

J. S. University , Shikohabad



Diploma

THREE YEAR DIPLOMA COURSE IN

(Electrical Engineering)

Scheme & Syllabus

[Effective from the session 2015-16]

**STUDY AND EVALUATION SCHEME FOR
THREE YEAR DIPLOMA COURSE IN
ELECTRICAL ENGG.**

SEMESTER - First

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DAS-11	Professional Communication	4	1	-	-	20	50	70	2.5
2	DAS-12	Applied Mathematics-I	4	1	-	-	20	50	70	2.5
3	DAS-13	Applied Physics-I	4	1	-	-	20	50	70	2.5
4	DAS-14	Applied Chemistry	4	1	-	-	20	50	70	2.5
5	DEE-11	Electrical & Electronics Engineering Material	4	1	-	-	20	50	70	2.5

PRACTICA/DRAWING SUBJECTS

5	DWP-11P	Workshop Practice	-	-	10	-	30	60	90	3
6	DAS-11P	Professional Communication	-	-	4	-	20	40	60	3
7	DAS-14P	Applied Chemistry	-	-	4	-	20	40	60	3
8	DGD-10	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total									585	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

**STUDY AND EVALUATION SCHEME FOR
THREE YEAR DIPLOMA COURSE IN
ELECTRICAL ENGG.**

SEMESTER - Second

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DAS-22	Applied Mathematics-II	4	1	-	-	20	50	70	2.5
2	DAS-23	Applied Physics-II	4	1	-	-	20	50	70	2.5
3	DEE-21	Basic Electrical Engg	4	1	-	-	20	50	70	2.5
4	DEC-21	Electronics - I	4	1	-	-	20	50	70	2.5
5	DDW-21	Engineering Drawing	-	-	-	8	20	50	70	3
PRACTICA/DRAWING SUBJECTS										
6	DAS-23P	Applied Physics-II Lab	-	-	4	-	20	40	60	3
7	DEE-21P	Basic Electrical Engg Lab	-	-	4	-	30	60	90	3
8	DEC-21P	Electronics – I Lab	-	-	4	-	30	60	90	3
9	DGD-20	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total									615	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

**THREE YEAR DIPLOMA COURSE IN
ELECTRICAL ENGG.**

SEMESTER - THIRD

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DAS-31	Applied Mathematics-III	4	1	-	-	20	50	70	2.5
2	DEE-31	Electrical Instruments & Measurements	4	1	-	-	20	50	70	2.5
3	DMC-31	Elementary Mechanical & Civil Engineering.	4	1	-	-	20	50	70	2.5
4	DEE-32	Electrical M/c-I	4	1	-	-	20	50	70	2.5

PRACTICA/DRAWING SUBJECTS

5	DCS-31P	Computer Application For Engg.	-	-	10	-	30	40	70	3
6	DEE-31P	Electrical Instruments & Measurements Lab	-	-	4	-	30	50	80	3
7	DMC-31P	Elementary Mechanical & Civil Engineering Lab	-	-	4	-	30	50	80	3
8	DEE-32P	Electrical M/c-I Lab	-	-	4	-	30	50	80	3
9	DGD-30	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total									615	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

**STUDY AND EVALUATION SCHEME FOR
THREE YEAR DIPLOMA COURSE IN
ELECTRICAL ENGG.**

SEMESTER - FOURTH

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DEC-41	Electronics-II	4	1	-	-	20	50	70	2.5
2	DEE-41	Electrical Design,Drawing and Estimating-I	4	1	-	2	20	50	70	3
3	DEE-42	Power Plant Engg.	4	1	-	-	20	50	70	2.5
4	DEE-43	Trans. &Distri of Elect.	4	1	-	-	20	50	70	2.5
PRACTICA/DRAWING SUBJECTS										
5	DEC-41P	Electronics-II Lab	-	-	4	-	30	60	90	3
6	DEE-41P	Electrical Design,Drawing and Estimating-I Lab	-	-	4	-	30	60	90	3
7	DGD-40	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total								485		

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

ELECTRICAL ENGG.

