SYLLABUS
DIPLOMA IN ELECTRICAL ENGINEERING
(SELF FINANCED)
w.e.f.: 2016

UNIVERSITY POLYTECHNIC
FACULTY OF ENGINEERING AND TECHNOLOGY
JAMIA MILLIA ISLAMIA
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Contents

EVALUATION SCHEME OF THREE YEAR DIPLOMA
IN ELECTRICAL ENGINEERING (SELF FINANCED) COURSE – I YEAR

THEORY COURSES:

S. No.	Course Code	Subjects	Hours/ week	Sessionals	Univ. exam	Total
1.	DEN-101	English	2	50	100	**150**
2.	DPH-102	Applied Physics	2	50	100	**150**
3.	DCH-103	Applied Chemistry	2	50	100	**150**
4.	DMA-104	Applied Mathematics – I	2	50	100	**150**
5.	DCE-103	Applied Mechanics	2	50	100	**150**
6.	DCE-106	Civil Engg.	2	50	100	**150**
7.	DME-107	Mechanical Engg.	2	50	100	**150**
8.	DME-108	Engg. Drawing	3	100	100	**200**
9.	DME-109	W/S Technology	2	50	100	**150**
		Total	**19**	**500**	**900**	**1400**

PRACTICAL COURSES:

1.	DPH-112	App. Physics	2	50	50	**100**
2.	DCH-113	App. Chemistry	2	50	50	**100**
3.	DCE-113	App. Mechanics	2	50	50	**100**
4.	DCE-116	Civil Engg.	2	50	50	**100**
5.	DME-117	Mechanical Engg.	2	50	50	**100**
6.	DME-119	W/S Practice	3	50	50	**100**
		Total	**13**	**300**	**300**	**600**
		Grand Total	**32**	**800**	**1200**	**2000**

There will be two sessionals and one assignment in each theory course.

EVALUATION SCHEME OF THREE YEAR DIPLOMA
IN ELECTRICAL ENGINEERING (SELF FINANCED) COURSE – II YEAR

THEORY COURSES:

S. No.	Course Code	Subjects	Hours/ week	Sessionals	Univ. exam	Total
1.	DMA-201	Applied Mathematics –II	2	50	100	**150**
2.	DME-202	Thermo Fluids	2	50	100	**150**
3.	DEE-204	Electrical Circuits & Fields	2	50	100	**150**
4.	DEL-205	Electronics Devices & Ckts	2	50	100	**150**
5.	DEE-206	Electrical Machine – I	2	50	100	**150**
6.	DEE-207	Measurement & Measuring Instruments	2	50	100	**150**
7.	DEE-208	Electrical Dgn. Drg. & Est.	2	100	100	**200**
8.	DEE-209	Electrical Engg. Materials	2	50	100	**150**
9.	DCA-209	Computer Application	2	50	100	**150**
		Total	**18**	**500**	**900**	**1400**

PRACTICAL COURSES:

S. No.	Course Code	Subjects	Hours/ week	Sessionals	Univ. exam	Total
1.	DME-211	Thermo Fluids	2	50	50	**100**
2.	DEE-212	Electrical Circuits & Fields	2	50	50	**100**
3.	DEE-213	Electrical Machines - I	2	50	50	**100**
4.	DEE-214	Measurement & Measuring Instruments	2	50	50	**100**
5.	DEE-215	Electrical Workshop	2	50	50	**100**
6.	DCA-216	Computer Applications	2	50	50	**100**
		Total	**12**	**300**	**300**	**600**
		Grand Total	**30**	**800**	**1200**	**2000**

There will be two sessionals and one assignment in each theory course.

EVALUATION SCHEME OF THREE YEAR DIPLOMA
IN ELECTRICAL ENGINEERING (SELF FINANCED) COURSE – III YEAR

THEORY COURSES:

S. No.	Course Code	Subjects	Periods/ week	Sessionals	Univ. exam	Total
1.	DEE-301	Generation of Electrical Energy	2	50	100	**150**
2.	DEE-302	Electrical Machines – II	2	50	100	**150**
3.	DEE-303	Transmission & Distribution	2	50	100	**150**
4.	DEE-304	Utilization & Traction	2	50	100	**150**
5.	DEE-305	Switch Gear & Protection	2	50	100	**150**
6.	DEE-307	Power Electronics	2	50	100	**150**
7.	DEE-308	Instrumentation & Control	2	50	100	**150**
8.	DEE-309	Trouble Shooting & Servicing of Equipments	2	100	100	**200**
9.	DME-309	Enterepreneurship Development and Industrial Management	2	50	100	**150**
		Total	**18**	**500**	**900**	**1400**

PRACTICAL COURSES:

1.	DEE-311	Electrical Machines –II	2	50	50	**100**
2.	DEE-312	Electrical protection & relay	2	50	50	**100**
3.	DEE-313	Trouble Shooting & Servicing of Equipments	2	50	50	**100**
4.	DEE-317	Power Electronics	2	50	50	**100**
5.	DEE-314	Project	4	150	50	**200**
		Total	**12**	**350**	**250**	**600**
		Grand Total	**30**	**850**	**1150**	**2000**

There will be two sessionals and one assignment in each theory course.

ENGLISH
DEN-101

"COMPLETE COURSE IN ENGLISH" by Robert J. Dixson   20 Marks

Chapters:
1. Two Thanks giving Day Gentlemen.
2. A Love Story.
3. The Gifts of Feoder Himkoff.
4. The Prince and The Judge.
5. Mr. Travers's First Hunt.
6. Portrait of a Teacher.

Composition:
1. Letter writing   10 Marks
2. Technical Report   10 Marks
3. Paragraph writing   10 Marks
4. Construction of Dialogue   20 Marks

Grammar:
1. Direct to Indirect (Speech)   05 Marks
2. Change of Voice   05 Marks
3. Transformation   05 Marks
4. Tenses   05 Marks
5. Comprehension (Passage)   05 Marks

APPLIED PHYSICS
DPH-102

Unit-I

Units and Dimensions: Fundamental and derived Units (SI system), Dimensions of various physical quantities, uses of dimensional analysis and its limitations.

Surface Tension: Molecular forces, molecular theory of surface tension, surface energy, relation between surface tension and surface energy, angle of contact, shape of liquid surface in a capillary tube, rise of liquid in a capillary tube.

Oscillations: Periodic motion, simple harmonic motion (SHM), derivation of displacement, velocity, acceleration, time period and frequency; vibration of simple spring mass system (vertical and horizontal, two or more springs in series and parallel). Vibration of bodies supported on more than one identical spring.

Unit-II

Electrostatics: Coulombs law, electric field, potential due to charge and number of charges, potential difference between two points, equipotential surface, electric field at a point due to a uniformly charged thin sheet, capacitor, capacitance of a parallel plate capacitor, energy stored in a capacitor, combination of capacitors (series and parallel).

D.C. Circuits: Kirchhoff's law, Application of Kirchhoff's law to the Wheat-Stone Bridge, post office box, meter bridge and potentiometer. Heating effect of current, heat produced by electric current in a conductor and Joules law of electrical heating.

Unit-III

Electromagnetism: Biot-Savart law, magnetic field around a current carrying conductor and at the center of a circular loop, force experienced by a moving charge and a current carrying conductor in a uniform magnetic field, forces between two parallel current carrying conductor definition of ampere, principle and working of a moving coil galvanometer, conversion of galvanometer into ammeter and voltmeter.

Unit-IV

Temperature and its measurement: Concept of heat and temperature, basic principle for temperature measurement, thermoelectric, platinum resistance thermometer and pyrometers.

Expansions of solids: Concept of linear (α), spherical (β) & cubical (γ) expansion, relations among (α, β, and γ)

Heat Transfer: Modes of heat transfer, coefficient of thermal conductivity and its determination by Searl's and Lee's disc methods, thermal conduction through compound media.

Optics: Huygen's principle, reflection & refraction of a wave at a plane surface, refraction through a prism, lens formula, principle of working and magnifying power of telescopes and microscopes.

Unit-V

Modern Physics: Atomic models: J.J. Thomson's model, Rutherfold's model, Neils Bohr's Model and its shortcomings, X-rays production, properties and uses, lasers, types of lasers, study of the He-ne and Ruby lasers and their properties and applications.

