University of Pune
S.E. Electrical Engineering 2008 - Course (w.e.f. 2009)

Semester-I

Sr. No	Subject No.	Subject	Teaching Scheme		Examination Scheme				Total Marks
			L	P	P	TW	PR	OR	
01	202001	Power Plant Engineering	04	02	100	**50**	----	----	150
02	207003	Engineering Maths III	04	-----	100	----	----	----	100
03	203141	Material Science	04	02	100	50	----	----	150
04	203142	Analog & Digital Electronics	04	02	100	**----**	50	----	150
05	203143	Electrical Measurements and Instrumentation	04	02	100	----	50	----	150
06	211121	Modern Manufacturing Techniques	----	02	-----	50	----	----	50
Total			**20**	**10**	**500**	**150**	**100**		**750**

Semester-II

Sr. No	Subject No.	Subject	Teaching Scheme		Examination Scheme				Total Marks
			L	P	P	TW	PR	OR	
01	203144	Power System I	04	----	100	----	----	----	100
02	203145	Electrical Machines I	04	02	100	---	50	----	150
03	203146	Network Analysis	04	02	100	**50**	----		150
04	203147	Digital Computational Techniques	04	----	100	----	----	----	100
05	203148	Computer Programming	02	02	----	**50**	50	----	100
06	203149	Microprocessor Fundamental & Applications	04	02	100	-----	----	50	150
Total			**22**	**08**	**500**	**100**	**150**		**750**

Note : Practical/ Oral is based on Term Work.

202001: Power Plant Engineering

Teaching Scheme
Lectures: 4 Hrs / week

Practical: 2 Hrs / week

Examination Scheme
Paper: 100 Marks
Duration : 3 hrs
Term Wok: 50 Marks

Unit 01 **Fuels and Combustion:** Thermodynamic cycle of steam flow; Rankine cycle; Actual Rankine cycle; Reheat cycle; Carnot cycle, heat rate. Classification of fuels; calorific value and its determination; combustion chemistry; Bomb calorimeter; Boy's gas calorimeter; combustion equation; stoichiometric air fuel ratio; excess air requirement; actual air fuel ratio; flue gas analysis; pulverized coal firing system; fluidized bed combustion. **08 hrs**

Unit 02 **Thermal Power Plants:** **08 hrs**
Types of boilers, Feed water and its treatment, Steam turbine and alternators.
Site selection, Main parts and its working.
Fuel Handling: delivery of load, unloading, preparation, transfer, outdoor (dead) storage, indoor (live) storage, In plant Handling, Coal weighing.
Ash disposal and dust collation: Draught systems, electrostatic precipitator
Prospectus and development of thermal plants in India

Unit 03 **Hydro Power Plant:** **06 hrs**
Site selection, Hydrology, storage and pondage, general arrangements and operation of hydro power plant, Hydraulic turbines, turbine size, pelton wheel turbine, Francis and Kaplan turbines, selection of turbines, Dams, Spillways, gates, intake and out take works, canals and layout of penstocks, water hammer and surge tank, simple numerical on hydrographs and number of turbine required
Prospectus and development of hydro plants in India

Unit 04 **Nuclear power plant:** **08 hrs**
Introduction, atomic physics, nuclear reaction, materials, site selection, nuclear reactors and working of each part, classification of nuclear reactor, , nuclear waste disposal, plant layout, Prospectus and development of nuclear plants in India
Diesel Power Plants:
Introduction, Site selection, Main components and its working, Diesel plant efficiency and heat balance, choice and characteristic of diesel power plant.

Unit 05 **Gas power plant:** **08 hrs**
Simple gas turbine power plant, methods to improve thermal efficiency, open loop and closed loop cycle power plants, gas fuels, gas turbine materials, plant layout.
Non-conventional power plant:
Sources, MHD plants, solar energy, fuel cells, tidal power generation, geothermal power generation , wind power stations, Prospectus and development of non conventional power plants in India
Comparison of all power plants

Unit 06 Economics Aspects of Power Generation: **06hrs**

Introduction, terms commonly used in system operations, factors affecting cost of generation, reduction of cost by interconnecting generators, choice of size and number of generator units, Input output curves of thermal and hydropower plants, Incremental fuel rate curves, incremental fuel cost curve, constrints on economic generation, economic loading of generators, load allocation among various generators, base load and peak load plants.

Practicals: The term work shall consist of a record of any eight of the following:

1. Study of boiler mounting and accessories.
2. Study of modern thermal power plant.
3. Demonstration and study on diesel engine.
4. Demonstration and study on diesel power plant.
5. Study of modern hydro electric power plant.
6. Demonstration and study of solar photo voltaic system.
7. Demonstration and study of any water turbine.
8. Demonstration and study of a centrifugal pump.
9. Demonstration and study of a pelton wheel turbine, Francis and Kaplan turbines.

Text Books

1. P. K. Nag : Power Plant Engineering ,Tata McGraw Hil
2. Dr. P. C. Sharma: Power Plant Engineering ,
3. Chakrabarti, Soni, Gupta, Bhatnagar "A text book on power system Engineering" Dhanpat Rai publication
4. R.K.Rajput, "Power Plant Engineering"
5. J B Gupta, , "Power Plant Engineering"

Reference Books

1. Arora and Domkundwar: A course in Power Plant Engineering , Dhapat Rai publication

2. S. P. Sukhatme : Solar Energy

207003 ENGINEERING MATHEMATICS – III (2008 Course)

Teaching Scheme:
Lectures: 4 hrs./week

Examination Scheme:
Paper: 100 marks
Duration: 3 hrs.

SECTION I

Unit I: Linear Differential Equations (**LDE**) (09 Hours)

Solution of n^{th} order LDE with Constant Coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous & Symmetric Simultaneous DE, Modeling of Electrical Circuits.