SEMESTER - Fifth

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DIM-51	Industrial Management and Entrepreneurship Development	4	1	-	-	20	50	70	2.5
2	DEE-51	Switch Gear & Protection	4	1	-	-	20	50	70	2.5
3	DEE-52	Industrial Elex. & Control	4	1	-	-	20	50	70	2.5
4	DEE-53	Electrical Machine II	4	1	-	-	20	50	70	2.5
5	DEE-54	Renewable Sources of Energy	4	1	-	-	20	50	70	2.5
PRACTICA/DRAWING SUBJECTS										
6	DFE-51	Field Exposure	-	-	4	-	20	50	70	3
7	DEE-52P	Industrial Elex. & Control Lab	-	-	4	-	30	60	90	3
8	DEE-53P	Electrical Machine II Lab	-	-	4	-	30	60	90	3
9	DGD-50	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total									625	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

**THREE YEAR DIPLOMA COURSE IN
ELECTRICAL ENGG.**

SEMESTER - Sixth

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme			
			L	T	P	D	Sessional	End Exam	Total	Duration
THEORY SUBJECT										
1	DDM-61	Environmental Education & Disaster Management	4	1	-	-	20	50	70	2.5
2	DEE-61	Electrical Design, Drawing & Estimating II	4	1	-	-	20	50	70	2.5
3	DEE-62	Installation, Maintenance & Repair of Elect. Machines	4	1	-	-	20	50	70	2.5
4	DEE-63	Utilization of Elect. Energy	4	1	-	-	20	50	70	2.5
PRACTICA/DRAWING SUBJECTS										
5	DEE-61P	Project	-	-	10	-	50	100	150	3
6	DEE-62P	Installation, Maintenance & Repair of Elect. Machines Lab	-	-	4	-	20	40	60	3
7	DEE-63P	Utilization of Elect. Energy Lab	-	-	4	-	20	40	60	3
8	DGD-60	Games//Social and Cultural Activities + Discipline (15 + 10)							25	
Grand Total									575	

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

[DAS-11] Professional Communication

1. PART I - COMMUNICATION IN ENGLISH

1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, listening, reading, writing and speaking, Barriers in communication, Modern tools of communication-Fax, e-mail, Telephone, telegram, etc.

1.2 Technical communication Vs. General Communication: Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Paragraph writing, Essay writing, Proposal writing.

1.3.2 Business and personal correspondence (Letters): Kinds of letters:-Official, demi-official, unofficial, for reply or inreply, quotation, tender and order giving letters. Application for a job, Resume.

1.3.3 Report writing and Note making and minutes writing.

1.4 Functional Grammar: Study of sentences and parts of speech(word class), Preposition, Verb, Articles, Abbreviations.

1.5 Vocabulary Building: Homophones, One word substitution, Idioms and Phrases.

1.6 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II - COMMUNICATION IN HINDI

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.

2.2 Development of expression through ;Letter writing in Hindi: Kinds of letters:-Official, demi-official, unofficial, for reply or inreply, quotation, tender and order giving letters, Application for a job, Press release in Hindi, Report writing.

Note: Paper should be in two parts, part I - English and part II -Hindi.

REFERENCE BOOKS

1. Bookshelf worksheet of Professional Communication, New Delhi: Bookshelf 2008
2. Functional Skills in language and literature by R. P. Singh, New Delhi: Oxford University Press.
3. Oxford English Hindi English Dictionary, New Delhi: Oxford 2008

[DAS-11P]Professional Communication Lab

For the practice/exercise the following is suggested:

1. A. Phonetic transcription

B. Stress and intonation:

(At least 10 word for writing and 10 word for pronunciation)

2. ASSIGNMENT: (Written Communication)

Two assignments of approximately 400 word each decided by the teacher concerned.

THE FOLLOWING MODEL IS PROPOSED:

1. A picture/photograph

2. An opening sentence or phrase

3. A newspaper/magazine clipping or report

4. Factual writing which should be informative or argumentative.

(The students may refer to "Bookshelf worksheet" for technical communication)

3. Oral Conversation:

1. Short speeches/declamation: Bid farewell, felicitate somebody, celebrate a public event, and Offer condolences

2. Debate on current problems/topics

3. Mock Interview: Preparation, Unfolding of personality and expressing ideas effectively

4. Group discussion on current topics/problems

5. Role Play/ general conversation: Making polite enquiries at Railway Station, Post Office, Banks and other Public places, replying to such enquiries, enquiring about various goods sold in the market and discussing their prices.

Complaining about service at Hotel, restaurant, Offering apologies in reply to such complaints, complain to a company about a defective product you have brought, reply to such complaints.

6. Presentation skill, Use of OHP and LCD.

7. through drilling of model words involving different phonetic symbols (Vowels, Consonants, and Diphthongs).

4. Aural :Listening to conversation/talk/reading of short passage and then writing down the relevant or main points in the specified number of words and answering the given questions. The assignments/project work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g.

10 marks for assignment (Given by subject teacher as sessional marks)

10 marks for conversation and viva-voce

10 marks for phonetic transcription

[DAS-12] APPLIED MATHEMATICS - I

Unit -1: Algebra-I

1. Arithmetic Mean: nth term, sum, Mean
2. Geometric Mean: nth term, sum, Mean
3. Binomial Theorem for positive, negative and fractional index (without proof)
4. Determinants: Elementary properties of determinants of order 2 and 3, system of linear equations and solution, Cramer's Rule

. Unit -2: Algebra-II

1. Vector Algebra: Dot and cross product, Scalar and vector triplet product
2. Complex Numbers: Representation, Modulus and Amplitude, De-Moivre theorem application in solving algebraic equations.