Radioactivity : Natural radioactivity, half life, average life, mass defect & binding energy, nuclear stability, fission, fusion, energy generated in reactors and radiation hazard.

Text/Reference Book:
1) Basic Applied Physics by H R Meena & Dr. Khushnood Hussain, Suhavi Publications, Delhi
2) Applied Physics By P.K. Mittal, I.K International Publishing House Pvt . Ltd.

APPLIED CHEMISTRY
DCH-103

Unit-I

Problems based on volumetric and gravimetric analysis.

Atomic Structure: Fundamental particles, Bohr's theory of electrons. Quantum numbers, electronic configuration of first thirty-six elements.

Electronic theory of valency: Electro-valency and covalency.

Polymerisation: Addition and condensation polymerisation, thermoplastic and thermosetting, examples.

Unit-II

Water Treatment: Hardness, Units of hardness, estimation of alkalinity, free chlorine, chloride ions, dissolved oxygen and hardness, softening processes of hard water, sedimentation, filtration and sterilization.

Unit-III

Fuels: Classification of fuels, characteristics of good fuel, calorific value.

Solid fuels: Composition, properties and uses of peat, lignite bituminous & Anthracite.

Liquid fuels: Petroleum: brief idea of refining into fractions with their uses and characteristics.

Gaseous fuels: Preparation, Properties, composition and uses of coal gas, producer gas, water gas and oil gas. Advantages and disadvantages of liquid, gaseous fuels over solid fuels. Combustion of gaseous, liquid and solid fuels. Problems, Analysis of flue gases.

Unit-IV

Corrosion: Its meaning, theory of corrosion, prevention of corrosion by various methods; metal and non-metal coatings.

Lubrication: Definition, theory and characteristics of lubricants (viscosity, viscosity index, oiliness, acid value and saponification value, cloud point, pourpoint, flash point and fire point). Effect of chemicals in lubricants, methods of lubrication.

Unit-V

Metals: Physical properties of cast iron and the effect of impurities such as sulphur, silicon, phosphorous on it.

Steel: Steel, Effect of carbon, nickel chromium and manganese on steel. Elementary knowledge of its heat treatment, hardening, tempering, annealing, normalizing and case hardening.

Alloys: Definitions, classification and necessity of making alloys. Composition, properties and uses of brass, bronze, duralumin, gun metal, invar.

Text/Reference Book:
1) Applied Chemistry by B S Chauhan, Vayu Education of India.
2) Applied Chemistry by Pradeep Palhera Green Leaf Publication, India.

APPLIED MATHEMATICS -I
DMA-104

Unit I
Algebra and Trigonometry
Algebra: Arithmetic progression, its nth terms, sum to n terms. Geometric progression, its nth term, sum to n terms and to infinity. Sum of the squares and cubes of finite natural numbers. Binomial theorem (without proof) for positive integral index (expansion and general term). Binomial theorem (without proof) for any index (expansion only). First, second Binomial approximation.
Trigonometry: Trigonometric ratios of sum and differences of two angles. Multiple and sub-multiple angles, simple trigonometric identities. Inverse trigonometric functions. Statement of cosine formula, sine formula, Napier's, half angle formula and its proof.

Unit II
Coordinate Geometry: Cartesian coordinates, polar coordinates and their conversion to Cartesian formula. Area of a triangle. Coordinates of the centroid and incenter of a triangle. Simple problems on locus. Equations of straight lines in various forms. Intersection of two straight lines and angle between them. Perpendicular distance formula. General equation of circle, determination of radius and center. Simple problems. Definition of conic section, standard equations of parabola, ellipse and hyperbola and their simple problems.

Unit III
Differential Calculus: Differential by first principle of x^n, $sinx$, $cosx$, $logx$ and a^x differential of sum, product and quotient function. Differential of function of a function, inverse trigonometric functions. Logarithmic differential. Successive Differentiation (excluding n^{th} order). Maxima and Minima. Equation of tangent and normal to a curve.

Unit IV
Integral Calculus: Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions. Evaluation of definite integrals, properties of definite integrals. Application of Gamma function on simple problems. Area of plain curves, Volume of simple solids of revolution.

Unit-V
Differential Equation and Vectors: Order and degree of differential equations. Solution of differential equations of first order and first degree, variable separable. Homogeneous equations. Scalar and Vectors, addition and subtraction of vectors and their simple applications, multiplication of vector by a scalar. Scalar and Vector product of two vectors, Scalar triple product.

Text/Reference Book:
1) Applied Mathematics for Polytechnics by H.K. Dass, CBS Publishers & Distributers Pvt. Ltd.
2) Applied Mathematics by R D Sharma, Dhanpat Rai Publications (P) Ltd.

APPLIED MECHANICS
DCE-105

Unit-I

Introduction: Concept of Mechanics and Applied Mechanics, Explanation of Mechanics and Applied Mechanics, its importance and necessity, giving suitable examples on bodies at rest and motion, explanation of branches of this subject, Concept of rigid bodies.

Laws of forces: Force and its effects, Units and measurement of force. Vector representation. Bow's notation, Types of forces, action and reaction, tension and thrust and shear force. Force system: coplanar, non-coplanar force systems. Free body diagrams. Resultant and components of forces. Concept of equilibrium. Parallelogram, Law of forces, equilibrium of two forces, super position and transmissibility of forces. Triangle of forces, different cases of concurrent coplanar two force systems, extension of parallelogram law and triangle law to many forces acting at one point. Polygon law of forces, method of resolution into orthogonal components for finding resultant, graphical methods.

Unit-II

Moments: Concept of moment, Varignon's theorem (statement only), Principle of moments- Application of moments to simple mechanism --- Parallel forces, calculation of their resultant. Concept of couple-properties and effect, General cases of coplanar force system. General condition of equilibrium of bodies under coplanar forces, Lami's theorem.

Center of Gravity and Moment of Inertia: Concept of gravity and center of gravity. Centroid for Day lamina and center of gravity for Day solids. Position of center of gravity of compound bodies and centroid of composite area. C.G. of reminders. Graphical determination of centroid. Concept of moment of inertia of Day bodies, rectangles and circles.

Unit III

Motion: Concept of displacement, speed, velocity, acceleration, vector representation of velocity and acceleration, composition and resolution of velocities, Uniformly accelerated motion. Derivation of equations of motion and their application, motion of freely falling bodies. Relative motion. Relative velocity.

Laws of Motion: concept of momentum, Newton's Laws of motion, their application, derivation of force equation from second law of motion. Numerical problems on second law of motion. Piles, lifts, bodies tied with string. Newton's third law of motion numerical problems. Conservation of momentum, impulse and impulse force.

Unit-IV

Work, Power & Energy: Review of the concept of the work, power & energy. Types of energy, conservation of energy. Horse-power, work done against gravity and work done against friction. Problems pertaining to all types of energy including the nuclear energy.

Circular motion: Curvilinear motion, angular velocity and acceleration, derivation of equation for angular velocity, relation between angular and rectilinear motion, concept of torque and angular momentum, Centripital and centrifugal forces.

Unit-V

Simple Machines: Concept of machine, mechanical advantage, velocity and efficiency of a machine, their relationship, law of machine, Simple machine (lever, wheel and axle, pulleys, jacks, winch crabs only). Concept of friction, laws of friction, limiting friction and coefficient of friction. Friction in machines. Elasticity, stress, strain, Hook's law, Young's Modulus, Shear Modulus and Poisson's ratio elastic limit, Yield, Ultimate stress & breaking point.

Text/ Reference books:
1. A Text book of Engineering Mechanics by A R Basu, Dhapat Rai Publications
2. A Text Book of Engineering Mechanics by R S Khurmi, S Chand Publications

CIVIL ENGINEERING
DCE-106

Unit-I
Elementary Surveying: Concept and Purpose of Surveying: Plane and Geodetic Surveys. Classification of surveys based on instruments used. Basic principles of surveying.
Chain Surveying: Principle and suitability, equipments used. Direct and indirect ranging. Selection of stations. Instruments used for setting out right angles. Cross staff survey, calculation of its area. Obstacles and erroneous length of chain.

Unit-II
Compass Surveying: Concept of bearings, systems of bearings. Use of prismatic compass, Magnetic dip, declination and local attraction.

