SYLLABUS
DIPLOMA IN ELECTRICAL ENGINEERING
(DAY COURSES)
w.e.f.: 2012

UNIVERSITY POLYTECHNIC
FACULTY OF ENGINEERING AND TECHNOLOGY
JAMIA MILLIA ISLAMIA
NEW DELHI - 110025

Contents

First Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/ Week
Theory Courses							
1	DEES 101	Communication Skills-I	04	40	60	100	04
2	DEEC 103	Applied Chemistry	04	40	60	100	04
3	DEEM 104	Applied Mathematics-I	04	40	60	100	04
4	DCE 105	Applied Mechanics	04	40	60	100	04
5	DEE 106	Fundamentals of Electrical Engg	04	40	60	100	04
Practical Courses							
1	DEEC 113	Applied Chemistry	02	30	20	50	02
2	DCE 115	Applied Mechanics	02	30	20	50	02
3	DEE 116	Fundamentals of Electrical Engg	02	30	20	50	02
4	DME 117	Engg. Drawing-I	02	30	20	50	03
Total			**28**	**320**	**380**	**700**	**29**

Second Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/ Week
Theory Courses							
1	DEEM 201	Applied Mathematics-II	04	40	60	100	04
2	DEEP 202	Applied Physics	04	40	60	100	04
3	DME 203	Elements of Mechanical Engg	04	40	60	100	04
4	DEE 204	Electrical Engg. Materials	04	40	60	100	04
5	DEL 206	Basic Electronics	04	40	60	100	04
Practical Courses							
1	DEEP 212	Applied Physics	02	30	20	50	02
2	DME 213	Elements of Mechanical Engg	02	30	20	50	02
3	DEL 216	Basic Electronics	02	30	20	50	02
4	DME 217	Workshop Practice	02	30	20	50	03
Total			**28**	**320**	**380**	**700**	**29**

Third Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/Week
Theory Courses							
1	DEE 302	Measurements & Measuring Instruments	04	40	60	100	04
2	DEL 305	Digital Electronics & µP	04	40	60	100	04
3	DCA 305	Computer Applications	04	40	60	100	04
4	DEE 306	Electrical Design Drawing & Estimating	04	40	60	100	04
5	DME 306	Thermo Fluids	04	40	60	100	04
Practical Courses							
1	DEE 312	Measurements & Measuring Instruments	02	30	20	50	02
2	DEL 313	Digital Electronics & µP	02	30	20	50	02
3	DCA 315	Computer Applications	02	30	20	50	02
4	DME 316	Thermo Fluids	02	30	20	50	02
Total			28	320	380	700	28

Fourth Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/Week
Theory Courses							
1	DEES 401	Communication Skills-II	04	40	60	100	04
2	DEE 402	Generation of Electrical Energy	04	40	60	100	04
3	DEE 403	Network Analysis	04	40	60	100	04
4	DEE 404	Electrical Machines-I	04	40	60	100	04
5	DEE 405	Power Electronics	04	40	60	100	04
Practical Courses							
1	DEE 413	Network Analysis	02	30	20	50	02
2	DEE 414	Electrical Machines-I	02	30	20	50	02
3	DEE 415	Power Electronics	02	30	20	50	02
4	DEE 416	Electrical Workshop	02	30	20	50	02
Total			28	320	380	700	28

Fifth Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/ Week
Theory Courses							
1	DEE 501	Electrical Machines –II	04	40	60	100	04
2	DEE 502	Electrical Troubleshooting	04	40	60	100	04
3	DEE 503	Control System Engg	04	40	60	100	04
4	DEE 504	Electrical Instrumentation	04	40	60	100	04
5	DME 506	Industrial Management	04	40	60	100	04
Practical Courses							
1	DEE 511	Electrical Machines –II	02	30	20	50	02
2	DEE 512	Electrical Troubleshooting	02	30	20	50	02
3	DEE 513	Control System Engg	02	30	20	50	02
4	DEE 514	Electrical Instrumentation	02	30	20	50	02
Total			**28**	**320**	**380**	**700**	**28**

Sixth Semester

S. No	Code No	Subject	Credit Hrs	Sessional	Univ. Exam	Total	Periods/ Week
Theory Courses							
1	DEE 601	Transmission & Distribution	04	40	60	100	04
2	DEE 602	Switch Gear & Protection	04	40	60	100	04
3	DEE 603	Special Purpose Machines	04	40	60	100	04
4	DEE 604	Utilization & Traction	04	40	60	100	04
5	DEE 605	Electrical Energy Management	04	40	60	100	04
Practical Courses							
1	DEE 612	Switch Gear & Protection	02	30	20	50	02
2	DEE 613	Special Purpose Machines	02	30	20	50	02
3	DEE 620	Project	08	120	80	200	06
4	DEE 630	Industrial Training & Visits	02	50	-	50	-
Total			**34**	**430**	**420**	**850**	**30**

NOTE: Project Topics (DEE 620) shall be assigned to the students at the commencement of 5th Semester.

COMMUNICATION SKILLS-I
DEES-101

Unit	Topic	Marks
I	**Reading** a. *Comprehension (Beginner)*	**10**
II	**Grammar** a. *Tenses, Active & Passive* b. *Vocabulary*	**20**
III	**Structure** a. *Sentence Formation* b. *Word Formation*	**10**
IV	**Writing-I** a. *Report Writing* b. *Curriculum Vitae*	**10**
V	**Writing-II** a. *Application* b. *Business Letter*	**10**

APPLIED CHEMISTRY
DEEC-103

Unit-I: Problem based on Volumetric Gravimetric Analysis
1. Molecular-mass, mole, weak and strong electrolytes, Equivalent mass and Gram-equivalent.
2. Strength, Normality and Molarity of a solution, Normality equation.
3. Problem base on Volumetric Gravimetric Analysis

Unit-II: Analysis and treatment of water
1. Impurities in water, Hardness, Units of Hardness and Calcium carbonate equivalent.
2. Estimation of dissolved oxygen, Alkalinity and Hardness by EDTA method.
3. Problems in boilers, Ion Exchange process for softening of water

Unit-III: Fuel and Combustion
1. Units of heat, Characteristics of good fuel, Calorific value, Calculation and determination of calorific value, types of Coal, Petroleum, LPG, CNG, Producer gas, Water gas and Coal gas
2. Problem based on combustion of solid, Liquid and Gaseous Fuel, Analysis of Flue gases by Orsat apparatus.