Unit II: Complex Variables
(09 Hours)

Functions of Complex Variables, Analytic Functions, C-R Equations, Conformal Mapping, Bilinear Transformation, Cauchy's Theorem, Cauchy's Integral Formula, Laurent's Series, Residue Theorem

Unit III: Transforms (09 Hours)

Fourier Transform (FT): Complex Exponential Form of Fourier Series, Fourier Integral Theorem, Sine & Cosine Integrals, Fourier Transform, Fourier Sine and Cosine Transform and their Inverses, Application to Wave Equation.

Introductory Z-Transform (ZT): Definition, Standard Properties, ZT of Standard Sequences and their Inverses. Solution of Simple Difference Equations.

SECTION II

Unit IV: Statistics and Probability (09 Hours)

Measures of Central Tendency, Standard Deviation, Coefficient of Variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression Estimates

Theorems and Properties of Probability, Probability Density Function, Probability Distributions: Binomial, Poisson, Normal and Hypergometric; Test of Hypothesis: Chi-Square test.

Unit V: Vector Differential Calculus (09 Hours)

Physical Interpretation of Vector Differentiation, Vector Differential Operator, Gradient, Divergence and Curl, Directional Derivative, Solenoidal, Irrotational and Conservative Fields, Scalar Potential, Vector Identities.

Unit VI: Vector Integral Calculus (09 Hours)

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence Theorem, Stoke's Theorem, Applications to Problems in Electro-Magnetic Fields.

Text Books:

1. Advanced Engineering Mathematics by Peter V. O'Neil (Cengage Learning).
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).

Reference Books:

1. Engineering Mathematics by B.V. Raman (Tata McGraw-Hill).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, Wylie C.R. & Barrett L.C. (McGraw-Hill, Inc.)
4. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
5. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
6. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

203141: Material Science

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical: 2 Hrs / week	Term Work: 50 Marks

Unit 01 **A) Dielectric Properties of Insulating Materials:** Static Field ,Dielectric Parameters [Dielectric constant, Dipole moment, Polarization, Polarizability], Mechanisms of Polarizations-Electronic, Ionic and Orientational Polarization (Descriptive treatment only), Clausius Mossotti Equation, Piezo-Electric, Pyro-Electric & Ferro-Electric Materials, Dielectric Loss and loss Tangent. **08 hrs**

B) Optical Properties of Materials & Cells used for Power Generation: Photo-Conductivity, Photo-Electric Emission, Photo-Voltaic cells [Materials Used, Construction, Equivalent Circuit, Working and Application], Photo-Conductive cells, Photo-Emissive cells

Unit 02 **A) Insulating Materials, Properties & Application:** **08 hrs**

Introduction, Characteristics of Good Insulating Material, Classification, Solid Insulating Materials-Paper Press Board, Fibrous Materials, Ceramics, Mica & Asbestos. Liquid Insulating Materials such as Transformer Oil, varnish , Askarel, Insulating Gases like Air, SF_6, Insulating Materials for Power & Distribution Transformers, Rotating Machines, Capacitors, Cables, Line Insulators and Switchgears

B) Dielectric Breakdown: Introduction, Concept of Primary & Secondary Ionization of Gases(Descriptive treatment only), Breakdown Voltage, Breakdown Strength, Factors affecting Breakdown Strengths of Gaseous, Liquid and Solid Dielectric Materials. Breakdown in Vacuum.

Unit 03 **Magnetic Materials**: **06 hrs**

Introduction, Magnetic Parameters [Permeability, Magnetic Susceptibility, Magnetization], Classification of Magnetic Materials, Diamagnetism, Para-magnetism, Ferro-magnetism, Ferri-magnetism, Ferro-magnetic behavior below Critical Temperature, Spontaneous Magnetization & Curie-Weiss law, Anti-ferromagnetism, Ferrites, Applications of Ferro-magnetic Materials, Magnetic materials for Electric Devices such as Transformer Core , Core of Rotating Machines, Soft Magnetic Materials, Hard Magnetic Materials, Magnetic Recording Materials, Compact Discs

Unit 04 **Conducting Materials:** **06 hrs**

General Properties of Conductor, Electrical Conducting Materials - Copper, Aluminum and its applications, Materials of High & Low Resistivity - Constantan, Nickel-Chromium Alloy, Tungsten, Canthal, Silver & Silver alloys ,Characteristics of Copper Alloys (Brass & Bronze), Materials used for Lamp Filaments, Transmission Lines, Electrical Carbon Materials, Material used for Solders, Metals & Alloys for different types of Fuses, Thermal Bimetal & Thermocouple

Unit 05 Nanotechnology: **08 hrs**

Introduction, Concepts of Energy bands & various Conducting Mechanism in Nano-structures, Carbon Nano-structures, Carbon Molecules, Carbon Clusters, Carbon Nano-tubes, Applications of Carbon Nano-tubes, Special Topics in Nano Technology such as Single Electron Transitor , Molecular Machines, BN Nanotubes, Nano wires.

Unit 06 Testing Of Materials: **08 hrs**

1. Measurement of Tangent of Dielectric Loss Angle (tan δ) by Schering Bridge-IS 13585-1994
2. Measurement of Dielectric Strength of Solid Insulating Material-IS 2584
3. Measurement of Dielectric Strength of Liquid Insulating Material -IS 6798
4. Measurement of Dielectric Strength of Gaseous Insulating Material -IS 2584
5. Measurement of P.F. and partial discharge of high voltage cables.
6. Testing of high voltage bushing.
7. Measurement of Flux Density by Gauss-meter

List of Experiments:

At least two experiments should be designed by the faculty members and can be included in the term work apart from the experiment list given below. SIX experiments from the list below and remaining two from the experiments designed and set up by the faculty member will form part of term work.