Unit -3: Trigonometry

1. Relation between sides and angles of a triangle: Statement of various formula showing relationship between sides and angles of a triangle.
2. Inverse Circular Functions

Unit -4: Differential Calculus-I

1. Functions, limits, continuity, elementary methods of finding limit (right and left)
2. Differentiability, method of finding derivatives, functions of a function, Logarithmic Differentiation, Differentiation of Implicit functions.

Unit -5: Differential Calculus-II

1. Higher order derivatives
2. Derivatives of Special Functions (Exponential, Logarithmic, and Inverse circular functions)
3. Application: Finding Tangent, Rate Measure, Velocity and Acceleration

[DAS-13]APPLIED PHYSICS-I

Topic Wise Distribution

S.no.	Topics	Marks Distribution
1	Unit & Dimensions	4
2	Errors & Measurement	4
3	Heat & Thermodynamics	5
4	Friction	4
5	Circular Motion	5
6	Motion of Planets & satellites	5
7	Dynamic of Rigid Body	6
8	Fluid Mechanics	6
9	Harmonic Motion	6
10	Acoustics	5
	Total	50

Detailed Contents

1. UNIT AND DIMENSION

Physical quantity and its types, Unit and its types, Definition of SI units, Dimensions of physical quantities, Dimensional formula and dimensional equation, Principle of homogeneity and its applications, Limitations of dimensional analysis

2. ERRORS AND MEASUREMENTS

Errors, Accuracy and Precision, Types of errors in measurement, Combination of errors, Significant figures, Rounding off

3. HEAT AND THERMODYNAMICS

Modes of heat transfer, Coefficient of thermal conductivity, Conduction through compound medium, Isothermal and Adiabatic process, Zeroth and First law of thermodynamics

4. FRICTION

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in daily life, Coefficient of static and dynamic friction and their measurement, Angle of friction, Angle of repose, Motion of a body on a inclined plane

5. CIRCULAR MOTION

Uniform circular motion, Angular velocity and acceleration, centripetal acceleration, Relation between linear and angular velocity and acceleration, Centripetal and centrifugal forces, Practical applications of centripetal forces

6. MOTION OF PLANETS AND SATELLITES

Gravitational force, Acceleration due to gravity and its variation with respect to height and depth from earth, Kapler's law, Escape and orbital velocity, Time period of satellite, Geo-stationary satellite

7. DYNAMIC OF RIGID BODY

Rigid body, Rotational motion, Moment of inertia, Theorems (parallel and perpendicular) of moment of inertia, Expression of M.I. of regular bodies (lamina, disc, sphere, cylindrical), Radius of gyration, Angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy, Rolling of sphere on the slant plane

8. FLUID MECHANICS

Surface tension, Capillary action and determination of surface tension from capillary rise method, Equation of continuity, Bernoulli's theorem and its application, Stream line and Turbulent flow, Viscosity, Stokes law, Reynold's number

9. HARMONIC MOTION

Periodic function, Characteristics of SMH, Equation of SMH and determination of velocity and acceleration, Simple pendulum and derivation of its periodic time, Spring-mass system, Energy conservation of SHM, Concept of phase, Definition of free, forced, damped and un-damped vibrations, Resonance and its application, Q-factor

10. ACOUSTICS

Definition of pitch, loudness, quality and intensity of Sound waves, Echo, Reverberation and reverberation time, Sabine's formula without derivation, Acoustics of building defects and remedy.

[DAS-14] APPLIED CHEMISTRY

1. ATOMIC STRUCTURE:

Basic concept of atomic structure, Matter wave concept, Quantum number, Heisenberg's Uncertainty Principle, Shapes of orbitals.

2. CHEMICAL BONDING:

Covalent bond, Ionic & Co-ordinate, Hydrogen bonding, Valence bond theory, Hybridisation, VSEPR theory, Molecular orbital theory

3. CLASSIFICATION OF ELEMENTS:

Modern classification of elements (s p d and f block elements), Periodic properties : Ionisation potential, electronegativity, Electron affinity.

4. ELECTRO CHEMISTRY-I:

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and base: Bronsted, Arrhenius and Lewis theory. Concept of pH based numerical. Buffer solutions,

Indicators, Solubility product, Common ion effect with their application,

5. ELECTRO CHEMISTRY-II:

Redox reactions, Electrode potential (Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change, Standard electrode potential, Electro chemical series and its application. Chemical and Electrochemical theory of corrosion, Galvanic Series. Prevention of corrosion by various methods.