Unit-IV: Corrosion and Lubricant
1. Dry and Wet corrosion, Galvanic corrosion, Concentration corrosion, Pitting corrosion, Stress corrosion.
2. Protection of corrosion by proper designing, Alloying, Cathode protection and coating methods.
3. Types and Mechanism of Lubricant, Characteristics of Lubricants like Viscosity, Acid value, Saponification value, Cloud point, Pour point, Flash and Fire point.

Unit-V: Atomic Structure and Bonding
1. Bohr's theory, Quantum no, Electronic configuration of first 36 elements, AUFBAU Principle, Pauli Exclusion Principle and Hund's Rule.
2. Electrovalent, Co-valent Compounds.
3. Metallic bonding and Free Electronic theory.

APPLIED MATHEMATICS-I
DEEM-104

Unit-I: Algebra
Arithmetic Progression, its nth term, sum to n terms, Geometric Progression, its nth term, sum to n terms and sum to infinite terms, Binomial theorem (without proof) for any index, General and middle term, terms independent of x, first and second binomial approximation.

Unit-II: Determinants
Determinants (upto 3rd order only), Minors, Co-factors, Properties of determinants, Solution for linear simultaneous equations in three variables by Crammer's Rule.

Unit-III: Matrices
Definitions and example of matrices, types of matrices, basic operations, equality of matrices, addition, multiplication and scalar multiplication of matrices, transpose of a matrix, symmetric, skew-symmetric matrices, singular and non-singular matrices, cofactor matrix, adjoint of matrix, inverse of a matrix, solution of a simultaneous equations in three variables by matrix inverse methods.

Unit-IV: Co-ordinate Geometry of Two Dimensions
Definition of locus with problems, Equations of straight lines in various forms. Angle between two lines, Perpendicular distance formula, Conic sections, Circles, Parabola, Ellipse and Hyperbola.

Unit-V: Vectors
Scalar and vector, addition and subtraction of vectors and their simple applications, Multiplication of vector by scalar, Scalar and Vector product of two vectors, Scalar product of three vectors, Geometrical Interpretation.

APPLIED MECHANICS
DCE-105

Unit-I

Introduction: Concept of engineering mechanics, its importance and necessity. Giving suitable examples on bodies at rest and motion, concept of rigid bodies.

Laws of forces: Principles of mechanics-superposition, transmissibility etc, types of forces, systems of forces, principles of forces, resultant of forces. Parallelogram law, triangle law, polygon law of forces, resolution of forces, free body diagram. Equilibrium force and its determination, Lami's theorem.

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Unit-II

Moments: Concept of moment, laws of moment, Varignon's theorem. Application of moment to simple mechanism, resultant of parallel / non-parallel forces, reaction at support in statically determinate beam due to point load, U. D. L and triangular load.

Unit-III

Centre of gravity: centre of gravity and centroid of regular body (cone, cylinder, sphere and hemisphere), areas (rectangle, circle and triangle), composite bodies, composite areas, remainder.

Moment of Inertia: Moment of inertia of Lamina-rectangular, circular (solid/hollow), triangular, parallel axis theorem, perpendicular axis theorem.

Unit-IV

Laws of motion: Newton's laws of motion, momentum, impulse, torque, linear and angular motion.

Circular motion: centripetal and centrifugal force.

Work, Power and Energy: Definition of terms, simple numerical problems.

Unit-V

Friction: Concept of friction, laws of friction-static and dynamic, limiting friction, coefficient of friction, angle of friction. Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.

Simple Lifting Machines: Concept of machine, mechanical advantage, velocity ratio and efficiency of machine, their relationship, laws of machine, simple machine winch crab, wheel and axle, simple screw jacks. System of pulley-first, second and third system of pulley.

Text Books/ Reference Books:
1. Applied Mechanics by A. K. Upadhay, S. K. Kataria& Sons.
2. A Text Book of Engineering Mechanics by R. K. Khurmi, S. Chand & Co.
3. A Text Book of Engineering Mechanics by A. R. Basu, Dhanpat Rai & Co.

FUNDAMENTALS OF ELECTRICAL ENGINEERING
DEE-106

Unit-I: D C Circuits
Current, Voltage, Power, Energy and their units, Ohm's law, Resistance, Resistances in series, Resistances in parallel, Laws of resistance, Temperature coefficient of resistance, Grouping of cells, Numerical problems.

Unit-II: Electromagnetism
Introduction to electromagnetism, Magnetic field around a straight current carrying conductor, Magnetic field at the axis of a circular conductor, Magnetic field at the axis of a solenoid, Methods for finding the direction of magnetic field of straight conductor and solenoid, Force on a current carrying conductor placed in the magnetic field, Force between two parallel current carrying conductors, Numerical problems.

Unit-III: Magnetic Circuits
Magnetic field, Flux, Flux density, Magneto motive force, reluctance, Laws of magnetic force, Absolute and relative permeability, Series and parallel magnetic circuits, Leakage flux, B-H curve, Magnetic hysteresis, Hysteresis loop, Hysteresis loss, Ampere-turns calculations, Comparison between electric and magnetic circuits, Numerical problems.

Unit-IV: Electromagnetic Induction
Faraday's laws ofelectromagnetic induction, Lenz's law, Fleming's rules, Principle of self and mutual induction, Self and mutually induced emf, Self-inductance and mutual inductance, Coefficient of coupling, Energy stored in inductor, Numerical problems.

Unit-V: D C Transients
Growth of current in an inductive circuit, Current in RL series circuit at different times, Time constant of RL series circuit, Decay of current in inductive circuit, charging of capacitor, Time constant of RC series circuit, Initial values, Final values, Discharging of capacitor, Numerical problems.

Text Books/ Reference Books:
1. Electrical Technology by C R Dargan, Dhanpat Rai Publications
2. Fundamentals of Electrical Engineering by Ashfaq Husain, Dhanpat Rai Publications

ENGINEERING DRAWING-I
DME-117

Unit-I: Introduction
a. **Drawing Instruments**, Drawing instruments, Sizes and layout of standard drawing sheet, Sizes on drawing boards.
b. **Lines, Lettering and Dimensioning:**
Different types of lines and freehand sketching, Different types of lines in engineering drawing as per BIS specifications, Practice in freehand sketching of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, small and large circles, parabolas, curves and ellipses.

Unit-II: Lettering Techniques and Practice
Instrumental single stroke (vertical and inclined) lettering of 3 to 7 mm height. Instrumental double stroke lettering of 35 to 50 mm height ratio of 7:4 (vertical).