1. To measure electric strength of solid insulating materials as per IS 2584
2. To measure electric strength of liquid insulating materials as per IS 6798.
3. To measure electric strength of gaseous insulating materials using Sphere Gap-Unit.
4. To obtain Hysteresis Loop of the Ferro-Magnetic Material.
5. To understand the principle of thermocouple & to obtain characteristics of different thermocouples.
6. To measure Insulation Resistance & KVAr capacity of power capacitor.
7. To measure Resistivity of High Resistive Alloys.
8. To observe development of tracks due to ageing on different insulating materials e.g. Bakelite, Perspex, Mica, Micanite, Fiberglass etc.
9. Testing of Cables as per IS 6380, 6474.
10. Measurement of Tangent of Dielectric Loss Angle (tan δ) by Schering Bridge
11. Measurement of Flux Density by Gauss-meter

Industrial Visits: Minimum one visit should be arranged to an industry related to material science. A hand written report should be submitted by every student as part of term work.

Text Books:

1. A Course in Electrical Engineering Materials by S. P. Seth, Dhanpat Rai and Sons, Delhi -6.
2. Electrical Engineering Materials, T.T.T.I, Madras
3. Electrical Engineering Materials by K. B. Raina & S. K. Bhattacharya, S. K. Kataria & Sons, Delhi-06.
4. Nanotechnology - A gentle introduction to next big idea by Mark Ratner & Daniel Ratner, Pearson Education
5. Introduction to Nanotechnology by Charles P. Poole, Jr. Frank & J. Ownes (Wiley Student Edition)
6. Introductioin to Nano Science & Technology – Chattopadhyay – PHI Publication

7. Material Science for Electrical Engineering by P.K. Palanisamy, Scitech Pub.(India) Pvt. Ltd., Chennai

Reference Books:

1. Electrical Power Capacitors-Design & Manufacture by D. M. Tagare, Tata McGraw Hill Publication.
2. Electrical Engineering Materials by S. P. Chalotra & B. K. Bhatt, Khanna Publishers, Nath Market, Delhi-06
3. Electrical Engineering Materials by C. S. Indulkar & S. Thiruvengadam, S. Chand & Com.Ltd, New Delhi -55
4. Introduction to Material Science for Engineering by James F. Shackelford, M.K. Muralidhara, Pearson Education, Sixth Edition.

203142: Analog and Digital Electronics

Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical: 2 Hrs / week	Practical: 50 Marks

Unit 01 BJT amplifier with reference to operational analysis of CE, CB and CC configuration, their input-output characteristics, AC-DC load line analysis, Class A, amplifier. Multistage BJT amplifier-direct, RC coupled and transformer coupled, Darlington pair, Push-Pull amplifier and differential amplifier FET-construction, Parameters, Characteristics. **08 hrs**

Unit 02 Op- Amp : Block diagrams of 741 and 324 , ideal and practical parameters open loop and close loop configuration of Op-Amp. Applications of Op-Amp, Integrator, differentiator, Comparator, Schmitt trigger, instrumentation amplifier, precision rectifiers, zero crossing detectors, V-I and I-V converters **08 hrs**

Unit 03 Waveform generation using Op-amp - sine, square, saw tooth and triangular generator, peak detector, IC 555 –construction, working and modes of operation - astable, monostable and multivibrators, Sequence generator, voltage regulators using ICs Viz. 78xx, 79xx, LM 317, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters **06 hrs**

Unit 04 Numbering Systems and Boolean algebra- numbering systems-binary, octal, decimal and hexadecimal and their conversion, codes-BCD, Grey and excess3, Binary arithmetic:- addition and subtraction by 1's and 2's compliment.
Revision of logic gates, Booleans algebra, De-morgon's theory etc. K-map: - structure for two, three and four variables, SOP and POS form reduction of Boolean expressions by K-map 1-bit comparator analysis using K-map **08 hrs**

Unit 05 Flip flops – R-S, Clocked S-R, D latches, Edge triggered D flip-flops, Edge triggered JK flip flops, JK Master - slave flip flop, Registers and Counters, Buffer registers, shift registers, controlled shift registers, asynchronous counters,
synchronous counter, twisted ring counters, N - module counters. **08 hrs**

Unit 06 Multiplexer, Demultiplexer using K-map, ADC, Dual slope SAR, DAC-binary weighted, ladder type, Memories: RAM-static& dynamic, ROM, PROMS and EPROMS , EEPROMS detailing. **06 hrs**

Lab Experiments:

Minimum 10 experiments to be conducted.

1. Transistor amplifiers: frequency response of BJT, multistage BJT amplifier and FET amplifier.
2. Op-amp as square, sine and triangular wave generator.
3. Op-amp as ZCD, Comparator and Schmitt trigger.
4. Instrumentation amplifier using 3 - op amp CMR measurement and precision rectifier
5. IC-555 applications- astable, monostable, sequence counter.

6. Study and verify shift register operation (IC 7495) and application of 7495 as pseudo random no. generation
7. Voltage regulation of IC VR 78xx, 79xx and LM317
8. Study of counters, ring counter and twisted ring counter.
9. A to D and D to A converter using ADC 0809 and DAC 0808.
10. Study of up - down counters (IC 74192/74193) and N- modulo counter. (IC 7490/7493).
11. Study of various flip-flops and verification of truth table.
12. Study of Multiplexer and Demultiplexer.
13. Study of active filters- Low pass and high pass filters.