6. CHEMICAL KINETICS:

Law of mass action, order and molecularity of reaction. Activation energy, rate constants, 1st order reactions and 2nd order reactions.

7. CATALYSIS:

Definition Characteristics of catalytic reactions, Catalytic promoters and poisons, Autocatalysis and Negative catalysis, Theory of catalysis, Application.

8. SOLID STATE:

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. FUELS:

Definition, its classification, high & low Calorific value. Determination of calorific value of solid and liquid fuels by Bomb calorimeter. Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Diesel and Petrol), Benzol and Power alcohol. Knocking, Anti-knocking agents, Octane number and Cetane number. Cracking and its type, Gasolining from hydrogenation of coal (Bergius process and Fischer Tropsch's process) Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG and CNG. Numerical Problems based on topics

10. WATER TREATMENT:

Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Soda lime, Zeolite and Ion exchange resin process). Disadvantage of hard water in different industries, scale and sludge

formation, Corrosion, Caustic embrittlement, priming and foaming in boilers. Disinfecting of Water By Chloramine-T, Ozone and Chlorine. Advantage and disadvantage of chlorination, Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Numerical Problems based on topics.

11. COLLOIDAL STATE OF MATTER:

Concept of colloidal and its types, Different systems of colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electrodialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, Tyndall effect, Electro phoresis and coagulation. Relative stability of hydrophilic and hydrophobic colloids. Protection and protective colloids. Emulsion, Types, preparation, properties and uses. Application of colloids chemistry in different industries.

12. LUBRICANTS:

Definition, classification, Necessity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compounds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

13. HYDROCARBONS:

A. Classification and IUPAC nomenclature of organic compounds homologous series (Functional Group)

B. Preparation, properties and uses of Ethane, Ethene, Ethyne (Acetylene), Benzene and Toluene.

14. ORGANIC REACTIONS & MECHANISM:

1. Fundamental aspects -

A. Electrophiles and nucleophiles, Reaction Intermediates, Free radical, Carbocation, Carbanion

B. Inductive effect, Mesomeric effect, Electromeric effect.

2.A. Mechanism of addition reaction (Markovnikov's Rule, Cyanohydrin and Peroxide effect),

B. Mechanism of Substitution reactions; (Nucleophilic) hydrolysis of alkyl halide, electrophilic substitution halogenation, Sulphonation, Nitration and Friedel-Crafts reaction.

C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehydrohalogenation of primary alkyl halide.

15. POLYMERS :

1. Polymers and their classification. Average degree of polymerisation, Average molecular weight, Free radical polymerisation (Mechanisms)

2. Thermosetting and Thermoplastic resins -

A. Addition polymers and their industrial application - Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.

B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.

3. General concept of Bio polymers, Biodegradable polymers and inorganic polymers (Silicon).

16. SYNTHETIC MATERIALS:

A. Introduction - Fats and Oils

B. Saponification of fats and oils, Manufacturing of soap.

C. Synthetic detergents, types of detergents and its manufacturing.

3. EXPLOSIVES: TNT, RDX, Dynamite.

4. Paint and Varnish

[DAS-14P]CHEMISTRY LAB

1. To analyse inorganic mixture for two acid and basic radicals from following radicals:

A. Basic Radicals : NH_4^+ , Pb^{++} , Cu^{++} , Bi^{+++} , Cd^{++} , As^{+++} , Sb^{+++} , Sn^{++} , Al^{+++} , Fe^{+++} , Cr^{+++} , Mn^{++} , Zn^{++} , Co^{++} , Ni^{++} , Ba^{++} , Sr^{++} , Ca^{++} , Mg^{++}

B. Acid Radicals : CO_3^{--} , S^- , SO_3^- , CH_3COO^- , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , SO_4^{--}

2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.

3. To determine the total hardness of water sample in terms of CaCO_3 by EDTA titration method using Eriochroma black-T indicator.

4. To determine the strength of given HCl solution by titration against NaOH solution using Phenolphthalein as indicator.

5. To determine the Chloride content in supplied water sample by using Mohr's method.

6. Determination of temporary hardness of water sample by O'Hene's method.

[DEE-11]ELECTRICAL AND ELECTRONICS ENGG. MATERIALS

1. Classification

Classification of materials with reference to their atomic structure.

2. Conducting Materials

- (i) Resistivity and factors affecting resistivity, such as temperature, alloying and mechanical stressing.
- (ii) Super conductivity and super conducting material.
- (iii) Low resistivity materials e.g. copper, aluminium and steel, their general properties as conductors e.g. resistivity, temperature co-efficient, mechanical properties, corrosion, contact resistance and practical application. Uses of mercury as a conducting material.
- (iv) Comparison of copper, aluminium and steel for various applications as electrical conductor.
- (v) Low resistivity copper alloys: brass, bronze (cadmium and beryllium), their practical application.
- (vi) High resistivity materials: manganin, constantan, nichrome, carbon, tungsten, their practical applications.
- (vii) Electric lamp materials.
- (viii) Brush contact materials.
- (ix) Soldering materials.
- (x) Thermocouple materials, Fuse materials.