Unit-III
Levelling: Concept and explanation of all terms connected with levelling work. Principle and constructional details of Dumpy level. Reduction of levels and maintenance of level field book. Error and precautions in levelling.

Unit-IV
Civil Engineering. Materials: Properties and uses of bricks, stones, cement, limes and Mortars. Lime concrete and cement concrete. Timbers, Bitumen and Asphalt. Fire resistant materials. Anti-vibration and sound proofing materials.
Road Construction: Elements of road structure, subgrade, subbase, base and surfacing: W. B. M. roads and surface dressing

Unit-V
Building Construction: Selection of site to be used for the construction of a building; setting out works; various components of building (workshop, factories, power house) and its orientation, ventilation and distribution of water.
Elementary idea of Foundations with particular reference to Machine foundation: Damp proof course: General principle of brick and stone masonry; Floors and types of flooring with particular reference to industrial flooring: Roofs and Roof coverings, Trussed roofs for factories.

MECHANICAL ENGINEERING
DME-107

Unit-I

Transmission of Power: Belt drive: Materials of belt, flat belt, V-belt, open and cross belt drive, length of belt (without derivation), velocity ratio, slip, creep, angle of contact, derivation of tension ratio for flat & V-belt, Power transmitted through belts. Advantages of V-belt over flat belt, Simple numerical problems.

Chain Drive: Roller chain, silent chain, block chain, comparison between chain & belt drive.

Pulleys: Introduction, type & crowning of pulleys.

Gears: Spur, helical, bevel, spiral warm gears rack & pinion.

Gear trains: Simple & Compound gears train and simple numerical problems.

Unit-II

Steam Generators: Introduction, classification, Differentiation between fire tube and water tube boilers. Simple vertical boiler, Babcock & Wilcox boiler, Cochran boiler.

Boiler accessories and mountings: Air pre-heater, super heater, economizer, steam separator, Fusible plug, pressure gauge, Feed check valve, steam stop valve, Blow of cock, water level indicator & safety valves.

Turbines: Introduction & classification of steam turbine, Impulse turbine, Simple impulse turbine, compounding of impulse turbines, Reaction turbines, comparison between impulse & reaction turbines, losses in steam turbine.

Hydraulic turbine: Classification, construction & working of Pelton wheel, Francis & Kaplan turbine.

Unit-III

I.C. Engines: Classification of internal combustion Engines, Main parts of IC engines, Otto cycle, diesel cycle, spark ignition engines, compression ignition engines, working principle of 2-stroke and 4-stroke engines, ignition system of petrol engines i.e. battery & magneto ignition system, spark plug, Simple carburetor, working of solid fuel injection system of IC engines.

Cooling System: Necessity, Air Cooling Water Cooling.

Lubricants: Introduction, Function of lubrication, method of lubrication: Petrol System, Splash system, pressure feed system, combined splash & pressure feed system.

Unit-IV

Pumps: Working of reciprocating, centrifugal and gear pump, jet and submersible pump.

Air Compressor: Working of reciprocating type air compressor.

Cranes: Tower and bridge crane, Jaw Crushers, Hydraulic Jacks, Dump truck & hydraulic lift.

Unit-V

Refrigeration and Air Conditioning System: Introduction, Performance of machine, Refrigerating machine, vapour compression cycle, simple vapour absorption cycle.

Air Conditioning System: Purpose of Air Conditioning, Factors affecting air conditioning, Evaporating cooling system in a desert country, window air conditioning.

Text/Reference Book:
1) Mechanical Engineering by H R Kapoor, Khanna Publishers
2) Mechanical Engineering by T J Prabhu, Scitech Publications (India) Pvt Ltd

ENGINEERING DRAWING
DME-108

Unit-I
Basic Concepts: Introduction to Engineering Drawing, dimensions, lettering, use of drawing instruments, Drawing Conventions as per IS: 696-1972 (revised). Scales: simple & diagonal symbols: Electrical, Electronics, Civil and Mechanical.

Unit-II
Plane Geometry: Construction of plane geometrical figures, parabola, ellipse, hyperbola, cycloid, epi-cycloid, hypocycloid involute of base circle.

Unit-III
Principle of projection: Orthographic projection of solids: Normal position and Inclined position. Development of surfaces of the simple solids, conversion of isometric pictorial projection to orthographic projection of simple objects. Isometric projection of solids and simple objects.

Unit-IV
Building Drawing: Plan and elevation of a simple building.
Machine Drawing: Drawing and free hand sketches of machine components such as screwed fastening (nut & bolts) keys, knuckle, cotter and riveted joint. Some practice in blue print reading of assembly drawing.

Text/Reference Book:
1) A Text book of Engineering Drawing By S R Singhal and O P Saxena, Asian Publications
2) A Text book of Engineering Drawing by Dr. R. K. Dhawan, S Chand Publications
3) Engineering Drawing by P S Gill, S. K. Kataria & Sons Publications

WORKSHOP TECHNOLOGY
DME-109

Unit-I
Carpentry Materials: Timber, Classification of timber, Structure and defects, conversion and selection of timber, Seasoning and protection, plywood and its advantages, tools: Marking and measuring tools, Holding and supporting tools, Cutting tools, Plane tools Striking tools, Boring tools and miscellaneous tools.

Unit-II
Fitting Materials: Material for tools, Vices, V Block, Surface plate, Try square, Combination set, Files, Scrapers, Chisels, Hacksaw, Surface gauge, Universal surface gauge, Punches, Hammers, Calipers and Dividers.

Unit-III
Smithy: Tools and equipments, Hammers, Sewage block, Anvil, Tongs, Chisels, Hardie Gauges, Fullers, Flatters, Set Hammer, open fire and stock fire, Fuel and blowers Processes forging, Upsetting, Welding, Defects in forging.

Unit-IV
Welding: Types of welding, Arc welding and gas welding. Tools and equipment used in are and gas welding, Types of flames, working pressure, Use of A.C. and D.C. Electrode, Soldering and brazing, precautions.

Unit-V
Metal Cutting: Various metal cutting machine and operations (sawing sharing, plain turning, drilling, grinding and milling).

Text/Reference Books:

1) Workshop Technology by B S Raghuwanshi, Khanna Publishers
2) Workshop Manual by Dr R K Singal, S K Kataria Publications

APPLIED MATHEMATICS-II
DMA-201

Unit-I
Matrices and Determinants: Determinants (up to 3rd order only), minor, co-factor, Laplace expansion and rule of Sarrus.
Properties of determinants, Solution of linear simultaneous equations (up to 3 equations) by Cramer's rule. Matrix addition, subtraction and multiplication. Inverse of a matrix. Solution of linear simultaneous equations (up to 3 equations) using matrix method. Solution of resistive network (up to 3 unknown) and L.R.C. network (2 unknown) by mesh and nodal analysis.
Solution of simultaneous linear equations and application to network analysis.

Unit-II
Differential Equations: Solution of linear differential equations of 1st order. Applications to L-R and R-C circuits with DC and AC sources.
Solution of linear differential equations of 2nd order with constant coefficients including particular integrals of forms e^{ax}, $sin\ ax$, $cost\ ax$, $x^n e^{ax} sin\ bx$, $e^{ax}\ cos\ bx$, $e^{ax} x^n$. Applications to RLC circuits.

Unit-III
Fourier Analysis: Periodical functions, Mathematical equations of square, sawtooth, triangular, half and full rectified waves, super position of sinusoidal waves.
Fourier Series Even and odd functions. Fourier cosine and sine series. Fourier expansion of square, sawtooth, triangular half and full rectified waves.

Unit-IV
Laplace Transform: Definition of Laplace Transform, General Laplace Transforms of Algebraic, Trigonometric and other functions. Inverse Laplace Transform. Applications of Laplace Transforms in solving differential equations of 2nd order. Simple problems on RLC circuits.

Unit-V
Complex Number: Complex number, representation (Argand diagram), Complex number in rectangular, polar and exponential forms and conversion from one form to other. De-Moivre's Theorem. Roots of a complex number. Phasor Voltage and Current as phasor, addition of alternating quantities by phasor method Impedance and admittance as a complex number.

