distribution

Teaching Scheme :
Lectures : 4 Hrs./week
Drawing : 4 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks

Unit 1

Supply Systems : typical transmission and distribution system from generation to utilization (over-all layout). A.C. transmission, d.c. transmission and comparison between them.

Types of transmission : overhead transmission, underground transmission and comparison between them.

Various systems of transmission : dc systems -- two wire dc, two wire dc with mid-point earthed, dc three wire system; single-phase ac systems -- single-phase two wire, single-phase two wire with mid point earthed, single phase three wire system; two – phase ac systems -- two-phase three wire system, two-phase four wire system; three-phase ac systems - three-phase three wire system, three - phase four wire system.

Cost of conductors in overhead and underground systems.

Economics of generation and tarrifs : types of loads, nature of load variation, load curve, load duration curve, demand factor, load factor, diversity factor, plant capacity factor, plant utilization factor; fixed costs, running costs, depreciation fund; different types of tarrifs. (10 Hrs.;20 marks)

Unit 2

Overhead transmission line components : The supports - poles, towers, and their types; cross arm and clamps; guys and stays. Conductors - characteristics of conductor material, types of conductors - solid conductor, bundle conductor, concentrically standard conductor (AAC, ACSR conductor). Insulators – types (pin,strain,shackle, and suspension insulator), comparison between them, requirement of material, failure of insulators, testing and protection od insulators. Lightening arrestors – types of arrestors, construction, working principle, field of use.

Fuses - types and operation.

Underground cables : classification, construction of cable, requirements of insulating materials, insulation resistance, capacitance dielectric stress in single-core/multi-core/sheathed/ armored cables. Grading of cables - capacitance grading and inter sheath grading. Causes of failure of underground cables, cable faults and location of faults. Feeder pillers, mini pillers. (10 Hrs.;20 marks)

Unit 3

Earthing : necessity, types and earthing in generating stations, transmission, substations and wiring installations as per IE-rules.

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Design of distribution system ; A.C. distribution - service mains design, design of radical and ring distributors for concentrated, distributed loads and combination of both types of loads, feeder design based on Kelvin's law.

(10 Hrs.;20 marks)

Unit 4

Alarm and timer circuits : basic alarm circuits for audible and visible signals, supervisory alarm systems, first alarm, multiple alarm sysems, indicating lamp circuits; types of timers, time sequence charts for reset and sequential timers, time delay relay circuits, thermal time delay and electronic time delay relays.

Control panels : introduction, advantages, symbols used on control panels, types of control panels, control panel components, toggle switches, controllers, timers, relays, protection circuits; introduction to SCADA systems and PLC panels.

Unit 5

Illumination : nature of light, different types of lamps, their comparison and applications, unifrm point source; definitions-plane angle, solid angle, luminous flux, luminous intensity, illuminance and their units, luminous efficiency; laws of illumination - inverse square law and Lambert's cosine law, polar curves.

Requirements of good lighting scheme : Polar curves, direct, indirect, semidirect, semi-indirect lighting.

Design of lighting schemes : factors to be considered, working plane, space to height ratio, absorption factor, maintenance factor, depreciation factor, coefficient of utilization; design of illumination schemes for industrial workshops, assembly halls, street lighting.

Design of flood lighting schemes : factors like reflection factor, waste light factor and beam factor and design of such schemes for typical installation.

Design and Estimation : Design and estimation of installations of domestic, commercial, industrial heads as per IE rules and IS 732; design and estimation of town or village electrification schemes as per IE rules and IS 732

References :

1. Transmission and Distribution, J.B.Gupta, S.K.Kataria and Sons, NewDelhi.
2. Electrical Wiring, Estimating and Costing, S.L.Uppal, Khanna Publishers, NewDelhi.
3. Electric Motor Control, W.N.Alerich, D.B.Taraporewala and Sons, Mumbai-1.
4. Electrical Power, S.L.Uppal, Khanna publishers, New Delhi.
5. Art and Science of Electrical Utilization, H.Pratap, Dhanpat Rai and Sons, New Delhi.
6. Electrical Wiring, Estimating and Costing, B.D.Arora, New Heights, New Delhi.
7. I.E. Rules.
8. Practical Relay Circuits, Frank J. Oliver, D.B.Taraporewala and Sons, Mumbai-1.