Text Books:

1. Fundamentals of Logic Design by Charles H. Roth, Jr. Forth Edition, A Jaico Book.
2. Digital Computer Electronics - An Introduction to Microcomputers by Malvino, Tata McGraw Hill
3. Electronics Devices & Circuits by Mottershed, PHI New Delhi
4. Digital Electronics by R. P. Jain, Tata McGraw Hill, New Delhi.
5. Digital Electronics-Principles and Application-Tokheim 6th edition, Tata McGraw Hill, New Delhi.
6. Introduction to Electronics for Engineers and Scientists by Raja Raman, Vishwanathan and Mehata.

References Books:

1. Operational Amplifier by Gaikwad R. PHI New Delhi
2. Integrated Circuits by K. R. Botkar, Khanna Publication, New Delhi.
3. Operational Amplifier and Linear Integrated Circuits Theory and Application by James M. Flore, A Jaico Books

203143: Electrical Measurements and Instrumentation

Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical: 2 Hrs / week	Practical: 50 Marks

Unit 01 **A) Measurement and Instrumentation theory:** Characteristics of measuring instruments: Static and dynamic, accuracy, linearity, speed of response, dead zone, repeatability, resolution, span, reproducibility, drifts. Need for calibration, standards and their classification. Block diagram of generalized instrumentation system. Classification of measuring instruments - Absolute and secondary instruments, types of secondary instruments: indicating, integrating, and recording, analog / digital. **08 hrs**

B) Essentials of indicating instruments: deflecting, controlling and damping systems. Construction, working, torque equation, various advantages and disadvantages of MI (attraction and repulsion), and PMMC.

C) Ammeter and Voltmeter theory: Extension of range of ammeters and voltmeters using shunt, multiplier. Universal shunt, Universal multiplier. Block diagram and operation of digital ammeters and voltmeters in brief.

Unit 02 **A) Measurement of Resistance :** **06 hrs**

Measurement of low, medium and high resistance. Kelvin's Double Bridge, Ammeter-Voltmeter method, Megger, Earth tester for earth resistance measurement, measurement of insulation
resistance when power is ON.

B) A.C. Bridges: Introduction, sources & detectors for a.c. bridge, general equation for bridge at balance. Measurement of Inductance: Maxwell's Inductance & Maxwell's Inductance – Capacitance Bridge, Andersons Bridge.
Measurement of Capacitance: Shearing Bridge.

Unit 03 **A)Wattmeter theory and measurement of power**: Construction, working, torque equation, errors and their compensation, advantages/disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Power measurement in three phase system. **08 hrs**
Power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method. Modification of two wattmeter method by single wattmeter & two way switch, measurement of reactive power, determination of power factor of the load and its nature in terms of two wattmeter readings

B) Special purpose measuring instruments:
Block diagram and operation of digital meters: Power factor meter, frequency meter, Power analyzer, tri-vector meter, TOD meter, multi meter.

Unit 04 **A) Energy meter theory:** Construction, working, torque equation, errors and adjustments of single phase conventional (induction type) energy meter, Block diagram and operation of electronic energy meter. Three-phase energy meters. **06 hrs**

B) Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages of CT / PT over shunt and multipliers for range extension, transformation ratio, turns ratio, nominal ratio, burden etc, ratio and phase angle error. (No derivation of formulae is expected)

Unit 05 **A) Oscilloscope:** Introduction, various parts, front panel controls, block diagram of dual trace and dual beam CRO, use of CRO for measurement of voltage, current, period, frequency, phase angle & frequency by lissajous pattern. **08 hrs**

B) Transducers: Introduction, classification, basic requirements, types: Resistive, inductive, Capacitive (brief treatment only), advantages of electrical transducers.

C) Pressure measurement: Introduction, classification of pressure as low / medium / high, absolute / guage / vacuum, static / dynamic & head pressure.
high pressure measurement using electric methods, low pressure measurement by McLeod guage and pirani gauge, capacitive pressure transducer.

Unit 06 **A) Flow measurement:** Introduction, types of flow, flow measurement methods / meters: Nozzle, Orifice, Venturi-meter, Pitot tube, Rotameter, electromagnetic flow meter, ultrasonic flow meter, hot wire meter **08 hrs**

B) Level measurement: Introduction and importance of level measurement, level measurement methods: mechanical, hydraulic, pneumatic, electrical, nucleonic, ultrasonic.

C) Displacement measurement: LVDT – construction, working, application, null voltage, specifications, advantages / disadvantages, effect of frequency on performance. RVDT. Strain Gauge: Introduction, definition of strain, types of strain gauge: Wire strain gauge, foil strain gauge, semiconductor strain gauge etc; their construction, working, advantages and disadvantages. Construction, working and application of load cell.

List of Experiments:

The term work shall consist of any 8 experiments from above list, out of which last experiment is compulsory.

1. Measurement of power in three phase circuit using two wattmeter method (Balanced & Unbalanced Loads)
2. Measurement of Reactive power in three phase balanced circuit using one wattmeter method and by one wattmeter method with two way switch.
3. Calibration of Single phase or Three phase static energy meter at different power factors using Digital meters.
4. Measurement of Low resistance using Kelvin's Double Bridge.
5. Measurement of inductance using Anderson's Bridge.
6. Earth resistance measurement by Earth Tester.

7. Electrical methods for measurement of liquid level.
8. Displacement measurement by LVDT.
9. Determination of characteristics of various pressure Transducers.
10. Extension of instrument range: ammeter, voltmeter, watt meter using CT / PT.
11. Measurement of power in three phase four wire using three CTs and Two wattmeters.
12. Study and use of CRO for measurement of Current, Voltage, Time period, Frequency, Phase angle.