Text/Reference Book:
1) Applied Mathematics for Polytechnics by H.K. Dass, CBS Publishers & Distributers Pvt. Ltd.
2) Applied Mathematics by R D Sharma, Dhanpat Rai Publications (P) Ltd.

THERMO FLUIDS
DME-202

Unit-I
Properties of Steam: Formation of steam, wet steam, dry saturated steam, superheated steam, dryness fraction of steam, sensible heat, latent heat, calculation on specific volume, specific enthalpy and specific entropy of wet and superheated steam.
Water Tube Boilers: Babcock & Wilcox boiler, Benson boiler, La Mont boiler, Loeffler boiler. Performance of boiler, Equivalent -Evaporation and Efficiency Calculation.
Steam Condenser: Surface steam condenser.

Unit-II
Heat Transfer: Basic concept of conduction, convection and radiation, Fourier's law of heat conduction. Thermal conductivity, Principle law of thermal radiation, Kirchhoff's law, Stefan Boltzmann's law, Basic concept of heat exchangers, recuperative and regenerative type heat exchangers
Gas Turbine: Basic principle, operation and application of open cycle and closed cycle gas turbines.
Diesel Engines: Working and characteristics of 4-strokes diesel engines. Simple numerical problems on I.H.P. B.H.P. and F.H.P., thermal efficiency, brake thermal efficiency and indicated thermal efficiency.

Unit-III
Fluid and Pressure Measurement: Characteristics of fluid, density, specific weight specific volume, specific gravity, viscosity, type of fluid, atmospheric pressure, gauge pressure, absolute pressure and vacuum pressure, Measurement of pressure by piezometer U-tube simple manometer and U-tube differential manometer, Bourdon pressure gauge.
Loss of Energy in Pipes: Major energy losses, Friction loss by Darcy-Weisbach formula and Chezy's formula (without proof). Minor energy losses, loss of head due to sudden enlargement, sudden contraction, obstruction, bend, entrance and exit loss (without derivation), simple calculation on above.

Unit-IV
Flow through Pipes: Types of fluid flow, Rate of flow or discharge continuity equation, Bernoulli's theorem (without proof), Flow through compound pipes, Equivalent pipes, Flow through parallel pipe and branched pipes, Transmission of power through pipe, Numerical problems on above topics.
Flow in open Channel: Most economical section of rectangular and trapezoidal channel.
Fluid System: Principle and working, hydraulics coupling and hydraulics torque converter.

Unit-V
Hydraulics Turbine: Construction and working of Pelton wheel and Francis turbine. Calculation on specific speed, Power and Efficiency of turbines, Selection of turbines on the basis of available head and specific speed.
Hydraulics Pumps: Construction working and application of centrifugal pump.
Air Compressor: Working and application of Rotary compressor.

Text/Reference Book:
1) Engineering Thermodynamics by P. K. Nag, Tata McGraw-Hill Publications
2) Fluid Mechanics and Hydraulic Machine by A. R. Basu, Dhanpat Rai Publications

ELECTRICAL CIRCUITS & FIELDS
DEE-204

Unit-I

D.C CIRCUITS: Concept of electricity, Basic terms-voltage, current, potential difference, power, energy and their units. Ohm's law, specific resistance, effect of material and size of conductor, effect of temperature on resistance, temperature coefficient of resistance, grouping of cells in series and in parallel. Resistance in series and parallel. Kirchhoff's current law and Kirchhoff's voltage law with their applications to simple circuits.

Unit-II

ELECTROMAGNETIC INDUCTION: Faraday's laws of electromagnetic induction. Lenz's law, Fleming's Right hand and Left hand rules, Principle of self and mutual induction, self and mutually induced e.m.f. Dynamically induced e.m.f., self-inductance, mutual inductance & its effects, Numerical problems, energy stored in the inductor.

Unit-III

(A) AC FUNDAMENTALS: Concept of alternating voltage and current, Difference between AC and DC, concept of cycle, frequency, period, amplitude, instantaneous value, average value, r.m.s. value, maximum value. form factor, peak factor. Representation of sinusoidal quantities by phasors. Derivation of equations of sinusoidal wave form

(B) SINGLE PHASE AC CIRCUITS: Physical concept of alternating voltage applied to a pure resistance, pure inductance and pure capacitance, inductive reactance, capacitive reactance. Alternating voltage applied to resistance and inductance in series, alternating voltage applied to resistance and capacitance in series, impedance triangle and phase angle. Complex Numbers, various forms, addition, subtraction, multiplication & division, addition of sinusoidal terms, solution and phasor diagrams for simple R-L-C series and parallel circuit, Active and reactive current and their significance, practical importance of power factor, solution of simple circuit using of Notation, use of conductance, susceptance and admittance.

RESONANCE: Series parallel resonance, its condition, phasor diagram at resonance, resonant frequency variation of different quantities with frequency, Quality factor, voltage magnification, selectivity, Bandwidth, and current magnification.

Unit-IV

NETWORK THEOREMS AND TRANSFORMATION: Constant voltage and current sources, Equivalence of current and voltage sources, Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Maximum power transfer theorem and their applications, conversion of circuits from Star to Delta and Delta to Star (transformation).

DC TRANSIENT: Growth of current in an inductive circuit, Time constant of RL Circuit. Decay of current in an inductive circuit, charging of capacitor. Time constant of RC current, initial and final values of discharge of a capacitor.

Unit-V

THREE PHASE CIRCUITS: Concept of generation of 3-phase voltages, Advantages of 3-phase system over single-phase system, phase sequence of 3-phase, Phasor diagrams and wave shapes, Star-Delta connections relationship between phase and line value of current and voltage, expressions for power. Numerical examples for balanced system, concept of unbalanced load. Power measurement in 3-phase circuit. Three wattmeter method, two wattmeter method, expression for power factor, Variation in wattmeter readings with load power factor, power factor improvement of single phase and 3-phase circuits.

Text/Reference Book:
1) Basic Electrical Engineering by V. K. Mehta, S. Chand Publications
2) Electrical Technology by C. R. Dargon, Dhanpat Rai Publications

ELECTRONIC DEVICES AND CIRCUITS
DEL-205

Unit-I
Introduction to Electronics: Applications of electronics in different fields. Brief introduction to active and passive components.
Semi-conductor Physics: Intrinsic and extrinsic semiconductors. Atomic and crystal structure of germanium silicon atoms, covalent bonds, generation of electrons and holes, recombination. Mechanism of holes contributing to conductivity. Energy level diagrams of conductor, insulators and semi-conductors. Doping, P and N type semi-conductors, their conductivity. Majority and minority charge carriers, immobile ions. Drift and diffusion currents. Effect of temperature on extrinsic and intrinsic semi-conductors. Unbiased PN junction, mechanism of current flow, depletion layer, potential barrier. Behaviour of P-N junction under forward and reverse bias. Reverse saturation current, surface leakage current. Breakdown phenomenon, Zener and avalanche breakdown. Static and dynamic resistance and their calculations from diode characteristics. Diode ratings and specifications. Problems
Applications: Diode as rectifier. Half wave, full-wave (center tapped and bridge rectifier). Construction, operation, output frequency and peak inverse voltage. Average value and rms value of output voltage and load current. Ripple factor, efficiency and regulation.
Filter Circuits: Shunt capacitors, series inductor, choke input LC filter, A-filter, bleeder resistor, physical explanation of working of the filters, expression for ripple in each case and application of each type.
Special Diodes: Brief description, operation and application of Zener diode. Name of some important diodes.

Unit-II
Concept of bipolar transistor as a two junction three terminal device having two kinds of current carriers. PNP and NPN transistors, their symbols and mechanism of current flow. Working of the transistor, concept of leakage current and effect of temperature on it. CB, CE and CC configurations, their current relations, input and output characteristics. Determination of input, output dynamic resistance and current amplification factor from the characteristics. Comparison of the three configurations with regards to input, output resistance, current gain, voltage gain and leakage currents. Preference of CE configuration over other configurations. Transistor as an amplifier in CE configuration. Effect of fixing operating point in cut-off saturation and active region. AC, DC load lines, its equation and drawing it on the output characteristic. Determination of small signal voltage and current gain of the amplifier using output characteristics and load line. Concept of power gain as a product of voltage gain and current gain.