Unit-III: Dimensioning
Necessity of dimensioning, terms and notations- methods and principles, dimensioning small components (mainly theoretical instructions), dimensioning of overall sizes circles, thread holes, chamfered surfaces, angles tapered surface holes equally spread on PCD, counter sunk and counter bored holes, cylindrical parts. Space and gaps radii curves and arches, chain and parallel dimensioning.

Unit-IV: Scales
Scales and their need and importance, definition of representative fraction (RF), calculating RF of a scale, types of scales, construction of plain and diagonal scales.

Unit-V:
Construction of curves such as ellipse, parabola, hyperbola, cycloids, epicycloid and hypocycloid, involute of simple curves.

APPLIED MATHEMATICS-II
DEEM-201

Unit-I: Differential Calculus

Limit and Continuity (without problems), Differentiation of function by first principle, Differential of sum, Product and quotient functions, Differential of a function of a function (chain rule), Logarithmic Differential, Higher order derivatives.

Unit-II: Integral Calculus

Indefinite integral, Integration of a function, Standard formulae, the Fundamental Laws of integration, Integration by Substitution Method, By parts Method and Partial Fraction Method.

Unit-III: Applications of Calculus

Maxima and Minima, Tangent and Normal, Evaluation of Definite Integral, Properties of Definite Integral, Area bounded by a curve between two ordinates and x-axis.

Unit-IV: Differential Equations

Differential Equations, Order and Degree of differential equations, Solution of differential equations of first order and first degree, Variable separable, Homogeneous and Linear differential equations, Solution of Linear differential equations of 2nd order with constant co-efficient.

Unit-V: Complex Numbers

Complex Number, Representation of a complex number (Argand diagram), Complex number in Rectangular, Polar and Exponential form, Conversion from one form to another form. De-Moiver's Theorem, Roots of complex number.

APPLIED PHYSICS

DEEP-202

Unit-I: Electrostatics
Coulomb's laws, unit charge, absolute and relative permittivity (dielectric constant), electric field, electric lines of force, electric flux, electric flux density, electric field at a point due to a point charge; **Gauss's theorem:** electric field intensity at a point due to uniformly charged thin sheet, electric field intensity at a point due to a charged sphere. Electric potential difference, electric potential at a point due to point charge and number of charges, potential gradient, relation between potential gradient and electric field intensity, relation between electric potential and electric field intensity.

Unit-II
Capacitors: definition and units, types of capacitors, capacity of parallel plate capacitor, energy stored in a capacitor, combination of capacitor (series and parallel).
DC Circuits:
Kirchhoff's laws, applications Kirchhoff's laws to Wheat Stone Bridge, Post-office Box, Meter bridge and Potentiometer. **Heating effect of current:** Heat produced by electric current in a conductor, statement and explanation of Joule's law, expression for the amount of heat generated in the conductor, determination of 'J' by electrical method.

Unit-III: Electromagnetism
Motion of charged particle in uniform magnetic field, Biot-Savart law, magnetic field due to current carrying circular loop and magnetic field due to current carrying conductor, force experienced by a current carrying conductor in a uniform magnetic field, torque on a current loop, force between two parallel current carrying conductors, definition of an ampere, principle and working of moving coil galvanometer, conversion of galvanometer into ammeter and voltmeter.

Unit-IV: Semi-Conductor Physics
Intrinsic Semiconductors – Conductivity, Atomic and crystal structure of germanium and silicon. Covalent bonds, generation and recombination, effect of temperature on conductivity of Intrinsic semi-conductor. Energy level diagrams of conductor, insulator and intrinsic semiconductors. Extrinsic semiconductor materials. Doping of impurity, P and N type semiconductors and their conductivity. Minority and Majority charge carriers. Drifts and diffusion current.

Unit-V: Modern Physics
Atomic models: J. J. Thomson model, Rutherford model, Bohr's model and its shortcomings, X-ray: - production, properties and uses. LASERS: - types of Laser, Helium-Neon laser, Properties and Applications of Laser. Radioactive decay, laws of mass defect, Natural Radioactivity, binding energy, fusion, fission, energy generated in reactors and radiation hazard.

ELEMENTS OF MECHANICAL ENGINEERING
DME- 203

Unit–I: Transmission of Power

Different modes of power transmission Belt Drive: Material of belt, flat belt V belt open belt and cross belt device, Length of belt (without derivation), Velocity ratio, Slip, Angle of contact, Derivation of tension ratio for flat belt, Power transmitted through belts.

Advantage of V belt over flat belt, Simple numerical problem. ($T_1/T_2=e^{\mu\theta}$)

Chain Drive: Classification, Clutch: Principal of clutch, comparison between chain and belt drive.

Pulley: Introduction, type of pulleys, step pulley, split pulley, vee-grove pulley, rope pulley.

Gears: Spur, Helical, Bevel, Spiral, Rack and Pinion, Gear Train: Simple and Compound gear train and simple numerical problems.

Unit-II: Steam Generators and Turbines

Steam generators: Introduction, classification, Difference between Fire tube and Water tube boilers. Simple vertical boiler, Babcock and Wilcox boiler, Cochran boiler, Boiler accessories and mountings.

Turbines: Introduction & classification of steam turbine, concept of reaction and simple impulse turbine, comparison between impulse and reaction turbines. Losses in steam turbine.

Hydraulic turbine: Classification, construction, working of Pelton wheel, Francis turbine and application of reaction and impulse turbine.

Unit-III: Internal Combustion Engines

- Classification and application if I.C. engine commonly used spark ignition engine
- Compression ignition (C.I) engines.
- Working principals of two stroke and four stroke petrol and diesel engine.
- Ignition system in petrol engine
- Simple carbonator.
- Cooling system of IC engine.

Lubrications: Introduction, Method of lubrication: Petrol System, mixed, (D), Splash and forced lubrication system.

UNIT-IV

Pumps: Construction and Working of reciprocating (single acting) centrifugal pump, Air compressor: Working of air compressor and applications of compressed air Material Handling: Tower and bridge crane. Jaw Crushers. Hydraulic jack and hydraulic Lift.

Unit -V

Refrigeration and Air Conditioning System: Introduction, unit of refrigeration, coefficient of performance, vapour compression cycle: Simple vapour absorption cycle & applications. Air conditioning System: Purpose of air conditioning,   Factors affecting air conditioning, definition relating to psychometric parameters like dry bulb temp., wet bulb temp., humidity etc. room air conditioner (window & split type) and desert cooler.