Drawing Sheets :

1. Transmission line components : Five insulators - one piece pin, three piece pin type, suspension insulator (one disc), string insulator (one disc), shackle insulator; towers for single circuit and double circuit lines; lightening arrestor, stays, clamps, pins; typical pole including service mains, HT,LT lines supporting pole, 'H' type pole.

2. Distribution substation : Two views (front view and side view) of distribution subsation layout; single line diagram, pipe earthing, plate earthing.

3. Wiring diagrams and symbols : minimum 25 symbols as per IS standards.

Any four circuit diagram out of the following : 1.Rotor resistance starter, 2.Scooter/motor cycle electric wiring diagram, 3.Lift(passenger/goods) or crane, 4.Automatic star/delta starter, 5.Autosynchronous motor starter, 6. battery charging circuit, 7.maximum demand indicator.

4. Project on illumination design of laboratory/workshop or small scale industrial establishment alongwith estimation.

5. Project on electrifiaction of given area showing distributors, feeders and substations alongwith estimation.

The termwork should include five drawing sheets and reports based on the above topics. The termwork marks will be based on performance in theory and practicals having a weightage of 40% & 60% respectively.

Term II Paper 1

Microprocessor Fundamentals and Applications

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

Review of numbering systems, digital logic – tristate, high level, low level, buffers, eccoders, decoders, latches. 8085 Intel microprocessor : organisation, architecture, instruction set, classification of instructions, stack operation. interrupts (10 Hrs. 20 marks)

Unit 2

Programming in assembly language, memory organisations and interfacing, chip capacity, memory module, address space; data transfer techniques – synchronous and asynchronous, interrupt driven data transfer, polling data transfer, parallel data transfer. (10 Hrs. 20 marks)

Unit 3

Data transfer standards, serial data transfer, baud rate, serial protocols, requirements of transmission – speed, synchronization; bus interface standards, RS 232.

New technology in the memory, memories used in computer such as EDORAM, SDRAM – basic introduction; study of some common memories, static memory and dynamic memory. (10 Hrs. 20 marks)

Unit 4

Study of common peripheral devices, their architecture and different modes of operation – 8255 PPI, mode 0,1,BSR mode; 8253 PIT, mode 0,1,2; 8279 keyboard display interface; DMA controller 8257; 8155, static RAM, I/O ports, timer. (10 Hrs. 20 marks)

Unit 5

Digital to analog and analog to digital converters, SAR type.

Microprocessor applications in : power systems – measurement of voltage, frequency, power factor; electrical drives- - stepper motor control, dc motor speed control; protection – over voltage and under voltage protection. (10 Hrs. 20 marks)

References :

1. Microprocessor Architecture, Programming and Applications with the 8085, third edition, Ramesh S. Gaonkar, Persam International (India).
2. 8085 Assembly Language Programming, Leventhal, McGraw-Hill.
3. Microprocessors and Digital Systems, second edition, Douglas V. Hall, McGraw-Hill.
4. Fundamentals of microprocessor and Microcomputer. B.Ram, Dhanpat Rai and Sons, New Delhi.

List of Experiments :

1. Architecture of 8085.
2. Instruction set of 8085.
3. 8255 PPI
4. 8253 PIT
5. D/A and A/D
6. 8259 interrupt controller
7. Application in power measurement
8. Application in electrical drive
9. Application in protection circuits
10. Serial data transfer
11. Study of different memories
12. Application in process instrumentation.

The termwork should include a minimum eight experiments from the above list. The termwork marks will be based on performance in theory and practicals haing a weightage of 40% & 60% respectively.

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Term II Paper 2
Power Systems II

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

Introduction : growth of national and international power systems; constituents of power system and role of each; role of digital computers in operation control and analysis of interconnected and integrated power systems; different aspects of power system analysis and their necessity, relationships and uses both under normal and abnormal conditions.

Complex power : the real, reactive and complex power concepts; load on the system, its composition, nature and variation; load-voltage-frequency, real power-load-frequency and reactive power-voltage-load dependency; methods of voltage control. (10 Hrs.;20 marks)

Unit 2

Long transmission line : V/I relationship, hyperbolic equations, ABCD constants, propogation constant, surge impedence and loading, incident and reflected voltage / currents, efficiency and regulation on load; equivalent 'tee' and 'pi' models; Ferranti effect.