Unit-III
Field Effect Transistor: Construction and operation, characteristics and parameters of junction FET. Construction and operation and characteristics of MOSFET in depletion and enhancement modes. Comparison of JFET with bipolar transistor. Comparison between JFET and MOSFET Simple FET amplifier circuit and its working principles.

Unit IV
Single Stage Small Signal Amplifier: Single stage transistor amplifier with proper biasing components. Explanation of phase reversal of the output voltage with respect to the input voltage. Calculation of different parameters using approximate model. Loading effects of R_S and R_L.
Multi-Stage Transistor Amplifier: Need of multistage amplifier. Gain of multistage amplifiers. Different coupling schemes used in amplifiers. Decibel and its significance. RC coupled multistage amplifier, construction, operation, advantages, disadvantages and applications. Calculations of voltage gain.

Frequency response curve. Definition and significance of terms Bandwidth, Upper and lower cut-off frequencies. Transformer coupled amplifier, its working, advantages, disadvantages and applications. Frequency response curve. Direct-coupled amplifier, construction, operation, advantages disadvantages and applications. Frequency response curve.

Transistor Audio Power Amplifier: Need for power amplifier. Difference between voltage and power amplifier. Classification of power amplifiers (class A, B, AB & C). Graphical analysis. Importance of impedance matching. Construction and operation of class B push-pull amplifier. Collector and overall efficiency. Crossover distortion in class B operation and its reduction. Different driver stages for push-pull amplifier circuits. Working principle of complementary symmetry push-pull amplifier and its advantages. Problems.

Unit-V

Feedback amplifier: Basic principle and types of feedback. (Block diagram). Derivation of expression for the gain of an amplifier, employing feedback, effect of negative feedback on gain stability, impedance, distortion and bandwidth, their mathematical expressions (No derivations). Typical practical feedback circuits. Problems

Sinusoidal Oscillators: Classification of oscillators, damped and undamped oscillators, basic oscillatory circuit. Use of positive feedback. negative feedback & resistance for generation of oscillations. Bark-Hausen criterion for oscillation. Frequency stability of an oscillator. Hartley & Colpitts's Phase Shift. Wein Bridge and Crystal oscillator and their working principles. Applications of oscillators.

Text/Reference Book:
1) Applied Electronics by R. S. Sedha, S Chand Publications
2) Basic Electronics by N. N. Bhargava, Tata McGraw-Hill Publications

ELECTRICAL MACHINES-I
DEE-206

Unit-I
SYNCHRONOUS MACHINES:
Alternator: Construction of armature and field structure, salient pole and non-salient pole, speed and frequency, armature winding, coil span factor and distribution factor, three-phase windings. E.M.F. equation, E.M.F. induced in three-phase system. Effect of harmonics on pitch factor and distribution factor. Alternator on load. Armature resistance, armature leakage reactance and armature reactions. Synchronous reactance and synchronous impedance of alternator. Specifications of alternators for thermal, hydro-electric and nuclear power station and diesel generating sets.

Unit-II
TRANSFORMER-I:
Working principle of transformer and its constructional features, E.M.F. equation for a transformer. Transformer at no-load with phasor diagram. Ideal transformer at load with phasor diagram. Ampere-turns balance. Mutual flux and leakage flux, leakage reactance.
Referred values and equivalent circuit. Voltage regulation and calculation. Efficiency, Condition for maximum efficiency. All-day efficiency with its significance. Cooling of transformer. Tests on transformer. Applications of transformer.

Unit-III
TRANSFORMER-II: Principle, construction and working of an auto-transformer. Construction of three-phase transformer (core & shell type). Main connections of three-phase transformer. Difference between power &b distribution transformers. Parallel operation of transformer and necessary conditions for parallel operation. On load tap changer with applications.

Unit-IV
THREE-PHASE INDUCTION MOTOR: Production of revolving magnetic field. Constructional details of three- phase induction motor (cage type & slip-ring type both). Principle of working, relationship between frequency, number of poles and speed of induction motor. Synchronous speed, slip and its importance, effect of slip on rotor emf and rotor frequency. Applications of 3-phase induction motor.

Unit-V
DC MACHINES: Constructional details of DC machines, emf equation, generator principle, types of DC generators and applications. Characteristics of DC generators. Principle of DC motor. Function of commutator for motoring & generating action. Armature winding. Determining electro-magnetic torque and speed of DC motor. Characteristics of DC motors. Starting of DC motors and motor starters. Speed control of Dc motors. Armature reaction and commutation, losses and efficiency. Applications of DC motors.

Text/Reference Book:
1) Electric Machine by Ashfaq Husain, Dhanpat Rai Publications
2) Principles of Electrical Machines by V.K.Mehta, S Chand Publications

MEASUREMENT AND MEASURING INSTRUMENTS
DEE-207

Unit-I

Instruments accuracy, precision, resistively, resolution and error. Basic requirement for measuring instrument: Definition of controlling torque, types and methods. Definition of Damping torque, types and methods. Types and classification of instruments. Principle of working, constructional feature of moving coil, moving iron, Electrostatic instruments and comparison.

Unit-II

Constructional feature and working of Dynamometer type watt meter, induction type single phase and three phase energy meters. Measurement of power by 1, 2 and 3 wattmeter method. Energy meter errors and their adjustment.

Unit-III

Construction and working of power factor meter, frequency meter and maximum demand indicator. Block diagram description and basic operating controls of a cathode ray oscilloscope.

Unit-IV

Measurement of low, medium and high resistance construction, working and application of Ohmmeter, megger and Wagner's earth device.

Unit-V

Basic principle of Wheatstone bridge, AC bridges: Maxwell bridge, Hay's bridge Wein's bridge and Anderson's bridge. Calibration of instruments with the help of DC potentiometer. Uses of shunts and multiplier. Extension of range of Ammeter, Voltmeter and Wattmeter. Concept and uses of C.T. and P.T.

Text/Reference Book:
1) A Course in Electronic Measurements and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co. (P) Limited

ELECTRICAL DESIGN DRAWING & ESTIMATING
DEE-208

Unit-I
A Review of Electrical Symbols: List of symbols for electrical equipments used in electrical installation like light, fan and power circuits, alarm circuits (i.e. indicating circuits using alarm bells, light, etc.) contractor control circuits as per ISS. Types of wiring diagrams using single and multiple representation and schematic diagrams as per ISS.
Design and drawing of panel board for simple Light and Fan circuit: Use of outside dimensions of switches, regular and plug points to design and draw panel boards on which these have to be mounted both for flush mounting in case of concealed wiring and for mounting on a wooden block in the case of surface wiring (at least two exercises).

Unit-II
Wiring installation drawings i.e. concealed conduit wiring in small residences.
Reading designing and drawing of electrical installation wiring for small residence involving schematic and wiring diagrams dividing the installation into sub circuits. Positioning of various outlets and main switch boards and calculation of the length of the wire required. Determining the ratings and installation of necessary equipments on the main switch boards (at least two exercises).

Unit-III
Electrical installation for commercial multi-storey buildings including (a)installation plan, (b) single line diagram (c) selection and rating of necessary equipments (d) estimating and costing of material as per given rate schedule.

Unit-IV
Electrical installation for small industries including (a) installation plan (b)single line diagram (c) estimating and rating of necessary equipments (d) estimating and costing of material as per given rate schedule.

Unit-V
Wiring diagram, schematic diagrams of auxiliary circuits, selection and rating of necessary equipment, the circuits should incorporate remote control, interlocking, time delay, sequential operation, over load protection etc. application to DOL starters, star-delta starter, slip ring induction motor starter, reversing starter, two speed motors, group drives and similar other applications.

Text/Reference Book:

1) Electrical Design Estimating and Costing by K. B. Raina, S.K. Bhattacharya, New Age International Private Limited.
2) A Course in Electrical Installation Estimating and Costing by J.B. Gupta, S.K. Kataria & Sons.