Text Books:

1. A Course in Electrical and Electronic measurements & Instrumentation – by A. K. Sawhaney, Dhanpat Rai & Suns
2. A Course in Electronic and Electronic measurements by J. B. Gupta, S. K. Kataria & Sons.
3. Instrumentation: Measurement and Analysis by Nakra & Chaudhari Sixth Reprint, Tata McGraw Hill, New Delhi.
4. Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers, New Delhi.

Reference Books:

1. Electrical measurement & measuring instrument by E. W. Golding & widing, Fifth edition, A. H. Wheeler & Co. ltd.
2. Electonic measurement and instrumentation by Dr. Rajendra Prasad, Khanna Publisher, New Delhi.
3. Introduction to Measurements and instrumentation by Ghosh, Second Edition PHI Publication.
4. Introduction to Measurements and instrumentation by Anand PHI Publication.

211121: Modern Manufacturing Techniques

Teaching Scheme: Examination Scheme:

Practical: 2 Hours/Week Term Work: 50 Marks

TERM WORK

A. Following termwork should be covered by giving demonstration of different machine tools and metrology instruments.

1. Study and working of machine tools - Lathe, milling and drilling etc.

2. Study of casting process.

3. Study of welding and joining processes.

4. Study of metrology and measuring instruments such as

i) Linear use of micrometer/ vernier/ dial gauge,

ii) Angular use of sine bar and slip gauges,

iii) Surface roughness measurement.

Students should submit assignments based on the above topics

B. Term work consisting of job on following processes:

1. Plain and taper turning : 1 job

2. Welding / Soldering : 1 job

3. Sheet metal working : 1 job

Sketches of jobs along with operation sequence should be submitted by each student

List of Books:

1. Manufacturing Technology by P.N.Rao., Volume I & II

2. Workshop Technology by Hazara Choudhary, Volume I & II

3. Engineering Metrology by R.K.Jain.

203144: Power System-I

Teaching Scheme
Lectures: 4 Hrs / week

Examination Scheme
Paper: 100 Marks
Duration : 3 hrs

Unit 01 **A) Load curve** , load duration curve, different factors connected with generating stations such as load factor, demand factor, diversity factor, plant capacity factor, annual plant use factor. Concept of base load and peak load stations and interconnected operation. Fitting of available stations into the area load duration curve. **06 hrs**

B) Tariff : Residential, commertial, H.T., L.T. Time of Day tariff, Incentives and penalties.

Unit 02 **A) Major Electrical equipments in Power Stations** : Descriptive treatment of ratings, Special features, field of use of equipments like alternators, transformers, bus-bars exciters and excitation systems, voltage regulators, switches and isolators, reactors, carrier current equipments (P.L.C.C.), Control panels, metering and other control room equipments in generating stations. **08 hrs**

B) Overhead line insulators : Types of insulators, pin type, suspension type, strain type insulators, voltage distribution along string of suspension insulators, string efficiency, Equalization of potential across each unit.

Unit 03 **Constants of Transmission Line :** Inductance, Resistance of line, skin effect and its effects, proximity effect, inductance of single phase two wire line, flux linkage of one conductor of one group, inductance of composite conductor line , concept of G.M.R. and G.M.D., inductance of three phase line with equilateral spacing, inductance of parallel circuit three phase line, three phase line with equilateral spacing, unsymmetrical spacing, double circuit three phase line, Calculation of inductance to be done with and without transposition. **08 hrs**

Unit 04 **Constants of Transmission line: capacitance:** Concept of G.M.R. and G.M.D for capacitance calculations, capacitance of three phase line with equilateral spacing, capacitance of parallel circuit three phase line with equilateral spacing, unsymmetrical spacing, double circuit three phase line, capacitance of single phase line with earth effect and without effect of earth's surface on electric field, calculation of capacitance to be done with and without transposition. **08 hrs**

Unit 05 **A) Circuit Representation of Lines and generalized Circuit Constants** : Classification of lines based on length as short, medium and long lines. Ferranti Effect Representation of lines as 'Pi' and 'Tee' circuits using R,L and C parameters voltage and current relations for short and medium lines only. Representation of 'Tee' and 'Pi' models of lines as two port networks, evaluation and estimation of ABCD constants for both the models. **08 hrs**

B) Long transmission line : Current and voltage relationship, Hyperbolic equations, equivalence circuit.

Unit 06 **A) Mechanical design of overhead lines** : Line supports, spacing between the conductors, length of span, calculation of sag, equal and unequal supports, effect of ice and wind loadings. **06 hrs**

B) Underground Cable : Classification, Construction of cable, XLPE cables, insulation resistance, capacitance, dielectric stress in single core/multi core cables, cable faults and location of faults.

Industrial visits :

Minimum one visit to a generating station and/or HV/EHV substations is recommended.

Text Books :

1. A text book on Power System Engineering by A Chakraborty, M.L.Soni, P.V.Gupta, U.S. Bhatnagar,Dhanpat rai & Co., Delhi.
2. Power System Analysis & Design by B.R.Gupta, 4th Reprint, S.Chand Publishing Co.
3. Power System Analysis by W.D. Stevenson, Tata McGraw Hill Publications.
4. Transmission and Distribution by J.B. Gupta, S.K.Kataria & Sons, New Delhi.
5. Electric Power Generation, Transmission and Distribution by S.N.Singh, Prentice Hall of India.

Reference Books :

1. Elements of Power Station Design by M.V. Deshpande, Wheeler Publishing.
2. Modern Power System Analysis by I.J. Nagrath and D.P.Kothari, Tata Mc Graw Hill Publications.
3. Generation and Economic Considerations by J.B.Gupta, S.K.Kataria & Sons, New Delhi.
4. Power System Engineering by Nagrath & Kothari, Tata McGraw Hill Publications.
5. Websites of MERC and MSEDCL
6. Power System Analysis by Arthur R. Bergen. Pearson Education, New Delhi.