Power system model : Single line - impedance and reactance diagrams and their use; PU system of parameter value representation, relations, selection of base, reduction to common base and advantages; application of impedance diagram. Representation and modelling of three-winding transformer. Development of mathematical models of simple systems by network reduction, nodal-voltage / mesh current form of equations; concept of Z-bus and Y-bus matrices, their inter-relation and simple method of formulation. (10 Hrs.;20 marks)

Unit 3

Symmetrical fault analysis : Sudden 3 phase short--circuit analysis of unloaded alternator--subtransient, transient and steady state currents and impedences, dc offset and effect of the instant of short--circuit on the waveforms; estimation of fault currents with and without pre-fault current for simple power systems; selection of circuit breakers and current limiting reactors.

Unsymmetrical fault analysis : method of symmetrical components, relationships, advantages and sequence impedences; representation of power systems by positive, negative and zero sequence diagram with p.u. values of parameters, nature of sequence impedences of system components; line-line, line-ground and line-line-ground faults analysis of unloaded and pre-loaded alternators and simple power systems with & without fault impedence. (10 Hrs.;20 marks)

Unit 4

Load flow analysis : Concept of load flow analysis; formulation of power flow equations (PFE's) for a n-bus power system, characteristics and planning of solution of PFE's, consideration of constraints, bus classification in adopting final strategy of solution of the PFE's. Outline of Gauss, Gauss-seidal and Newton-Raphson methods to solve genral non--linear algebraic equations of the same form as the PFE's (Numericals restricted upto two simultaneous equations). (10 Hrs.;20 marks)

Unit 5

Power system stability : Concept of steady-state, dynamic and transient stability of power systems and the factors controlling each. Steady-state stability, its evaluation and variation of limits of stability under system conditions. Introduction to dynamic stability concepts, controlling factors and need for its considerations in modern systems. Transient stability and importance of rotating machine dynamics in system stability evaluation; the swing equation, its derivation, nature of its likely solution and uses. (10 Hrs.;20 marks)
(consideration of one machine-infinite bus problem only).

References :

1. Elements of Power System Analysis, W.D.Stevenson, Tata McGraw-Hill.
2. Introduction to Electrical Energy Systems Theory, Olle I. Elgard, Tata McGraw-Hill.
3. Modern Power System Analysis, I.J.Nagrath, D.P. Kothari, Tata McGraw Hill.
4. Power System Analysis and Design, B.R.Gupta.
5. Power System Stability-Vol.I, E.W. Kimbark.
6. Electrical Power Systems, Weedy.
7. Synchronous Machine, G.C.Jain.

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List of Experiments :

1. Measurement of ABCD constants of long transmission line and plotting of its circle diagram to estimate performance parameters.
2. The effect of VAR compensation on recieving and voltage profile of transmission line using capacitor bank.
3. Determination of steady state power limit of a transmission line.
4. Measurement of sub-transient reactances of a salient pole synchronous machine by static/Daton-Cameron method.
5. Study of load flow on a three-bus power system using A.C. network analyser or by actual simulation.
6. Measurement of sequence reactances of a synchronous machine.
7. Fault analysis for symmetrical 3-phase fault by simulation or by A.C./D.C. analyser.
8. Unsymmetrical fault analysis for LL,LG,LLG faults on A.C./D.C. network analyser.
9. Steady state stability study on a synchronous motor and plotting P-delta curve.
10. Computer-aided solution of a 3-bus load flow problem using Gauss-Seidal method
11. Formulation of "Y-BUS" matrix using computer program.

The tormwork should include a minimum od eight experiments from the above list. The termwork marks will be basad on performance in theory and practicals having a weightage of 40% and 60% respectively.

Term II Paper 3

Industrial Organization and Management

Teaching Scheme :
Lectures : 4 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)

Unit 1

Basic management : meaning and definitions-management, administration, organization concepts, evolution of management science, contributors to management science, whether management is an art, science or a profession ?, functions of management and importance of management in modern society.

Forms of business organization : different forms of business organizations, organization structures in industry.

(10Hrs ;20marks)

Unit 2

Elementry economics : basic economic concepts, laws of demand and supply, law of diminishing marginal utility, elasticity of demand and supply; money -- its evolution, functions of money, different forms of money.

Indian economy : features of Indian economy, economics of scale of production, liberalisation and its effect on Indian economy; foreign trade (import, export) of India. (10Hrs.;20marks)

Unit 3

Plant location and plant layout : factors governing plant location, different types of layout.