3. Insulating Materials

- (i) Introduction.
- (ii) Properties of insulating material.- Electrical properties: Volume resistivity, Surface resistivity, Dielectric Loss, Dielectric Constant, Dielectric strength.- Mechanical properties:- Mechanical strength- Physical properties :- Hygroscopicity, tensile and compressive strength, Abrasive resistance, brittleness.- Thermal properties - Heat resistance, Classification according to high permissible temperature rise, Effect of over loading on the life of an electrical appliance, Increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity.- Chemical properties - Solubility, Chemical resistance, Weather ability.
- (iii) Insulating materials and their application-
 - Definition and classification- Thermo setting materials e.g. Phenol Formaldehyde, Resins (i.e. Bakelite), Amino resins (Urea formaldehyde and Melamine formaldehyde), Epoxy resins their properties, Applications and Commercial names.- Thermo Plastic materials e.g. Polyvinyl Chloride (P.V.C.), Poly Ethylene, Silicons their properties, application and commercial names. Brief description of extrusion and moulding process of using plastic materials in electrical engineering.- Natural Insulating Materials- Mica and Mica products, Asbestos and Asbestos products, Ceramic materials (Porcelain and Steatite), Glass and glass products, Cotton, Silk, Jute, Paper (Dry and impregnated), Rubber Butyl, Mineral and insulating oil for transformer, switch gear, capacitors, high voltage cables, insulating varnishes for coating and impregnation, Enamels for winding wires, Glass fibre sleeves Gaseous Materials e.g. Air, Hydrogen, Nitrogen and SF₆.

4. Magnetic Materials :

- (i) Classification of magnetic materials into soft and hard magnetic materials.
- (ii) Soft magnetic materials - high silicon alloy steel for transformers and low silicon alloy steel, for electric rotating machine cold rolled grain oriented and non-oriented steel, Nickel iron alloy, soft ferrites, their properties and uses.
- (iii) Hard magnetic materials - tungsten steel, chrome steel, cobalt steel, alnico, hard ferrites, their properties and applications.

5. Semiconductor Materials

Introduction, semiconductor and their applications, Different semiconductor materials used in manufacturing various semiconductor (Si & Ge), Material used for electronic components like resistor, capacitor, diode, transistors and inductors.

6. Special Purpose Materials :

Materials used in transistor and IC manufacturing, PCB, computer memory devices (name of such materials to be added) Ferrous and non ferrous materials. Thermistor, Sensistor, Varistor and their practical applications.

[DWS-11P]WORKSHOP PRACTICE

1. Carpentry Shop :

EX-1 Introduction & demonstration of tools used in carpentry shop and different types of joints, types of wood, seasoning and preservation of wood

EX-2 Planing and sawing practice

EX-3 Making of lap joint

EX-4 Making of mortise and tenon joint

Ex-5 Making of any one utility article such as wooden picture frame, hanger, peg, name plate, etc.

2. Painting and Polishing Shop:

EX-1 Introduction of paints, varnishes, Reason for surface preparation, Advantage of painting, other method of surface coating i.e. electroplating etc.

EX-2 To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Ex-3 To prepare metal surface for painting, apply primer and paint the same.

EX-4 To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

3. Sheet Metal and Soldering Shop :

EX-1 Introduction and Types of sheets, measuring of sheets

EX-2 Study and sketch of various types of stakes/anvil.

EX-3 Introduction & demonstration of tools used in Sheet metal working shop.

EX-4 Cutting, shearing and bending of sheet.

EX-5 To prepare a soap case by the metal sheet.

4. Fitting Shop, Plumbing Shop & Fastening Shop:

EX-1 Study of materials, limits, fits and tolerances.

EX-2 Introduction & demonstration of tools used in Fitting Shop.

EX-3 Hacksawing and chipping of M.S. flat. Filing and squaring of chipped M.S. job. Filing on square or rectangular M.S. piece.

EX-4 Making bolt & nut by tap and die set and make its joints

Ex-5 To drill a hole in M.S. Plate and tapping the same to create threads as per need.

5. Foundry Work

Ex-1 Study of metal and non metals

Ex-2 Study & sketch of the foundry tools.

Ex-3 Study & sketch of cupola & pit furnace.

Ex-4 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)

Ex-5 Casting of non ferrous (lead or aluminium) as per exercise 3.

6. Smithy Shop :

EX-1 Study & Sketch of Tools used in smithy shop.