203145: Electrical Machines-I

Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical: 2 Hrs / week	Practical: 50 Marks

Prerequisite : Single phase transformer : Constructional details, Arrangement of cores and coils in shell-type and core type transformers. Material used for magnetic cores, windings and insulation.

Unit 01 **Transformers:** **08 hrs**

Single phase Transformer :Concept of leakage flux and its effects, resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency.
Exact and approximate equivalent circuits referred to either side. General phasor diagrams on no-load and on load. Various losses in a transformer, their variation with load. Efficiency, maximum efficiency, transformer ratings.

Open circuit and short circuit tests, determination of equivalent circuit parameters from the test data. Polarity test, Determination of voltage regulation and efficiency from equivalent circuit.

Autotransformers and dimmerstats, their ratings and applications. Comparison with two winding transformer with respect to saving of copper and size.

Unit 02 Parallel operation of single phase transformers, conditions to be satisfied, load sharing under various conditions. **06 hrs**

Three phase transformers: Standard connections of three phase transformers and their suitability for particular applications, voltage phasor diagrams and phasor groups.

Descriptive treatment of Parallel operation of three phase transformers Scott connection and V connections. Three winding transformers- tertiary windings.

Unit 03 **D.C. Machine:** **08 hrs**

Construction, main parts, magnetic system, poles, yoke, field winding, armature core, typical flux path, Armature winding : Simple lap and wave winding, commutator and brush assembly.

Generator action, e.m.f equation, magnetization curve , motor action of a DC machine. Types of DC motors, torque equation, significance of back e.m.f. working at no-load and on-load. Power flow diagram, losses and efficiency.
Descriptive treatment of armature reaction.

Unit 04 Characteristics and applications of D.C. Shunt and D.C. Series Motors, starting of DC motors, study of starters for series and shunt motor, solid state starters, speed control of various types of DC motors. **08 hrs**

Commutation : Process of commutation, time of commutation, reactance voltage , straight line commutation, commutation with variable current

density , under and over commutation, causes of bad commutation and remedies, interpoles, compensating windings .(Descriptive treatment only)

Unit 05 **Basic Theory :** Production of rotating mmf by 3-phase currents fed to a symmetrical 3-phase winding. **08 hrs**

Construction : Stator & rotor, Stator 3-phase windings.

Types of rotors : Squirrel cage rotor & phase wound rotor. principle of working, simplified theory with constant air gap flux; slip, frequency of rotor emf & rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor & w.r.t. stator, production of torque & torque-slip relation, condition for maximum torque & expression for the maximum torque, torque-slip characteristics, effect of rotor resistance on torque-slip characteristics. Ratios of starting torque, full load torque and maximum torque.

Losses in three phase induction motor, power-flow chart., relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency & condition for maximum efficiency.

Unit 06 Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent circuit; Circle diagram. Tests to determine the equivalent circuit parameters & for plotting the circle diagram. Computation of performance characteristics from the equivalent circuit & from circle diagram. Performance curves. **06 hrs**

Necessity of starter for 3-phase induction motor. Starters for slip-ring induction motors & for cage rotor induction motors ; stator – resistance starter, auto transformer starter, star delta starter & rotor resistance starter. D.O.L. starter & soft starting, with their relevant torque and current relations. Comparison of various starters. Methods of speed control.

Industrial Visit:-

Minimum One visit to a machine manufacturing industry is recommended

List of Experiments :

Note : Any three experiments on transformer, two on D.C. machine and three on Induction motor.

1. O.C. S.C. test on single phase Transformer.
2. Polarity test on single phase and three phase transformer.
3. Sumpners test on two identical single phase transformers.
4. Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedance.
5. Speed control of D.C. Shunt motor and study of starter
6. Brake test on D.C. Shunt motor
7. Load characteristics of D.C. series motor.
8. Swinburne's test on D.C. shunt Motor.
9. Load test on 3-phase induction motor.
10. No load test & blocked-rotor test on 3-phase induction motor :
    (a) Determination of parameters of equivalent circuit
    (b) Plotting of circle diagram.
11. Calculation of motor performance from (a) & (b) above.
12. Speed-torque characteristics of 3-phase slip-ring induction motor with different values of resistances inserted in the rotor circuit.

Text Books :

1. Electrical Technology by Edward Hughes ELBS, Pearson Education.
2. Electrical Machines by Ashfaq Husain
3. Electrical Machine by S. K. Bhattacharya, 2nd Edition, Tata Mc Graw Hill publishing co. Ltd.
4. Electrical Machines by Nagrath & Kothari, Tata Mc Graw Hill.
5. Electrical Machines by Bhag S Guru, Husein R. Hiziroglu, Oxford University Press.
6. Electrical Machines- I and II, K Krishna Reddy, SCITECH Publications (India) Pvt. Ltd. Chennai

Reference Books :

1. Performance and Design of Direct Current Machines by A.E.Clayton and N.N. Hancock . CBS Publishers, Third Edition.
2. Electrical Machines by A.E. Fitzgerald, Charles Kingsley, Stephen D.Umans (Tata Mc Graw Hill Publication Ltd) Fifth Edition.
3. Theory and performance of DC machines by A.S. Langsdorf (Tata Mc Graw Hill)
4. Theory and Performance of AC machines by A.S. Langsdorf (Tata Mc Graw Hill)
5. Performance and Design of AC. Machines by M.G. Say (CBS Publishers and Distributors)
6. Electrical Machines by Smarajit Ghosh (Pearson Education), New Delhi.
7. Electrical Machines Theory, Application, & Control by Charles I Hubert (Pearson Education, New Dehli Second Edition)

203146: Network Analysis

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical: 2 Hrs / week	Term work: 50 Marks

Unit 01 **Types of Networks:** Lumped and distributed linear and nonlinear, bilateral and unilateral, time variant and time invariant, space variant and space invariant. **06 hrs**

Independent and dependent (controlled) voltage and current sources. source transformation and shifting.