ELECTRICAL ENGINEERING MATERIALS
DEE-209

Unit-I
Conducting Materials: Introduction, Resistivity and factors affecting resistivity, Classification of conducting materials into low resistivity and high resistivity materials, Low Resistivity Materials and their Applications, Copper, Aluminum, Stranded conductors, Bundled conductors, High Resistivity Materials and their Applications, Tungsten, Carbon, Platinum, Mercury

Unit-II
Semiconducting Materials: Introduction, Semiconductors, Electron Energy and Energy Band Theory, Excitation of Atoms, Classification of Insulators, Semiconductors and Conductors, Semiconductor Materials, Intrinsic Semiconductors, Extrinsic Semiconductors, N-Type Materials, P-Type Materials, Minority and Majority Carriers, Semi-Conductor Materials, Applications of Semiconductor materials

Unit-III
Insulating Materials: Introduction, General properties of Insulating Materials, Electrical properties, Visual properties, Mechanical properties, Thermal properties, Chemical properties, Ageing, Insulating Materials – Classification, properties, applications, Classification of insulating materials on the basis physical and chemical structure

Unit-IV
Dielectric Materials: Introduction, Dielectric Constant of Permittivity, Polarisation, Dielectric Loss, Electric Conductivity of Dielectrics and their Break Down, Properties of Dielectrics, Applications of Dielectrics

Unit-V
Magnetic Materials: Introduction, Classification, Diamagnetism, Para magnetism, Ferromagnetism, Magnetization Curve, Hysteresis, Eddy Currents, Curie Point, Magnetostriction, Soft and Hard magnetic Materials
Materials for Special Purposes: Thermocouple materials, Bimetals, Soldering Materials, Fuse and Fuse materials

Text/Reference Books
1) K.B. Raina, S.K. Bhattacharya, T. Joneja, Electrical Engineering Material & Electronic Components, S. K. Kataria & Sons.
2) G. K. Bainerjee, Electrical and Electronics Engineering Materials, PHI.

COMPUTER APPLICATIONS
DCA-209

Unit-I
Introduction: Digital computer, brief history, computer generation, types of computer and their classification, PC family, application of computer in office automation. Science and engineering, hardware and software system, basic computer organisation, basic concept of data and information. Number system, decimal and binary number systems, Data representation- fixed point and floating-point number representation. Introduction to networking, various type of networks, software and hardware, internet.

Unit-II
Operating system and PC Software: Basic concept and functions of an operating system, disk operating system, MSDOS, directories and files, commands and utilities, batch file programming, management of computer resources like memory, CPU, I/O, storage, computer virus and protection, familiarization with windows structure and use. Working knowledge of PC software word processor, spreadsheet, database.

Unit-III
Numerical Analysis and Programming Techniques: Numerical analysis- iteration methods; Newton-Raphson method, Bisection method Algorithm, Pseudo-codes, flow charting- rules and symbols, structured programming concept, computer language- low level, high level and 4 Gls, compilers, interpreters, object-oriented programming, need and characteristics, inheritance, reusability, polymorphism and overloading.

Unit-IV
C/C++ Programming: C/C++ - preliminaries data types, operators, expressions, input/output, functions and program structure, program control flow, looping, arrays, string, pointers, structures, unions, file handling, functions and pre-processor commands, graphics functions, common programming errors, classes.

Unit-V
Computer graphics: Introduction to computer graphics, graphics primitives, computer aided drafting and design (CADD), various CADD packages, auto-CAD, simple engineering drawing using auto-CADD, graphic function in C.

Text/Reference Books:
1) Let Us C by Yashavant P. Kanetkar, BPB Publications.

GENERATION OF ELECTRICAL ENERGY
DEE-301

Unit-I
INTRODUCTION: Available sources and forms of energy. Necessity for generating and utilizing electrical energy. Units of energy: Mechanical energy, Electrical energy and Thermal energy and their relationship. Classification of power generating stations, relative merits, Choice of plant for specific requirements.
NON-CONVENTIONAL GENERATING STATIONS: Elements of diesel plant. Magneto-hydrodynamic generation (MHD Generation). Generation of electrical energy from wind, tides and solar. Energy and other methods under development.

Unit-II
ATOMIC GENERATING STATION: Nuclear fuels. Nuclear fission, Construction, working and processes involved in the nuclear reactions, Reactor accessories, Generation of electrical energy in a nuclear power plant, Important components: coolants, heat exchanger, prime movers, condensers, cooling water systems, feed water storage and other components, relative merits. Brief description and schematic diagram of Boiling water reactor (BWR), Pressurised water reactor (PWR), Sodium Graphite reactor (SGR),Fast breeder reactor (FBR) and CANDU reactor (Canadian-Deuterium Uranium).

Unit-III
THERMAL GENERATING STATION: Generation of electrical energy in thermal power plant. Choice of site and factors affecting the selection of site. Schematic diagram of thermal power plant. Important components and their functions, Coal handling plant, Ash disposal systems, etc. Boilers, Superheaters, Economizer, Air pre-heaters, Prime-movers and Cooling towers etc. Advantages and disadvantages.

Unit-IV
HYDROELECTRIC GENERATING STATION: Hydroelectric power station, advantages and disadvantages. Classification of hydroelectric power plant. Selection of site for plant. Hydel prime-movers. Salient features and essential components of hydel scheme. Catchment area, Dams, Survivors, Head works power channels. Arrangements and locations of hydroelectric power plant: Spillways, Intake, Fore bay, Pen stocks, water hammer, surge tank, Draught tubes pump storage plant.
ECONOMICS OF GENERATION: Load Curves: daily, monthly and yearly. Connected load, Average load, Peak load. (maximum demand), Load factor, Demand factor, Diversity factor, Plant factor and Plant use factor. Base load and Peak load power stations. Inter connections of power stations. Fixed, semi fixed and running costs, Interest and Depreciation, Annual costs. Numerical Problems.

Unit-V
TARIFFS: Tariffs and its characteristic. Various types of tariffs: Simple tariff, Flat rate tariff, Block rate tariff, Two-part tariff, Three-part tariff, Maximum demand tariff, Power factor tariff. Problems on tariffs.
POWER FACTOR: Cause and disadvantages of low power factor. Methods of power factor improvement using static capacitor and synchronous condenser. Problems on power factor. Economics of power factor improvement & Numerical problems.

Text/Reference Books:
1) Generation of Electrical Energy by B.R. Gupta, S Chand Publications
2) Principles of Power System by V. K. Mehta, S Chand Publications

ELECTRICAL MACHINE-II
DEE-302

Unit-I

SYNCHRONOUS GENERATOR (ALTERNATOR): Determination of voltage regulation, armature resistance, Open circuit characteristics (no load characteristics) short circuit characteristics. Synchronous impedance method: voltage regulation and phasor diagram. Ampere turn method or MMF method. Zero power factor or Potier method. Synchronizing, Various methods of Synchronizing of alternator, single phase and three-phase. Operating a synchronous machine when connected to infinite bus bars, synchronizing torque, effect of load on synchronizing power. Parallel operation of two alternator. Effect of unequal voltages, distribution of load: Effect of change excitation, effect of change in steam supply. Maximum power output.

Unit-II

SYNCHRONOUS MOTOR: Principle of operation, Methods of starting, procedure for Starting a synchronous motor. Motor on load with constant excitation, Equivalent circuit of synchronous motor. Power developed by the synchronous motor, Synchronous motor with different excitation. Effect of increased load with constant excitation: normal excitation, under excitation and over excitation. Effect of changing excitation of constant load: excitation decreased and excitation increased. Different torque of synchronous motor synchronous motor: starting torque, running torque, pull in torque and pull-out torque. Power developed by synchronous motor. Effect of excitation on armature current and power factor. Hunting or surging or phase swinging. Comparison between synchronous and induction motor. Synchronous motor applications: power factor correction, constant peed, constant load drives, voltage regulation. Cooling of synchronous motor.

Unit-III

INDUCTION MOTOR: Power developed and torque. Locking of rotor and stator fields, Rotor current & Rotor torque. Relationship between the rotor I^2R loss and the motor slip, Factors determining the torque. Effect of rotor resistance upon the Torque-slip relationship, Slip-Torque Characteristics, Development of circuit model (Equivalent circuit), Break down torque, torque conditions of mean torque-slip and torque speed curves. Effect of change in supply voltage on starting and full load torque and maximum torque. Approximation relationship at low slip; maximum power output, Limitation of circuit model. Tests to determine circuit model parameters the no load tests, separating out core loss from windage and friction loss, voltage ratio test, Blocked-Rotor (Short circuit test), performance calculations, Circle diagram, determination of circle diagram. Determination of efficiency slip, speed & Power factor etc. from circle diagram. Starters for induction motors: DOL Starter, Star-Delta, Auto transformer & rotor resistance.