Text Books/ Reference Books:

1. Mechanical Engineering by H. R. Kapoor, Khanna Publishers.
2. Basic Mechanical Engineering by T. S. Prabhu, SCITECH
3. Fundamentals of Mechanical Engineering by G. S. Sawhney, PHI

ELECTRICAL ENGINEERING MATERIALS
DEE-204

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, Polarization, 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 Books/ 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.

BASIC ELECTRONICS
DEL-206

Unit-I

Applications of electronics in different fields. Active and Passive components, Voltage and Current source with numerical examples.

Unit-II

PN junction, behaviour of PN junction under forward and reverse bias. Semiconductor diode characteristics. Static and dynamic resistances. Their calculation from diode characteristics. Diode as half wave, full wave, and bridge rectifier, applications. Ripple factor, and its value for half wave rectified output. Calculation of DC voltage, RMS voltage, and efficiency.

Unit-III

Capacitor input filter, choke input filter, LC filter, RC filter, Pie filter. Brief idea and applications of power diode, Zener diode, Tunnel diode, Varactor diode, application of Zener diode as voltage regulator, numerical examples.

Unit-IV

Concept of Bipolar Junction Transistor (BJT) as two junctions three terminal device having two kinds of current carriers. PNP and NPN transistors their symbol and mechanism of current flow, explanation of fundamental current relations. Concept of leakage current, CE, CB, CC configuration. Input and output characteristics. Determination of the transistor parameters. Comparison of CE, CB, and CC configuration.

Unit-V

Transistor as an amplifier in CE configuration. DC load line, its equation and drawing it on the output characteristics. Transistor biasing circuit, effect of temperature on operating point. Need for stabilization of operating point, effect of fixing operating point in cut-off and saturation region on the performance of amplifier.

Text Books/ Reference Books:
1. Electronic Devices and Circuit Theory: by Robert Boylested& Louis Nashelsky
2. Basic Electronics and Linear Circuit: by N N Bhargava
3. Applied Electronics: by R S Sedha
4. Electronics Devices and Circuits: by Sanjeev Gupta
5. Electronic Principles: by Sahdev
6. Electronic Principles: by Malvino
7. Microelectronic Circuits: Analysis and Design, by Rashid
8. Microelectronic Circuits: by Sedra & Smith
9. Microelectronics: by Millman &Grabel

WORKSHOP PRACTICE
DME-217

Carpentry Shop
Introduction of tools, Making of various Joints-Cross lap joint. Half lap joint, Mortise and tenon joint, Dovetail joint.

Fitting Shop
Introduction of tools, Cutting and Filing as per diagram, Drilling

Smithy Shop
Introduction of tools, Hot working and Cold working, Fabrication of U clamp, Fan hook and sheet metal joints

Welding Shop
AC welding and Gas welding, preparation of Lap joints and But joints, preparation of Oxy-acetylene gas welding joint, Metal Cutting.

MEASUREMENT AND MEASURING INSTRUMENTS
DEE 302

Unit-I: Measurement of Voltage and Current
Important terms, classification of errors, classification of instruments, essentials of indicating instruments, controlling torque, types of controlling torque, damping torque and its type.

Unit-II: Construction of Instruments
Construction and working of PMMC, construction and working of MI instruments, Construction and working of electrostatic instruments.

Unit-III: Measurement of Power and Energy
Rectifier type instruments, construction and working of dynamo meter type wattmeter, construction and working of single phase induction type energy meter.

Unit-IV: Measurement of Resistance
Measurement of low, medium and high resistance, megger, single phase power factor meter.

Unit-V: AC Bridges
Basic principle of AC Bridges, Maxwell's Bridge, Hay's Bridge and Wien's Bridge extension of range of instruments.

Text Books/ Reference Books:
1. A Course in Electrical and Electronic Measurement and Instrumentation. by A K Sawhney, Dhanpat Rai Publication.
2. Electrical Measurement and Measuring Instruments. by Rajendra Prasad, Khanna Publisher.

DIGITAL ELECTRONICS AND MICROPROCESSOR
DEL-305

Unit-I
Number Systems: decimal, binary, octal and hexadecimal number system, inter conversion of decimal, binary and hexadecimal numbers. BCD numbers, BCD addition and subtraction.

Unit-II
Logic Gates**:** NOT – OR – AND – NAND – NOR – XOR – X-NOR, NAND and NOR as universal gates.
Logic Families: TTL logic circuits (NAND and NOR), comparison of TTL, ECL and CMOS.
Boolean Algebra: De Morgan's theorem, standard POS and SOP forms, min-term and max-term representation of Boolean functions, simplification of Boolean functions using K-maps (up to 4 variable)

Unit-III
Combinational Circuits: Half and Full adders, Half and Full subtractor, Multiplexer, Demultiplexer, Encoder, Decoder, seven segment decoders.
Flip Flop: R-S, J-K, master slave and edge triggered J-K, T and D flip flops.
Sequential Circuits: Shift registers, Ring counter, Ripple and Synchronous counter, Modulo-N counter, Decade counter, digital to analog converter (binary weighted register and ladder types) and analog to digital converter (using D/A converter and comparator).

Unit-IV
Digital Waveform Generator: concept of timer IC 555 and its use for waveform generation (astable and monostable).
Memories: Concept of Random Access Memory (RAM), static and dynamic RAM, read Only Memory (ROM), PROM, EPROM.

Unit-V
Introduction to Microprocessors: Evolution of microprocessors, organization, architecture, and pin description of 8085 microprocessor, addressing modes and instruction set, input, output interfacing devices (8255, 8251), simple program for addition and subtraction, developmental trends in microprocessors technology (8086, 80286, 80386, 80486 and Pentium).
Applications of Microprocessors: Application of microprocessors in Geophysical Instrumentation, Microprocessor based data acquisition, frequency, temperature and voltage measurements using microprocessors.

Text Books/ Reference Books:
1. Jain: Modern Digital Electronics
2. Malvino: Digital Computer Electronics
3. Puri: Digital Electronics
4. Mathur: Introduction to Microprocessors
5. Sheth & Hebber: Microprocessors
6. Goankar: Microprocessors Architecture Programming and Applications
7. Gaikwad: Operational Amplifier

COMPUTER APPLICATIONS
DCA-305

Unit-I
Digital Computer systems, Characteristics, History, Computer Generations, Types of computers and their classifications, application of computers in various fields, Computer Hardware & Software, Elements of computer hardware-CPU, I/O devices, storage media, Computer Software- Types of software, system software, Application software.