EX-2 To prepare square or rectangular piece by the M.S. rod.

EX-3 To make a ring with hook for wooden doors.

EX-4 Utility article-to prepare a ceiling fan hook.

7. Welding Shop :

EX-1 Introduction to welding, classification of welding, types of weld joints.

EX-2 Welding practice-gas and electric.

EX-3 Welding for lap joint after preparing the edge.

EX-4 Welding of Butt joint after preparation of the edge.

EX-5 'T' joint welding after preparation of edge.

8. Machine Shop

EX-1 Study & sketch of lathe machine.

EX-1 Study & sketch of grinders, milling M/c, Drilling M/c and CNC Machines

EX-2 Plain and step turning & knurling practice.

EX-3 Study and sketch of planing/Shaping machine and to plane a Rectangle of cast iron.

DAS-22 Mathematics - II

Unit -1: Integral Calculus-I

Methods of finding indefinite integral

1. Integration by substitution
2. Integration by parts
3. Integration by partial fraction
4. Integration of special functions

Unit-2: Integral Calculus-II

1. Definite integral: definition and properties, Evaluation of integrals
2. Applications of definite integrals: Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution,
3. Numerical Integration: Trapezoidal rule, Simpson's $1/3$ rd rule and Simpson's $3/8$ th rule

Unit-3: Coordinate Geometry-I

1. Circle : Equation of circle in standard form, centre –radius form , diameter form and two intercept form.
2. Standard form of curves and their simple properties:
 - Parabola
 - Ellipse
 - Hyperbola

Unit-4: Coordinate Geometry-II

1. Distance between two points in space , direction cosines and direction ratios, Finding equation of a straight line and shortest distance between two lines.
2. Sphere

[DAS-23]Applied Physics-II

1. Optics

Nature of light, Laws of Reflection and Refraction, Snell's Law, Interference (Constructive and Destructive), Diffraction and Polarization (Concept Only), Law of Malus and Polaroids.

2. Introduction To Fibre Optics :

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

3. Lasers and its Applications

Absorption and Emission of energy by atom, Spontaneous and Stimulated Emission, Population inversion, Main component of laser and types of laser- Ruby Laser, He-Ne laser and their applications. Introduction to MASER.

4. Electrostatics :

Coulomb's Law, Electric field, Electric potential, Potential energy, Capacitor, Energy of a charged capacitor, Effect of dielectric on capacitors.

5. D.C. Circuits

Ohm's Law, Kirchhoff's Law and their simple application, Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); Carey Foster's bridge, potentiometer.

6. Magnetic Materials and Their Properties:

Dia, Para and Ferro-magnetism, Ferrites, Magnetic Hysteresis Curve and its utility. Basic idea of super conductivity, Meissner's effect.

7. Semiconductor Physics

Concept of Energy bands in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, P-type and N-type semiconductors.

8. Junction Diode and Transistor :

Majority and Minority charge carriers, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor action, Base, emitter and collector currents and their relationship LED's.

9. Introduction To Digital Electronics :

Concept of binary numbers, Interconversion from binary to decimal and decimal to binary. Concepts of Gates (AND, NOT, OR).

10. Non-conventional energy sources:

(a) Wind energy : Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill.

(b) Solar energy: Solar radiation and potentiality of solar radiation in India, uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector.

[DAS-23P]Applied Physics-II LAB

Note: Any 5 experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.
2. Determination of 'g' by plotting a graph T^2 versus l and using the formula $g = 4\pi^2 / \text{Slope of the graph line}$
3. Determine the force constant of combination of springs in case of 1. Series 2. Parallel.
4. To verify the series and parallel combination of Resistances with the help of meter bridge.
5. To determine the velocity of sound with the help of resonance tube.
6. Determination of viscosity coefficient of a lubricant by Stoke's law.
7. Determination of E_1/E_2 of cells by potentiometer.
8. Determination of specific resistance by Carey Foster bridge.
9. Determination of resistivity by P.O.Box.
10. Verification of Kirchhoff's Law.
11. To draw Characteristics of p-n Junction diode.

[DEE-21] Basic Electrical Engg

1. Basic Terminology and their concepts

- 1.1 Current, EMF, potential difference (Voltage), resistance, resistivity their units conductors & insulators, Insulation resistance of a cable.
- 1.2 Effect of temperature on the resistance of conductors, semiconductors (C, Si, Ge) and insulators.
- 1.3 Electrical power, energy and their units (SI), Heating effect of electric current and its practical examples.
- 1.4 Relationship between electrical, mechanical and thermal SI units of work, power and energy.