Work study : techniques of work study -method study and work measrement; therbligs, different charts, diagrams used in method study. (10Hrs.;20marks)

Unit 4

Personnel management : manpower planning, recruitment, selection and training of employees, wage; administration-job evaluation, merit rating, incentives; different methods of wage payments, essentials of a good wage incentive plan.

Financial management : capital, types of capital, sources of capital, financial institutions, elements of cost, depreciation, stores and inventory control, methods/techniques of inventory control; money market and capital market, role of SEBI. (10Hrs.;20marks)

Unit 5

Marketing management : marketing and selling concepts, market survey and market research; manngement and productivity; advertising-media of advertising.

Industrial laws : The factories act, minimum wages act, pollution control act, workmen's compensation act, apperentice act; industrial safety-causes of accidents, prevention of accidents, legal provisions.(10Hrs.;20marks)

References :

1. Management, Harold Koontz, O D'onnel
2. Industrial Engineering and Management, O.P.Khanna.
3. Elementry Economics Theory, K.K.Dewett.
4. Indian Economy, Dutta, Sundaram.
5. Modern Business Organization and Management, S.A.Sherlekar.
6. Marketing management, Philip Kotler.
7. Personnel management, C.B.Mamoria.

Term II Paper 4
Electrical Measurements II

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 2 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks
Practical : 25 marks

Unit 1

A.C. bridges : classification, Maxwell, Anderson, Hay, Schering, Campbell and Weinbridges; accessories and errors.
Special measuring instruments : construction and principle of operation of single and three phase power-factor meters, frequency meters, synchroscopes, trivector meter and maximum demand indicator, multimeters, digital C.R.O.

(10Hrs.;20marks)

Unit 2

Introduction to instrumentation :definition, purpose of instrumentation; measurement-definition, types, classification of instruments, generalized measurement system, standards, calibration.
Instrument response : instrument response to step input, ramp input, sinusoidal input upto second order systems.
Errors : types-gross, systematic, random errors; limiting error, sources of error, techniques to minimise them.

(10Hrs.;20marks)

Unit 3

Introduction to transducers : definition, classification, selection of transducers.
Measurement of temperature : using RTD, thermistor, thermocouple, bimetallic thermometers, pressure thermometers, pyrometers.
Pressure measurement : Bourden tube, bellows, diaphargm.
Vaccum measurement : McLeod gauge, Pirani gauge.

(10Hrs.;20marks)

Unit 4

Flowmeasurement : Rotameter, electromagnetic flow meter, hot wire anemometer, ultrasonic flow meter.
Level measurement : mechanical, pneumatic methods; electrical methods - capacitance level guage, hot wire or carbon resistance method, nucleonic level gauge, ultrasonic method.
Displacement measurement : LVDT; strain gauges - types, working principle, measurement circuitry, temperature compensation, applications.

(10Hrs.;20marks)

Unit 5

Recorders : necessity, construction, working principle of recorders, types-strip chart, circular chart, self-balancing potentiometric type, X-Y recorder, ultra violet recorder.
Electronic techniques : for measurement of current, voltage, power, energy, phase angle and true r.m.s. values.

(10Hrs.;20marks)

References :

1 Electrical Measurements and Measuring Instruments, fifth edition, Golding, Widding, Y.P. Chopra (A.H. Wheeler and Co.Ltd.)
2. Fundamentals of Electrical Measurements, second edition, C.T.Baldwin, Lyall Book Depot.
3. Measurement Systems - Applications and Design, fourth edition, E.B.Doeblin, McGraw-Hill International edition.
4. Instrumentation, Measurement and analysis, B.C. Nakva, K.K. Chaudhry, Tata McGraw-Hill.
5. A course in Electrical and Electronic Measurements and Instrumentation, eleventh edition, A.K. Sawhney, Dhanpat Rai and Sons.
6. Electronic Instrumentation, H.S.Kalsi, Tata McGraw-Hill.

List of Experiments :

1 Measurement of inductance by Anderson's bridge.
2. Measurement of capacitance and loss angle of a capacitor by Schering bridge.
3. Measurement of frequency/mutual inductance by Campbell's frequency bridge.
4. Strain measurement using strain gauge.
5. Study of LVDT.