Unit IV

FRACTIONAL KW MOTORS: 1-Ph Induction Motors: Construction, Characteristics, Working and applications. Nature of field produced in single phase induction motor. Split phase induction motor, Capacitor start motor, Capacitors start and Capacitor run motor, Shaded pole motor, Reluctance start motor, AC series motor and Universal motors. Single phase synchronous motor: (i) Reluctance motor (ii) Hysteresis motor.

Unit-V

SPECIAL PURPOSE MACHINE: Construction and working principle of brushless generators and three brush generators. Construction and working principle of Eddy current drives for variable operations.

Text/Reference Books:
1) Electric Machine by Ashfaq Husain, Dhanpat Rai Publications
2) Principles of Electrical Machines by V.K.Mehta, S Chand Publications

TRANSMISSION AND DISTRIBUTION
DEE-303

Unit-I
ELECTRICAL DESIGN AND PERFORMANCE: Layout of different transmission and distribution systems. Advantages of high voltage transmission line. Effect of increase of voltage on: (a) Weight of copper (b) Efficiency of line (c) Line drop. Concept of short, medium and long transmission lines. Parameters of lines; resistance of transmission line; Inductance of single-phase over-head line, Inductance of 3-phase over-head line. (Triangular formation with symmetrical and unsymmetrical spacing only). Performance of short transmission line: phasor diagram, regulation and efficiency.
CORONA: Factors affecting corona, Critical disruptive voltage, Visual critical voltage, Power loss due to corona, Methods of reducing corona effects, Advantages and disadvantages of corona, Skin effect, Proximity effect and Ferranti effect.

Unit-II
MECHANICAL DESIGN OF OH LINE: Constructional features of Over-head transmission lines. Types of conductors; types of supports; types of insulators; and their properties; selection and testing. Transposition of conductors, Stringing of lines, Potential distribution over suspension insulator string, Calculation of voltage across different Units of string (assembly of three disc only), String efficiency.
SAG: Calculation of sag at level supports and unequal level supports, Effect of wind and ice on sag, use of sag template, Indian electricity rules pertaining to clearances. Clearances above the ground of lowest conductor of line. Clearance of line conductor from buildings, Comparison of conductor costs in various AC/DC systems and their choice for transmission and distribution purposes.

Unit-III
SUB-STATIONS: Various classifications of sub stations; Power and distribution sub-station, Transforming substations, Rectifying substation, Inverting substations. Comparison between out-door and indoor substation. Equipment used in transformer sub stations. Lay out of indoor sub-stations. Erection and estimation of 11/0.4 kV sub-station
HVDC: Advantages of HVDC transmission line over long distances. Limitations of HVDC transmission line over long distances.

Unit-IV
UNDERGROUND CABLES: Relative merits of overhead and underground system. Construction of cables, Insulating materials for cables, Classification of cables. Cables for 3-phase service, laying of underground cables, Different methods used in laying of cables, Insulation resistance of single core cable. Simple Numerical problems. Fault locations by performing different types tests such as Murray's loop test, Varley loop test etc. Testing of cables and their specification.

Unit-V
DISTRIBUTION SYSTEM: Feeders; distributor and service mains Connection schemes of distribution system- Radial system, ring main system, interconnected system. Types of D.C. distributors, Simple calculations on distributor fed at one end and distributor fed at both ends having equal and unequal voltages. AC distributors: Simple calculation on ac distributors fed at one end.

Text/Reference Books:
1) Principles of Power System by V. K. Mehta, S Chand Publications
2) Electric Power Systems by Ashfaq Hussain , CBS Publications

UTILIZATION AND ELECTRIC TRACTION
DEE-304

Unit-I
ILLUMINATION: Nature of light, curve of relative sensitivity of human eye and wave length, Definitions: flux, solid angle, plane angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, reflection factors, space to height ratio, MHCP, MSCP. MHSCP, reduction factor, lamp efficiency, specific consumption, absorption factor, waste light factor, Luminous efficiency, Laws of illuminations, calculation of illumination, Calculation of illumination at different points, Calculations of number of light points for interior illumination, consideration involved in simple design problems and illumination schemes indoor and outdoor illumination level.

Different sources of light: Different types of lamps and lamp fittings, Construction, working and circuitry of filament lamps, mercury lamp, fluorescent lamp, sodium vapour lamp, neon lamp, halogen lamps, Compact fluorescent lamp. Difference in incandescent lamp and discharge lamp. Main requirements of proper lighting scheme; absence of glare, principles of street lighting.

Unit-II
(A) ELECTRIC HEATING: Advantages of electric heating, classification of electric heating methods and equipments; Resistance heating (direct resistance heating, Indirect resistance heating, electric ovens & their temperature range), properties of heating element, domestic water heaters and other heating appliances, induction heating- principles, core type and core less induction furnace.

Electric Are heating: Direct and indirect are heating; arc furnace, Dielectric heating, advantages, applications in various industrial fields. Simple design problems of Resistance heating element, simple numerical problems on different types of heating.

(B) ELECTRIC WELDING: Welding Methods, principle of resistance welding, welding equipment. Principle of are production, electric arc welding, principle & characteristics of arc, carbon and metallic arc welding, power supply, advantage of coated electrodes, Comparison of AC & DC arc welding, welding control and its circuits.

Unit-III

(A) ELECTROCHEMICAL PROCESSES: Laws of electrolysis, need of electro deposition, Applications of Faraday's laws in electro-deposition, objectives of electro plating, factors governing electro-deposition, Equipment and accessories for electro plating plant and used for electro plating extraction & refining of metals. Principle of anodizing and its applications, electroplating on non-conducting materials, numerical problems on electroplating.
(B) REFRIGERATION AND AIR CONDITIONING: Introduction, Description of electrical circuits controls used in Domestic refrigerator, air conditioner and water coolers. Types of Air Conditioning.

Unit-IV
ELECTRIC DRIVES: Advantages of electric drives, characteristics of different kinds of electric drives, Types of motors used in electric drive, Electric braking: (Plugging, Rheostatic Braking, Regenerating braking), Methods of power transfer by devices (Belt drive and pulleys, Gear and direct drive) selection of motors for particular loads, Applications of electric drives such as- general workshop, textile mills, paper mills, steel mill, printing press, crane and lift etc. Application of commonly used 1-Φ and 3-phase motors such as (Induction motors, AC series motors, squirrel cage induction motors and slip ring induction motor etc.)

Unit-V
ELECTRIC TRACTION: Field scope, advantages of electric traction, Different systems of electric traction (AC and DC), economical aspects of electric traction and diesel electric traction, supply system & supply voltage methods of feeding distribution and current collection, traction substation & road ways OH structure, Electric engine components, OH wires, conductor, rail system, current collectors, pantograph etc. Electrical block diagram of an electric locomotive with description of various equipment & accessories. Methods of speed control and braking

Electric Trains: Speed time curve, power and energy calculation, specific energy consumption and efficiency (Numerical problems) Electric lighting and signaling system.

Text/Reference Books:
1) Utilization of Electrical Energy and Traction by J.B. Gupta, S.K. Kataria & Sons.
2) Utilization of Electrical Energy and Traction by Tarlok Singh, S.K. Kataria & Sons

SWITCHGEAR & PROTECTION
DEE-305

Unit-I
CIRCUIT INTERRUPTING DEVICES: Fuses, isolators & circuit breakers, Arc phenomenon theories of arc extinction. Methods of Arc extinction, Classification of circuit breakers, Construction and Working of Modern circuit breakers, Circuit breakers ratings, Important terms as applied to fuses and CBs, MCB RCCB, ACB, ELCB and VCB for distribution and transmission system.

Unit-II
PROTECTIVE RELAYS AND RELAYING CIRCUITRY: Faults, Types, Nature, Causes and Consequences of Faults, Requisites of Protective System. Relays, Classification of Relays- Induction Type Over Current Relay, Reverse Power Relays, Induction Type Directional Over Current Relays, Concept of Fault Level, Earth Fault Relay, Static Relays and Relaying Circuitry, Distance Relays.