2. D.C. Circuits

- 2.1 Kirchhoff's laws.
- 2.2 Simple numerical problems based on Kirchhoff's laws.
- 2.3 Introduction to Thevenin and Superposition theorem, Norton's theorem

3. Batteries

- 3.1 Construction, chemical changes during charging and discharging of lead acid cells.
- 3.1(a) Indications of a fully charged battery.
- 3.2 Capacity and efficiency of lead acid cell / battery.
- 3.3 Charging of 6 V., 12 V. commercial batteries.
- 3.3(a) Grouping of cells.
- 3.4 Care and maintenance of commercial batteries.
- 3.5 Problems/defects in lead acid batteries.
- 3.6 Concept of Nickel-Iron and Nickel Cadmium Batteries.
- 3.7 Concept of solid sealed maintenance free batteries (SMF batteries), Oxygen recombination principle.

4. Capacitors

- 4.1 Concept of capacitor, types of capacity of parallel plate capacitor, Composite capacitor and effect of physical parameters.
- 4.1 Energy stored in a capacitor, dielectric and its influence on capacitance of a capacitor, dielectric constant dielectric breakdown and dielectric strength. Dielectric loss.
- 4.3 Series and parallel combination of capacitors.
- 4.3(a) Capacitance of multi-plate capacitors.
- 4.4 Variable capacitors.
- 4.5 Charging and discharging of capacitors.
- 4.6 Simple problems on capacitors.

5. Electromagnetism

- 5.1 Concept of magnetic flux, flux density, magnetic field intensity, permeability and their units.
- 5.2 Magnetic circuits, concept of reluctance and mmf and simple problems.
- 5.3 Analogy between electric and magnetic circuits.
- 5.4 B-H curve and magnetic hysteresis (No mathematical derivation).
- 5.5 Elementary ideas about hysteresis loss.
- 5.5(a) Lifting powers of a magnet.

6. Electromagnetic Induction

- 6.1 Faraday's laws of electromagnetic induction. Lenz's law, simple problem. Dynamically induced emf.
- 6.2 Self induced emf, inductance, its role in electrical circuits. Simple problems.
- 6.3 Mutually induced emf, mutual inductance, its role in electrical circuits. Simple problems.
- 6.4 Energy stored in magnetic circuit.
- 6.5 Rise and decay of current in inductors.
- 6.6 Force on a current carrying conductor placed in a magnetic field and its applications.
- 6.7 Elementary idea about eddy current loss.

7. A.C. Circuits

- 7.1 Recapitulation of terminology, instantaneous value, maximum (peak) value, cycle, frequency, alternate current and voltage. Difference between AC and DC.
- 7.2 Equation of an alternating voltage and current and wave shape varying sinusoidally.
- 7.3 Average and RMS value of alternating voltage and current. Importance of RMS value. Simple problems.
- 7.4 Concept of phase, phase difference and phasor representation of alternating voltage and current.
- 7.5. A.C. through pure resistance, inductance, capacitance, phasor diagram and power absorbed.
- 7.6 R-L series circuit, idea of impedance and calculations.
- 7.7 Apparent power, reactive power and active power, power factor, its importance and simple problems.

7.8 R-C series circuit , simple problems.

7.9 R-L-C series circuit , simple problems.

7.10 Solution of simple parallel A-C circuits by

(a) Phasor diagram method,

(b) Admittance method.

7.11 Solution of AC circuits series/parallel by j method.

7.12 Resonance (Series and parallel) and practical application, simple problems.

8. Poly-phase System

8.1 Introduction to poly-phase system. Advantage of three phase system over single phase system.

8.2 Star and Delta connections. Relationship between phase and line value of currents and voltage. Power in poly-phase circuits. Simple problems of balanced circuits only.

[DEE-21P]BASIC ELECTRICAL ENGG. LAB

- i) To show the variation of resistance of a lamp with temperature by plotting a V-I curve for 60W and 100W filament lamps.
- ii) To verify the Kirchhoff's laws.
- iii) To observe the B-H curve for a ferro-magnetic core on CRO.
- iv) To find the relationship between voltage and current for R-L series circuit for variable resistances & variable inductance.
- v) To determine the variation in the values of inductance of a coil for different positions of the movable iron core.
- vi) To measure the power factor in a single phase AC circuit by using voltmeter, ammeter & wattmeter.
- vii) To test a battery for charged and discharged condition and to charge a battery.
- viii) Verification of voltage and current relations in Star and delta connected systems.
- ix) To charge and discharge a capacitor and to show the graph on C.R.O.
- x) Verification of laws of capacitors in series and parallel.

[DEC-21] Electronics – I

1. Semiconductor Diodes

Semiconductor materials N type and P Type P.N. junction, its forward and reversed biasing; junction diode characteristics. Diode (P-N junction) as, half wave, full wave rectifier including bridge rectifier, relationship between D.C. output voltage and A.C. input voltage, rectification efficiency and ripple factor for rectifier circuits, filter circuits, shunt capacitor, series inductor, capacitor input filter. Different types of diodes, brief idea of characteristics and typical applications of power diodes, zener diodes, varactor diodes, point contact diode, tunnel diodes, LEDs and photodiodes. Important specifications of rectifier diode and zener diode.