Network Equations: Network equations on loop basis and node basis, choice between loop analysis and node analysis. Concept of super node and super mesh, concept of voltage and current divider, mutual inductance, dot convention for coupled circuits, Concept of duality and dual networks.

Unit 02 Superposition, Thevenin, Norton, Reciprocity, Substitution, Compensation, Millmans theorems applied to electrical networks with all types of sources. **08 hrs**

Unit 03 Solutions of differential equations and network equations using Laplace transform method and classical method for R-L,R-C and R-L-C circuits (series and parallel),Inverse Laplace transforms, transformed networks with initial conditions. **08 hrs**

Analysis of electrical circuits with applications of step, pulse, impulse & ramp functions, shifted & singular functions the convolution integral. Laplace transforms various periodic and non periodic waveforms application of Laplace transforms.

Unit 04 **A) Two Port Network:** Z, Y, H and transmission parameters, Inter-relations between parameters. **08 hrs**

B) **Input power, Power transfer and Insertion loss:** Energy and power, Effective or Root-Mean –Square values, Average power and complex power, Problems in Optimizing power transfer, Insertion Loss

Unit 05 **Fourier Analysis and Filters:** The Fourier series, Evaluation of Fourier coefficients, symmetry considerations, exponential form of Fourier series, steady state response to periodic signals. Introduction to passive filters, low pass filters, high pass filters and by-pass filters and mentioned filter design. **06 hrs**

Unit 06 **Network Functions: Poles and Zeros:** Terminal pairs or ports, network functions for the one port and two port, The calculation of network functions ,ladder networks, general networks. Poles and zeros of network functions, Restrictions on poles and zeros locations for transfer functions, Time –domain behavior from the pole and zero plot .Stability of active networks **08 hrs**

List of Practical :

Any four experiments from the first five of the following and any four experiments from rest of the list. (Minimum four experiments should be based on simulation software PSPICE/MATLAB along with hardware verification)

1. Verification of Superposition theorem in A.C. circuits.
2. Verification of Thevenin's theorem in A.C. circuits.
3. Verification of Reciprocity theorem in A.C. circuits.
4. Verification of Millman's theorem.
5. Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
6. Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
7. Determination of time response of R-L-C series circuit to a step D.C. voltage input.
8. Determination of parameter of two port network.
9. Harmonic analysis of no load current of a transformer.
10. Determination of resonance, bandwidth and Q factor of R-L-C series circuit.
11. Determination of resonance of R-L-C Parallel circuit.

Text Book

1. "Network Analysis" by M. E. Van Valkenburg. Third Edition, Prentice Hall of India Private Limited.
2. Network Theory by N. C. Jagan, C. Lakshminarayana, Second Edition, BSP Publication.
3. Network Analysis & Synthesis – G. K. Mittal, Khanna Publication.
4. Introduction to Electric Circuits by Richard C. Dirof, James A. Svoboda, Sixth Edition, Wiley.
5. Introduction to Electric Circuits -Alexander & Sadiku.
6. Introduction to Electric Circuits –S Charkarboorty.
7. Fundamentals of Electrical Networks- B.R.Gupta & Vandana Singhal – S.Chand Publications

8. Electrical Circuit Analysis by P. Rameshbabu, Scitech PublicationIndia Pvt Ltd, Second Edition

Reference Books:

1. Network Analysis by Cramer McGraw Hill Publication.
2. "Engineering Circuit Analysis" by William H. Hayt, Jr. Jack E. Kemmerly, McGraw Hill.
3. "Introduction to Circuit Analysis" by Bolylestad Robert L.
4. Electric Circuits and Networks by K.S. Suresh Kumar, Pearson Education
5. Network Analysis, N.C. Jagan, Second Edition, BS Publication, Hydrabad.

203147: Digital Computation Techniques

Teaching Scheme
Lectures: 4 Hrs / week

Examination Scheme
Paper: 100 Marks
Duration : 3 hrs

Unit 01 **Introduction**: Basic principle of numerical methods and necessity of computers for high speed calculations. Floating point algebra with normalized floating point technique, Significant digits. **08 hrs**

Errors: Different types of errors, causes of occurrence and remedies to minimize them.

Numerical instability in computations.

Concept of roots of an equation and methods to find the same. Descartes' rule of signs, Sturm's theorem.

Solution of Polynomial Equations using - Synthetic division, Birge-Vieta and Lin-Bairstow methods.

Unit 02 **Solution of Transcendental and Polynomial Equations** : Bisection, Secant, Regula-Falsi, Chebyshev and Newton-Raphson methods, Newton-Raphson method for two variables and complex roots **06 hrs**

Unit 03 **Solution of Linear Algebraic Simultaneous** Equations : Direct methods - Gauss and Gauss-Jordan elimination methods, concept of pivoting. Iterative methods – Jacobi and Gauss Seidal methods. Matrix inversion by Gauss Elimination and Gauss-Jordan methods. **08 hrs**

Unit 04 **Interpolation** :Difference operators, Introduction to interpolation - Newton's forward, backward, central (Stirling and Bessel) and divided difference formulae Lagrange's interpolation. **08 hrs**

Curve Fitting using Least square approximation – First order and second order.

Unit 05 **Solution of ordinary differential equations :** Euler's, Modified Euler's methods. **06 hrs**

Taylor's series method, Runge-Kutta second and fourth order methods. Milne-Simpson Predictor-Corrector method

Unit 06 **Numerical Integration :** Trapezoidal and Simpson's rules as special cases of Newton-Cote's quadrature technique. **08 hrs**

Numerical Differentiation : Lagrangian and Newton-Gregory polynomials.