Unit-II
Basic concept and function of an operating system, textual v/s GUI interface, type of Operating Systems, concept of multiprogramming, multitasking, multiprocessing, introduction to Disk operating System (DOS). Commands and utilities, working with MS Windows, Unix & Linux, Working knowledge of PC Software Word Processor.

Unit-III
Computer Languages, Generation of Languages, Translator, Assemblers, Interpreters, Compilers, Algorithm, Pseudo-code, Flowcharts- Rules & Symbols, Structured Programming concepts, various techniques of programming, Use of programming.

Unit-IV
Introduction to **'C'**, importance of C, basic structure of a C program, constants, variables and data types, operators and expressions, managing I/O operators, Control statement, **'IF'** statement and its various forms, **'goto'** statement, for, while and do-while loops, switch decision making statement, Arrays: Array notation, storage and representation, User define functions, and their use.

ELECTRICAL DESIGN DRAWING & ESTIMATING
DEE-306

Unit-I: Electrical Symbols and Simple Light and Alarm Circuits:
Electrical symbols used in electrical installation, Schematic and wiring diagrams, light and fan point controlled by individual switches, fluorescent tube controlled by one-way switch, one lamp controlled by two switches (staircase circuit) three lamps controlled by four switches (Corridor light circuit).

Unit-II: Alarm Circuits Without and with Relays:
One bell controlled by one push button, two ordinary bells (for day and night) used at a doctor's residence, bell response circuit using one bell and one relay, bell response circuit of an office (of three rooms). Traffic light control system for two road crossing, a Light circuit which automatically gets connected to DC supply in case of power failure.

Unit-III: Electrical Installation of Small Residential Buildings:
Internal Distribution system, Single-phase Light and Power Sub-Circuit, Systems of wiring, Installation plan, Multiline and Single line wiring diagrams, Design and Estimation of electrical installation of small residential buildings, list of material required along with cost by doing market survey, Description of various tests to test the wiring installation before commissioning.

Unit-IV: Electrical Installation of Commercial Buildings:
Internal Distribution system, Busbar chamber, Mains, installation plan, Single-Line wiring diagram, Design and Estimation of electrical installation of large commercial buildings, list of material required along with cost by doing market survey, commissioning of electrical installation, Introduction to Intelligent Lightning system.

Unit-V: Contractor Control Circuits:
Schematic diagram and complete wiring diagram of:
  i.   DOL starting of three-phase induction motor.
  ii.   Three-phase induction motor getting supply from selected feeder.
  iii. Reversing of three-phase induction motor.
  iv.   Two speed control of three-phase induction motor.
  v.   Sequential operation of two motors using Time-Delay Relay.
  vi.   Automatic Star-Delta starter of three-phase induction motor.

Text Books/ Reference Books:
  1. Electrical Design Estimating and Costing, by K. B. Raina & S. K. Bhattacharya, New Age International Publishers

THERMO FLUIDS

DME- 306

Unit-I
Introduction and application areas of thermo-fluid sciences, Property, system, and surroundings. Enthalpy and internal energy, state and equilibrium, processes and cycles, Laws of thermodynamics, reversible, irreversible processes, heat and work, Formation of steam, dryness fraction, specific volume, specific enthalpy, specific entropy of saturated and superheated steam, simple numerical problems.

Unit-II
Introduction to three modes of heat transfer (conduction, convection and radiation) and their governing equations, one dimensional steady state conduction. Thermal conductivity, thermal resistance, convective heat transfer coefficient, critical radius of insulation, Principle laws of thermal radiation, Kirchhoff 's law, Stefan Boltzmann's law, emissivity, absorptivity, reflectivity and transitivity, simple numerical problems.

Unit-III
Properties of Fluid: Mass, density, weight density (specific weight), specific volume, specific gravity, viscosity (kinematic & dynamic viscosity), surface tension, compressibility and their units, Newtonian fluids. **Pressure:** Intensity of pressure, pressure head, Pascal's law with, atmospheric pressure, gauge pressure, vacuum pressure, absolute pressure.
Measurement of pressure: Piezometer, simple manometer, differential manometer, inverted differential manometer. **Loss of Energy in pipe flow:** Loss of head during flow through pipelines, major &minor losses, Darcy's and Chezy's formula (without proof), loss of head in pipe due to sudden enlargement, sudden contraction, bend, elbow, obstruction (without Proof), power transmission through pipes, simple numerical problems.

Unit-IV
Types of fluid flow. Steady & unsteady, uniform & non-uniform. Laminar & turbulent flows. Reynold number and its significance, rate of flow, continuity equation, Bernoulli's theorem (without proof) and its limitations; discharge through venturimeter, pitot tube; and small orifice, vena controcta, coefficient of contraction(C_c), coefficient of velocity(C_v.), coefficient of discharge(C_d), coefficient of resistance(C_r), simple numerical problems

Unit-V
Hydraulic machines: Introduction, selection of turbines, performance and Complex Number parameters, Complex Number of turbines: specific speed, unit speed. Unit discharge. Unit power, and efficiency, working principle and application of hydraulic coupling. Rotary air compressors, simple numerical problems.

Text books/ Reference Books:
1. Engineering thermodynamics by P. K. Nag
2. Fundamentals of Thermodynamics by Sonntag, Borgnakke, Van Wylen
3. Fluid Mechanics and Hydraulic Machines by A. R. Bas
4. Hydraulic and Hydraulic Machines by Bansal

COMMUNICATION SKILLS-II
DEES-401

Unit	Topic	Marks
I	**Reading** a. *Comprehension (Advanced)*	**10**
II	**Grammar** a. *Direct and Indirect*	**05**
III	**Writing** a. *Dialogue* b. *Paragraph*	**15**
IV	**Speaking-I** a. *Presentation Skills*	**15**
V	**Speaking-II** a. *Interview*	**15**

GENERATION OF ELECTRICAL ENERGY
DEE-402

Unit-I

Importance of electrical power in day today life, various sources of energy. Comparison of sources of power. Selection of site for thermal power stations, block diagram of thermal power station, operation of boiler, economizer, air preheater, super heater, steam prime movers, condensers, draft fans etc.

Unit-II

Classification of hydroelectric plants. General arrangement and operation of hydroelectric plant, layout diagrams, hydraulic turbines, selection of turbines, dams, spillways, penstock, surge tank, fore bay, reservoirs, catchment area.