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6. Temperature measurement by RTD/thermistor/thermocouple.
7. Study of pressure transducers.
8. Study of recorders.
9. Speed measurement by magnetic pick-up/photoelectric method.
10. Study of C.R.O.'s of different types and their applications.
11. Step response of meters.
12. Measurement of Systematic error of wattmeters.

The termwork should include a minimum of eight experiments from the above list. The termwork marks will be based on performance in theory and practicals having a weightage of 40% and 60% respectively.

Term II Paper 5
Principles of Electrical Machine Design

Teaching Scheme :
Lectures : 4 Hrs./week
Practical : 4 Hrs./week

Examination scheme :
Paper : 100 marks
(3 Hrs. duration)
Termwork : 25 marks

Unit 1

Introduction : principles of design and design factor, ratings, specifications, standards, performance and other criteria to be considered; brief study of magnetic, electric, dielectric and other materials.
Heating/cooling and ventilation : study of different modes of heat generation, temperture rise, heat dissipation; heating/ cooling cycles, thermal heating time constants, cooling time constants, their estimation, dependence and applications. (10Hrs.;20marks)

Unit 2

Design of electrical apparatus and devices : detailed design of heating coils, rotor resistance starter, regulators, field coils, choke coils and lifting magnets. (10Hrs.;20marks)

Unit 3

Design of transformers : design of distribution and power transformers-types, classification and specifications; design of main dimensions, core, yoke, winding, tank (with or without cooling tubes) and cooling tubes/radiators; estimation of leakage reactance for equal heights for h.v. and l.v. windings. Resistance of windings, calculation of method current, calculation of losses, determination of voltage regulation and efficiency; calculation of mechanical forces developed during short circuits, their estimation and remedies to overcome them. (10Hrs.;20marks)

Unit 4

D.C. machine windings : types of dc windings; choice and design of simplex and duplex lap and wave windings; equalizer connections, dummy coils; concept of multiplex windings and reasons for choosing them. (10Hrs.;20marks)

Unit 5

A.C. machine windings : single and double layer, single phase ac winding with integral and fractional slots; single and double layer, integral and fractoinal slots, 3 phase ac windings. (10Hrs.;20marks)

References :

1. Performance and Design of DC machines, third edition, A.E.Clayton, ELBS, Issac Pitman and Sons.
2. Performance and Design of AC machines, third edition, M.G.Say, ELBS, Pitman and Sons.
3. Electrical Machine Design, tenth edition, A.K.Sawhney, Dhanpat Rai and Sons., New Delhi.
4. Electrical Machine Winder, N.Vinogradov, MIR publication.
5. Repair of windings and insulation in Electrical Machines, N.Perelmuter.
6. D.C. Machines, Say and Taylor, ELBS, Pitman and sons.
7. A.C. Motor Winding, Hopwood, Taraporewala and Sons, Mumbai.
8. Modern Power Transformer Practice, first edition, Feinberg, MacMillan.
9. Transformers, BHEL, Bhopal.

Drawing Sheets :

1. One of the electrical devices from the following :
   a) Rotor resistance starter for slip ring induction motor.
   b) D.C. Shunt/series generator field regulator.
   c) D.C. Shunt/series motor field regulator for speed control.
   d) Lifting magnet.
2. Details and assembly of 3-phase transformer.
3. Details and layout of DC and AC winding.

The termwork should include three drawing sheets and reports based on actual design of the above topics. The termwork marks will be based on performance in theory and drawing work having a weightage of 40% and 60% respectively.

Term II Subject 6

Practical Training / Special Study / Minor Project

Common with TE (Electronics, Industrial Electronics, Electronic and Telecomm. Engg & Computer Engg., Electrical Engg., Mech. & Prod. Engg. Instrumentation.)

Examination scheme :
Termwork : 25 marks

Every student need to complete following requirements for termwork of practical training/special study/ minor project. Practical training in any industry for a period of minimum two weeks and submit training report certified by personnel manager or works manager or any other higher authority of that industry.

OR

Special study on a recent topic from reported literature and submit a report on it.

OR

One mini theoritical or fabrication project and submit a report on it.

OR

Attend a course of Enterpreneurship Development course conducted by college and submit a report on it.

Note :-

1. Practical training is to be undergone in summer vacation after S.E. and/or winter vacation after first term of T.E.
2. Report should be typed on A4 size paper and three copies in paper bound are to be prepared, one copy is for the candidate, one for the library and one for the teacher concerned.