TEXT BOOKS :

1. Numerical Methods for Scientific and Engineering Computations – M. K. Jain / S. R.K.Iyangar / R. K. Jain
2. Introductory Methods of Numerical Analysis – S. S. Sastry.
3. Calculus of Finite Difference and Numerical Analysis – Gupta / Malik.
4. Numerical Methods for Engineers by Steven Chapra, Raymond P. Canale – Tata McGraw Hill Publication.
5. Numerical Methods, second edition, S. Arumugan, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications (India) Pvt. Ltd.

6 Programming with ANSI and Turbo C, by Ashok N. Kamthe, Pearson Education, New Delhi

REFERENCE BOOKS :

1. Numerical Mathematical Analysis – J. B. Scarborough.
2. Numerical Methods with Programs in C and C++ - T. Veerarajan and T. Ramchandran - Tata McGraw Hill Publication.
3. Numerical Methods – E. Balgurusamy - Tata McGraw Hill Publication.

203148: Computer Programming

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs / week	Term work: 50 Marks
Practical: 2 Hrs / week	Practical: 50 Marks

Revision: Basics of 'C' language - Data types, Operator precedence, 'if-else' and nested 'if-else' statements, 'for, while and do-while' statements etc. **08 hrs**

Unit 01 **Arrays**: Introduction, one and two dimensional arrays. Features of C preprocessor, Macro expansion directives, File inclusion directives and compiler control directives. **04 hrs**

Unit 02 **Functions:** Function declaration and prototypes. Local and Global variables, Types of functions – call by value, call by reference. **04 hrs**

Unit 03 **Pointers**: Introduction, declaring and initializing pointers, pointer expressions, pointer and arrays, pointers and functions **04 hrs**

LAB PRACTICE:

Term work shall consists of minimum eight computer programs in C or C++ language with flow charts and results based on syllabus of Digital Computational Techniques.

1. Minimum one program based on following methods of finding solution of Transcendental / polynomial equations –
    a. Bisection method
    b. Secant method
    c. Regula-Falsi method
    d. Newton –Raphson Method
2. Minimum one program based on following methods of finding solution of Polynomial equations –
    a. Birge Vieta method
    b. Lin Bairstow's method
3. Minimum one program based on following methods of solution of system of linear simultaneous equations –
    a. Gauss Elimination method
    b. Gauss Seidal method / Jacobi method
    c. Matrix Inversion using Gauss Jordan
    d. Newton-Raphson method for two variables
4. Minimum one program based on following interpolation methods –
    a. Newton's Forward Difference formula
    b. Newton's Backward Difference formula
    c. Newton's Divided Difference formula
5. Minimum one program based on following interpolation methods –
    a. Lagrange's Interpolation method
    b. Bessel's or Stirling's method using central difference formula
    c. Curve Fitting using Least square approximation method.
6. Minimum one program based on following methods of Numerical Integration –
    a. Trapezoidal Rule
    b. Simpson's $1/3^{rd}$ Rule
    c. Simpson's $3/8^{th}$ Rule

7. Minimum one program based on following methods for solution of Ordinary Differential equation –
    a. Modified Euler method
    b. Runge-Kutta method (4^{th} order)
8. Program based on Milne – Simpson's method for solution of Ordinary Differential equation

203149: Microprocessor Fundamentals and Programming

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs / week	Paper: 100 Marks Duration : 3 hrs
Practical:2 Hrs / week	Oral: 50 Marks

Unit 01 Architecture of 8085, Memory interfacing, Addressing modes, Instruction set **08 hrs**

Unit 02 Assembly language programming, timing diagrams, stack operations, Interrupt structure, concept of lookup table. **08 hrs**

Unit 03 Parallel Data transfer scheme (Synchronous, asynchronous, interrupt driven, polling type). Concepts in serial Communication, standards RS232, PCI 8251-Asynchronous mode. **06 hrs**

Unit 04 Study, interfacing and programming of **06 hrs**
a) PPI 8255- mode 0,1, BSR mode
b) PIT 8254- Mode 0,1,2

Unit 05 Study of ADC 0809, DAC 0808 **08 hrs**
Applications of 8085
1. Measurement of Voltage
2. Measurement of Current
3. Measurement of Power factor
4. Measurement of frequency
5. Measurement of Energy

Unit 06 Applications of 8085 : **08 hrs**
1. Control of stepper motor
2. Control of DC motor
3. Temperature measurement
4. Speed Measurement
5. Flow measurement
6. 7-segment display

List of Experiments:

Experiment 1 is compulsory, out of remaining any 7 experiments.

1. Assembly language Programming (8 experiments minimum)
2. Interfacing of 8255 with 8085
3. Interfacing of 8254 with 8085.
4. Interfacing of 8 bit D/A and A/D converter with 8085.
5. Control of stepper motor using 8085.
6. Control of D.C. motor using 8085.
7. Measurement of temperature using 8085.
8. Measurement of speed using 8085.
9. Interfacing of seven segment LED display with 8085.

Text Books :

1. Fundamentals of Microprocessor and Microcomputer – B.Ram Dhanpat Rai & Sons , New Delhi.
2. Microprocssor and Peripherals- S.P.Chaudhari, Sucheta Chaudhari SCITECH Publications, Chennai.

Reference book :

1. Microprocessor Architecture, Programming & Applications- R.S. Gaonkar Wiley Eastern Ltd. New Delhi.
2. Douglas Hall : microprocessors and interfacing , hardware and programming. Tata McGraw Hill publication.
3. Liu and Gibson : Microprocessors and Digital systems : Tata McGraw Hill India