Unit-III

Nuclear Power Plant, Diesel Power Plant and Gas Power Plant.

Unit-IV

Prospects of non-conventional power plants, solar power, wind power, tidal power, MHD generation.

Unit-V

Prediction of load, load curves, plant capacity factor, utilization factor, Components for total cost of generation per unit, Methods for depreciation calculation, Effect of load curves on cost per kWh.

Text Books/ Reference Books:
1. A Course in Electrical Power by J. B. Gupta.
2. Non-Conventional Energy Sources by S. Hasan Saeed & D. K. Sharma.
3. Electrical Power 2 - Generation & Protection by M. L. Anand

NETWORK ANALYSIS
DEE-403

Unit-I: Network Terminology
Basic circuit element, dependent and independent sources, KCL & KVL, its application in solving D.C. circuits, Mesh and Nodal Analysis.

Unit-II: AC Fundamentals
 Generation of alternating Voltage and Current, important terminology: Peak value, RMS value, Average value of current and voltage, Form Factor & Peak Factor, phase and phase difference, addition of alternating quantities, AC circuit containing pure resistance, pure inductance, pure capacitance. Numerical problems

Unit-III: Single Phase AC Circuits
RL, RC and RLC series and parallel circuit, impedance triangle, phasor algebra, rectangular and polar conversion, addition, subtraction, division and multiplication, different methods for solving series and parallel circuits, series and parallel resonance, numerical problems.

Unit-IV: Network Terminology
Concept of generation of 3-phase voltage, advantage of 3-phase over 1-phase, Star-Delta connection (relationship between phase and line values of current & voltage), Expression for power measurement by 2-Wattmeter Method & 3-Wattmeter Method, numerical problems.

Unit-V: Network Theorems
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem and their applications, Conversion of circuits from Star to Delta and vice versa, and Numerical Problems.

Text Books/ Reference Books:
1. Basic Electrical Engineering by V.K Mehta & Rohit Mehta, S Chand Publication.
2. Fundamentals of Electrical Engineering by Ashfaq Husain & Haroon Ashfaq, Dhanpat Rai & Co.
3. Basic Electrical Engineeringby C L Wadhwa-, New Age International Publishers.
4. Basic Electrical Engineering, by S. K.Sahdev, Pearson Publications.
5. Fundamentals of Electrical Engineering & Electronics by S.K. Sahdev, Dhanpat Rai & Co.

ELECTRICAL MACHINES-I
DEE-404

Unit-I: DC Generator

Construction, Working principle of d.c. generator, e.m.f. equation, Types of DC generator, Equivalent circuits, Lap & Wave windings, armature reaction & commutation, improving commutation, Separately excited, self excited, Shunt wound, Series wound, Compound wound, Characteristics of d.c. generator, Application of d.c. generator, Losses and efficiency of d.c. generator, Numerical problems.

Unit-II: DC Motors
Working principle, Back emf and its importance, equivalent circuit, e.m.f. equation, torque equation, types of d.c. motors, armature reaction and interpoles, Characteristics of d.c. motors, Application of d.c. motors, speed equation & speed control, starting, DOL Starter, 3-pin starter, losses & efficiency, Numerical problems.

Unit-III: Introduction to Single Phase Transformer:
Principle of operation of 1-phase transformers, Construction, e.m.f. equation, Ideal Transformer, voltage transformation ratio, turn ratio, current ratio, Transformer on no-load. Transformer on load, resistance and leakage reactance.

Unit-IV: Equivalent Circuit and Phasor Diagram for 1-Phase Transformer
Equivalent circuit and phasor diagram of 1-phase transformer at different power factors, referred values, application & simplified equivalent circuits with phasor diagrams, voltage regulation and calculation at different power factors, Losses, tests and efficiency, condition for maximum efficiency, All-day efficiency, cooling of transformer, Auto transformer, its construction, working and application, introduction to 3-phase transformer.

Unit-V: Introduction to Three- Phase AC Machine:
Working principle, Construction and types of 3-phase induction Motor, Concept of rotating magnetic field, slip and its importance, Construction and Working principle of Synchronous machines & their e.m.f. equations.

Text Books/ Reference Books:
1. Electrical Machines by R. K. Rajput
2. Electrical Machines by J. B. Gupta
3. Electric Machines by Ashfaq Husain and Haroon Ashfaq
4. A Textbook of Electrical Technology Vol-2 by B. L. Theraja

POWER ELECTRONICS
DEE 405

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-Murray 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 Books/ Reference Books:
1. Power Electronics by P S Bhimbra
2. Power Electroncis, by Jamil Asghar, PHI

ELETRICAL MACHINES-II
DEE 501

UNIT-I: Three Phase Transformers:
Constructional details, Advantages of 3 phase transformers over 1-phase transformers, Applications of different connections and their advantages over one another, Condition for parallel operation.

UNIT-II: Three Phase Induction Motors*:*
Induced EMF & Torque Equations, Torque-Speed Characteristics, Speed control of 3 phase IM, Equivalent Circuit Model, Starting & Starters for 3 phase IM, Applications.

UNIT-III: Three Phase Alternators*:*
Voltage Regulation, Methods for determining voltage regulation, Open circuit & Short circuit characteristics, Concept of distribution and coil span factor, Operation of alternator when connected to an infinite bus-bar, Effect of load on synchronizing power, Parallel Operation, Load sharing by two alternators & calculations.

UNIT-IV: Three Phase Synchronous Motors:
Starting methods, Motor on load with constant excitation, Equivalent circuit, Power developed, Motor with different excitations, Effect of load increment with constant excitation, Effect of changing excitation with constant load, Different Torques, Effect of excitation on armature current and power factor, Hunting, Applications.

UNIT-V: Single Phase Motors (FKW motors)
Single phase motors - Principle of operation, classification
Single phase Induction Motors- [Split Phase Motors, Capacitor Motors, Shaded Pole motors & Reluctance Start Motors]
Single phase Synchronous Motors- [Reluctance Motor & Hysteresis Motor]
Single phase Commutator Motors- [AC Series Motor, Universal Motor & Repulsion Motor].

Text Books/ Reference Books:
1. Electrical Machines by S. K. Bhattacharya, TMH
2. Electrical Machinery by P. S.Bhimbra, Khanna Publishers.
3. Electric Machines by Ashfaq Husain& Haroon Ashfaq, Dhanpat Rai & Co.