Unit-III
SYSTEM PROTECTION: Zones of protection, Types of protection, principle of Differential Protections, Principle of Distance protection, R-X diagram, Protection of generators, transformers, bus bars, feeders and induction motors against various faults.

Unit-IV
POWER STATION & SUBSTATION SWITCH GEAR: Bus bar arrangements, current limiting reactors, station auxiliaries, Unit system and its importance, Switch gear layout of generating station and sub stations.

Unit-V
SURGE PROTECTION AND SYSTEM GROUNDING: Switching and Atmospheric surges, Protection against surges, Modern surge diverters, Purpose of Neutral Grounding, Method of Grounding-Resonant, Solid and impedance grounding. Earthing transformer, Earthing of all non-current carrying metallic parts.

Text/Reference Books:
1) Principles of Power System by V. K. Mehta, S Chand Publications
2) Fundamentals of Switchgear and Protection by J.B. Gupta, S.K. Kataria & Sons

POWER ELECTRONICS
DEE-307

Unit-I
INTRODUCTION TO SCR: Construction and working principle of an SCR, Characteristics of SCR, Two Transistor analogy of SCR, Construction and working principle of DIAC, TRIAC, UJT and MOSFET, Triggering circuits of Thyristor, Commutation of Thyristor, Series and Parallel operation of Thyristors.

Unit-II
CONTROLLED RECTIFIERS: Introduction to Rectifiers and its applications, Single phase half-wave controlled rectifier with R-L load, Single phase full-wave controlled rectifier with R-L load, Fully controlled full wave rectifier, 3-phase full wave half controlled bridge rectifier, 3-phase full wave fully controlled bridge rectifier.

Unit-III
INVERTERS: Introduction, applications, Series inverters, Parallel inverters, Bridge inverters, Voltage source inverter, Mc-Murrey Bedford inverter, 3-phase inverter, Current source inverter

Unit-IV
CHOPPERS: Introduction to Choppers and their working principles & applications, Types of Choppers, Jones Chopper, Morgan Chopper.

Unit-V
CYCLO-CONVERTERS: Introduction to Cycloconverters, working principle and applications, 1- phase step up & step down Cycloconverters, 3- phase to 1-phase, 3- phase to 3-phase, 1-phase to 3-phase Cycloconverters.

Text/Reference Books:

1) Power Electronics by P S Bhimbra, Khanna Publishers.
2) Power Electronics by Jamil Asghar, PHI

INSTRUMENTATION AND CONTROL
DEE - 308

Unit-I

Introduction: Primary and Secondary transducers, classification of detectors. Bourdon tubes, Diagrams, Bellows, Hydro pneumatic Devices. Classification of Electrical transducers. Advantages of electrical transducers strain gauge, thermistors and linear variable differential transformers.

Unit-II

Advantages of electrical Instrumentation, principle of telemetry and data transmission. Classification of telemetry system. Instrumentation schemes for the measurement of non-electrical quantities such as temperature, pressure, torque, linear velocity, displacement and other quantities significant in the power system.

Unit-III

Basic principles of open and closed loop systems, Basic elements of feed-back control system and basic control actions. A specific position control system, Introduction to Laplace transform, Partial fraction expression and inverse Laplace transform.

Unit-IV

Definition of transfer function, simple example, Block diagram representation, signal flow graph, application of signal flow graph, gain formula & block diagrams, Transfer function of simple electrical & mechanical systems. Effect of feedback, Potentiometer, Synchros.

Unit-V

DC servo motor, AC servo motor, Typical test inputs for transient analysis, transient response, steady state response, steady state error, rise time, overshoot and settling time, transient response of first order system, frequency response, stability criterion, Introduction to Hurwitz Criterion and Nyquist Criterion.

Text/Reference Books:
1) Instrumentation and Control Systems by Y J Reddy, McGraw Hill Education
2) Automatic Control Systems by S. Hasan Saeed, S.K. Kataria & Sons

TROUBLE SHOOTING AND SERVICING OF ELECTRICAL EQUIPMENTS
DEE-309

Unit-I
Principle and planning of maintenance; functions of electrical maintenance department. Common testing equipment used by maintenance personnel and their field of application. Types of electrical wiring, criteria for selection of wiring, (i) domestic (ii) industry, testing of installation and preparation of test report.

Unit-II
Reasons for earthing of electrical equipment, earthing systems, factors influencing the earth resistance, permissible earth resistance for different types of installations, inspection and maintenance of earth resistance. Measurement of earth resistance.

Unit-III
Causes for failure of electrical equipment, classification of faults under (i) electrical (ii) magnetic (iii) mechanical tool and instruments used for trouble shooting and repair. Diagnosis of faults in D.C. machines, transformers, induction motors, circuit breakers overhead, and under-ground transmission lines etc.

Unit-IV
Insulation testing: Insulation resistance measurement, effect of temperature on resistance, reason for determining the insulation resistance, testing of insulation resistance to earth, testing of insulation resistance between conductors, transformer oil testing and interpretation of the test results.

Unit-V
Types of batteries Lead and acid and Nickel Cadmium batteries their charging and maintenance. Classification of accidents, treatment for electric shock, artificial respiration, types and use of different types of fire extinguishers.

Text/Reference Books:
1) Installation Commissioning & Maintenance of Electrical Equipments by P. P. Gupta, Dhanpat Rai Publications (P) Ltd

ENTREPRENEURSHIP DEVELOPMENT AND
INDUSTRIAL MANAGEMENT
DME-309

Unit-I

Management, industrial management, different functions of management. Planning, organising, co-ordination and control, structure of an industrial organisation, function of different departments, relationship between individual departments. Human relations and performance in organisation, understand self and others for effective behaviours, behaviour modification techniques, industrial relations and disputes, relation with subordinates, peers and superiors, interpersonal relationship.

Characteristics of group behaviour and trade unionism, mob psychology, grievances, handling of grievances, agitation strikes, lockouts, picketing and gherao, labour welfare, workers participation in management, introduction to human resource development/ Personnel management, staff development and career development, training strategies and methods, introduction of wages, classification of wage payment scheme.

Unit-II

Importance and necessity of industrial legislation. Type of labour laws and disputes, brief description of the following Act, the Factory Act 1948, Payment of wages Act 1936, Minimum Wages Act 1948, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Employees state insurance Act 1948, Provident Fund Act, various type of taxes- Excise duty, Local sales tax and Central sales tax, Income tax, etc. Classification of accidents: according to the nature of injuries, fatal, temporary, according to event, according to place. Causes of accident- psychological, physiological and other industrial hazards. Safety consciousness, safety measures during the execution of engineering works. Ecology, factors causing pollution, effect of pollution on human health, air pollution and control act, Water pollution and control act, list of pollution control equipment, Solid waste management, Noise pollution.

Unit-III

Concept of ethics, concept of professionalism, need for professional ethics, code of professional ethics, typical problems of professional engineers. Factor determining motivation, characteristics of motivation, method of improving motivation, incentives, pay promotion, rewards, job satisfaction and job enrichment. Need of leadership, function of a leader, factors to be considered for accomplishing effective leadership, manager as a leader. Types of production. Job, batch and mass production, E.O.Q (Economic order quantity). Concept of quality production, philosophies of different groups, concept of total quality management, JIT (Just in time), ISO-9000 and ISO-14000, concept of intellectual property rights and patents.

Unit-IV

Concept of entrepreneurship, importance and need of entrepreneurship in context of prevailing employment conditions in the country, qualities of successful entrepreneurs, career options, scanning of business environment, small scale sector. Types and forms of entrepreneurs and enterprises. Government assistance, steps in setting up enterprises, social responsibility of an entrepreneur. Project identification techniques, selection of a project. Conducting a market survey, preparation of project report and project appraisal.

Unit-V

Working capital assessment, estimating cost, production cost, working capital requirement and profit estimation, break even analysis, book keeping and accounts. Marketing management including export NATURE and scope of marketing, identification of products/country, price analysis, documentation and procedures. Role of financial institutions like SIDBI, SFC, NGOs, Bank etc. and their support for enterprise building, Role of non-financial institutions like DIC, KVIC, SISI, NSIC etc. Legal requirements in setting up and running an enterprise, commercial, labour and tax laws.