Electrical Trouble Shooting
DEE-502

Unit-I: General

Maintenance, Classification of maintenance, function of electrical maintenance department. Advantages and disadvantages of various maintenance system, common testing equipment.

Unit-II: Earthing Maintenance & Testing

Reasons for earthing, classification of earthing, factors influencing the earth resistance, inspection and maintenance of earth electrodes.

Unit-III: Maintenance of Machines

Causes for failure and diagnosis of faults in transformers, induction motors and circuit breakers.

Unit-IV: Testing of Insulation Resistance

Testing of electrical installation, testing of insulation resistance between conductors and between conductor and earth, Transformer oil testing

Unit-V: Maintenance of Batteries and Safety Measures

Maintenance of batteries, Shock treatment, artificial respiration and fire extinguishers.

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

CONTROL SYSTEM ENGINEERING
DEE503

Unit-I: Fundamental Elements and Components

Introduction to control system: Types, Open loop and Closed loop system, Basic elements of feedback control systems, Position control system, Effect of feedback.

Unit-II: Introduction to Laplace Transform

Laplace transform: General Laplace transform of algebraic and other functions, Partial fraction expansion, Inverse Laplace transform, Application of Laplace transform in solving second order differential equations, Initial and final value theorems.

Unit-III: Transfer Function & Modeling of Electrical Systems

Block diagram representation, Reduction techniques, Signal flow graph, Mason's gain formula, Transfer function, Transfer function of electrical system.

Unit-IV: Time Response Analysis

Standard signals, Steady state and transient response, Input test signals, Step signal, Ramp signal, Impulse signal and Parabolic signal, Transient response of control system, Rise time, Maximum overshoot, Peak time, Settling time, Steady state error.

Unit-V: Stability Analysis

Stability concept, Necessary conditions for stability, Hurwitz's stability criterion, Root locus plot, General rules for constructing root loci, Examples.

Text Books/ Reference Books:
1. Automatic Control System by Hasan Saeed.
2. Control Systems Engineering by I. J. Nagrath.
3. Control System Engineering by U.A.Bakshi and V.U. Bakshi.

ELECTRICAL INSTRUMENTATION
DEE-504

Unit-I: Introduction
Important terms in measurement system, Errors, types of error, classification of errors Advantages of electrical instrumentation, Data transmission & their classification, Principle of telemetry system, Classification of telemetry system.

Unit-II: Sensors and Transducers
Introduction, Classification of transducers, advantages and disadvantages of electrical transducers, resistance transducers, Inductive transducers, Primary sensing element, Proximity sensors, Pneumatic sensors, Light sensors and selection of sensors.

Unit-III: Displacement Transducers
Potentiometric transducer, Inductive transducer, Capacitive transducer, LVDT, Photoelectric transducer, Piezo-electric transducer.

Unit-IV: Strain Gauge and Thermoelectric Transducers
Principle of strain gauge and its applications, types of strain gauge, Resistance transducer and thermistor, Thermocouples and thermopiles, Pyrometer.

Unit-V: Measurement of Non-Electric Parameters
Measurement of Displacement scheme, Measurement of velocity and acceleration, Measurement of Force and Pressure, Measurement of Flow rate of liquid, Measurement of temperature.

Text Books/ Reference Books:
3. A Course in Electrical and Electronic Measurement and Instrumentation. by A K Sawhney, Dhanpat Rai Publication.
4. Electrical Measurement and Measuring Instruments. by Rajendra Prasad, Khanna Publisher.
5. Electrical Instrumentation, by Rangan and Sharma

INDUSTRIAL MANAGEMENT
DME-506

Unit -I

Management, Industrial Management, Different functions of Management, Planning, Organizing, co-ordination, Controlling, Structure of an Industrial Organization, Functions of different departments, Human relations and performance in organization.

Unit -II

Trade Unions, Grievances, Handling of grievances, Agitations, Lockout. Labour welfare, Workers participation in management. Labour laws, and disputes. Wages: types of wages, wage & incentive plants. Factory Act 1948, Payment of Wages Act 1936. Industrial Dispute Act1947.

Unit -III

Business ethics, Managerial ethics, Codes of ethics. Causes of accidents, Safety consciousness, Safety measures, Factors causing pollution, Effect of pollution on human health, Noise pollution.

Unit -IV

Entrepreneurship Development, Entrepreneur, Modern concept of entrepreneur, entrepreneurship,
Qualities to becomes entrepreneur, Classifications of entrepreneurs. EDP training, Small Scale Industries, Classifications of Small Scale Industries, Project report guidelines, Content of project report, Project appraisal. Market survey, Preparation of project report, Role of financial institutions.

Unit -V

Types of Production, Job, Batch, Mass Production. Concept of Total Quality Management, Six Sigma Concept, Just in Time (JIT), ISO-14000 Series. Concept of intellectual property right and patents. Breakeven analysis, Marketing management, Price Analysis, Determination of Economic order.

TRANSMISSION AND DISTRIBUTION
DEE-601

Unit-I: Transmission Lines
Introduction to overhead transmission line, Classification and Comparison of AC/DC transmission systems. Main components of transmission line i.e. tower, conductors, and overhead line insulators. Potential distribution over suspension insulator string, string efficiency and methods of improving string efficiency, sag calculation of equal supports, effect of transmission voltage on efficiency and regulation of line. Kelvin law.

Unit-II: Line Parameters
Identification of Line parameters, R, L, C & G, Calculation of line parameters for 1-phase and 3-phase lines, Skin and Proximity effect, Ferranti effect, Corona, Corona losses and other effects.

Unit-III: Performance of Transmission Lines:
Parameters of performance of transmission lines, Efficiency and regulation of line, performance of 1-phase short transmission line, Effect of load power factor on performance, Medium transmission lines- Nominal **T** & **π**-models, A, B, C & D parameters of short, medium and long lines.

Unit-IV: Distribution of Electrical Energy:
Introduction, Classification of distribution system, A.C distribution, Connection schemes of distribution system, Requirements of Distribution systems, Design consideration, A.C. distribution calculation, Methods of solving A.C. 1-phase & 3-phase connected (balanced) distribution system, Underground cables, Introduction and requirements. Classification of cables, cable conductors, cable construction, cable insulation, Metallic sheathing and mechanical protection, Comparison with Overhead lines, Cable laying.

Unit-V: Substations:
Introduction, Classification of indoor & outdoor Sub-station, Advantages and Disadvantages, Selection and location of site, main connection schemes, Equipment's circuit elements of substations:-Incoming & Outgoing lines, Transformers, CT & PT, Relays, CB's, Fuses, Isolators, Batteries, lightning arresters. Insulators, Bus-bar's material types in detail, Connection Diagram and layout of Substation.

Text Books/ Reference Books:
1. Principles of Power System by V K Mehta-S Chand & Co.
2. Transmission and Distribution of Electrical Power by J. B. Gupta- S K Kataria& Sons.
3. Electrical Power System by Soni, Gupta & Bhatnagar- Dhanpat Rai Publishing Co.

SWITCHGEAR AND PROTECTION
DEE-602

Unit-I: Fault Analysis

Concept of fault, Symmetrical and Unsymmetrical fault calculations, Fault level.

Unit-II: Circuit Breakers

Fuses, Circuit breakers, Arc phenomenon, Theories of arc extinction, Methods of arc extinction, Important terms as applied to fuses and circuit breakers, Classification of circuit breakers, Construction and working of modern circuit breakers, Circuit breaker ratings, MCB, RCCB, ACB and ELCB.

Unit-III: Protective Relays and Relaying Circuitry

Faults, Types of fault, Nature of faults, Causes and consequences of faults, Requisites of protective system, Relays, Classification of relays- Induction type overcurrent relay, Induction type reverse power relay, Induction type directional overcurrent relay, Earth fault relay, Distance relays, Static relays and relaying circuitry.

Unit-IV: System Protection

Zones of protection, Types of protection, Principle of differential protection, Principle of distance protection, R-X diagram, Translay system, Principle of carrier protection. Protection of Generators, Transformers, Bus-bars, Lines and Induction motors.

Unit-V: Surge Protection and System Grounding

Surges, Protection against surges, Modern surge diverters, Purpose of neutral grounding, Methods of neutral grounding- Resonant, Solid and Impedance grounding, Earthing transformer, Earthing of all non-current carrying metallic parts, Introduction to lightning.

Text Books/ Reference Books:
1. Principle of Power System by V K Mehta & Rohit Mehta- S Chand Publication.
2. Power System Protection and Switchgearby Badri Ram & D Vishwakarma-TMH
3. Electrical Power Systemsby C L Wadhwa-New Age International Publishers.
4. Power System Engineering by D P Kothari& I J Nagrath-TMH
5. Electrical Power Systems, by Ashfaq Husain-CBS Publishers

SPECIAL PURPOSE MACHINES
DEE- 603

Unit-I

Three Brush Generator: Construction, working and applications.
Three Wire Generator: Construction, working and applications.
Boosters: Types, working and applications.
Cross field generator, Rotary amplifiers, Rototrol and Regulex.

Unit-II

Brushless motor: Introduction, applications.
Dynamotor: Construction, working and applications.
Printed circuit Motor: Introduction and applications.
The Osnos Motor (no lag motor): Introduction and applications.
Linear Motor: Construction, working and applications.

Unit-III

Induction Generator: Construction and working principle.
Induction voltage Regulator: Introduction types and applications.
Power Selsyn: Construction, working and applications.
Position Selsyn: Construction, working and applications.
Phase Advancer: Construction, working and applications.

Unit-IV

Frequency Changer: Construction and working.
Brushless Generator: Construction, working and applications
Eddy drives: Construction, working and applications.
Homopolar machines: Construction, working and applications.

Unit-V

Servo motor: Principle, construction, types and applications.
Stepper motor: Principle, Construction, Types, working and applications.
Schrage motor: Construction, working and applications.

Text Books/ Reference Book:
1. Ashfaq Hussain & Haroon Ashfaq, " Electrical Machines" Dhanpat Rai Publications.
2. P. K. Mukherjee & S Chakravorti, "Electrical Machines" Dhanpat Rai Publications.

UTILIZATION AND TRACTION
DEE-604

Unit-I: Illumination
Nature of light, definition, Measurement of candle power and MSCP, photometer bench, photometers, Principle of production of light, Sources of light, requirements of good lighting. Lamp fitting, basic principles of control. Factors affecting the design of indoor lighting installation, special precautions, street lighting, flood lighting and its design, various types of lamps, CFL, Mercury-vapour lamp, Sodium-vapour lamp, LED for lighting

Unit-II: Electric Heating
Classification of electric heating methods and their comparisons. Various types of resistance and arc furnaces, their power supplies and heat control, comparison of various furnaces, High frequency heating, induction heating, Core and coreless induction furnaces, choice of frequency and application of induction heating, high frequency generation, Dielectric heating, choice of voltage and frequency, Calculation of heating power, depth of penetration & Losses, Application and use of dielectric heating.

Unit-III: Electric Welding
Welding & its classifications, Various types of welding and power supply, Electron beam welding, Modern welding techniques, Electronic welding control, need for AC contactors, heat control unit, AC timer units, Sequence of welding timers.

Unit-IV: Electrolytic Processes
Principle of Electro-deposition, Laws of electrolysis. Electroplating, Anodizing and Electro-polishing.

Unit-V: Traction
Advantages of electric traction, requirements of an ideal traction system, train movement, mechanism of train movement, traction motors, traction motor control, Multi unit control, braking of electric motors, thyristors control of electric traction.

Text Books/ Reference Book:
1. PartabH.“*Art and Science of Electrical Energy*”, Dhanpat Rai & Sons.
2. Dubey G. K. “*Fundamentals of Electric Drives*”, Narosa Publishing House
4. Taylor E.O. “*Utilization of Electric Energy*”, Pitman& Sons.
5. Utilization of Electrical Engineering by J. B. Gupta

ELECTRICAL ENERGY MANAGEMENT
DEE-605

Unit-I: Economic Aspects of Power Generation:
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 curve, constraints of economic generation, economic loading of generator, load allocation among various generators, base load and peak load plants.

Unit-II: Operation and Control:
Criteria for distribution of load between units, unit commitment, load sharing, Tie line, transmission loss as a function of plant generation, loss coefficient and brief aspects of load dispatching.

Unit-III: Interchange of Power and Energy:
Introduction, economy interchange between interconnected utilities, power pool, energy banking, transmission effect and issues.

Unit-IV: Energy Audit:
Definition, need for energy audit, types of audit, procedures to follow, data and information analysis, energy consumption, finding of audit, action plans, bench marking energy performance, energy audit instruments, report writing.

Unit-V: Economic Aspects of power factor:

Importance of high power factor, Economic aspects of selection of power factor improvement, Different tariffs of power.