2. Bipolar Junction Transistor :

Concept of bipolar junction transistor, PNP and NPN transistors their symbols and mechanisms of current flow, explanation fundamental current relations. Concept of leakage current (I_{CBO}) effect of temperature on leakage current. Standard notation for current and voltage polarity; CB, CE, and CC configurations. Transistor input and output characteristics, concept of active, cut off and saturation region. Common emitter configuration: current relations in CE configuration, collector current in terms of base current and leakage current (I_{CEO}), relationship between the leakage current in CB and CE configuration, input and output characteristics, determination of dynamic input and output resistances and current amplification factor from the characteristics.

3. Single Stage Transistor Amplifier

Single stage CE amplifier with proper biasing circuit and its working as voltage amplifier. AC load line and its use in:

(a) Explanation of phase reversal of the output voltage with respect to input voltage. Introduction to tuned voltage amplifier.

4. FIELD EFFECT TRANSISTOR (FET), MOSFET & CMOS

A. FET :

- Construction, operation, characteristics and Biasing of Junction FET.
- Analysis of Single stage CB, CG and CD amplifier.

B. MOSFET :

- Construction, operation, characteristics and Biasing of MOSFET in both depletion and enhancement modes.
- Analysis of Single stage CB, CG and CD amplifier.

C. CMOS :

- Construction, operation, characteristics of CMOS in both depletion and enhancement modes.
- Use of CMOS as Inverter, Different Application of CMOS, CMOS IC.
- Comparison of JFET, MOSFET and Bipolar transistor.

5. MULTISTAGE & POWER AMPLIFIERS:

5.1 Need of multistage amplifier, different coupling schemes and their working, brief mention of application of each of the type of coupling.

5.2 Working of R.C. coupled and transformer coupled multistage amplifier, approximate calculation of voltage gain and frequency response for a two stage R-C coupled amplifier. Working principles of push pull amplifier circuits its advantages over single ended power amplifier.

6. Feedback in Amplifiers

Basic principles and types of feedback, derivation of expression for the gain of an amplifier employing feedback. Effect of negative feedback on gain, stability, distortion, and band width. (only physical explanation) typical feedback circuits:

(a) RC coupled amplifiers with emitter by-pass capacitor removed.

(b) Emitter follower, complementary symmetry power amplifier and its applications.

7. Regulated Power Supply

7.1 Concept of regulation.

7.2 Basic regulator circuits (using zener diode).

7.3 Concept of series and shunt regulator circuits.

7.4 Three terminal voltage regulator ICs (positive negative and variable) application. Block diagram, Pin configuration and working of popular regulator IC.

8. OSCILLATORS:

8.1 Application of oscillators.

8.2 Use of positive feedback/negative resistance for generation of oscillation, Barkhausen's criterion for oscillations.

[DEC-21P]ELECTRONICS I LAB

1. Semiconductor diode : identification of types of packages, terminals and noting different ratings using data books for various types of semiconductor diodes (germanium, point contact, silicon low power and high power and switching diode).
2. Rectifier circuits using semiconductor diode measurement of input and output voltage and plotting of input and output wave shapes:
 - i) Half wave rectifier
 - ii) Full wave rectifier (centre tapped and bridge rectifier circuits).
3. Plot the wave shapes of a full wave rectifier with shunt capacitor, series inductor, and filter circuit
4. Single stage common emitter amplifier circuit
 - i) Measurement of voltage gain at 1 KHZ for different load resistances.
 - ii) Plotting of frequency response of a single stage amplifier circuit.
 - iii) Measurement of input and output impedance of the amplifier circuit.
5. To measure the overall gain of two stage R.C coupled amplifier at 1 KHZ and note the effect of loading of second stage on the first stage.
- 6.(a) To plot the load V_s output power characteristic to determine the maximum signal input for undistorted signal output.
(b) The above experiment is to be performed with single ended power amplifier, transistorized push pull amplifier. Complementary symmetry power amplifier.
7. To observe the effect of a by-pass capacitor by measuring voltage gain and plotting frequency response for a single stage amplifier.
8. To measure input and output impedance of a feedback amplifier with and without by-pass capacitor.
9. Measurement of voltage gain, input and output impedance and plotting of frequency response of an emitter follower circuit.
10. Plot the FET characteristics and determination of its parameters from these characteristics.
11. To test adjustable IC regulator and current regulator.
12. Identification of Some Popular IC of 74 and 40 series with Pin Number and other details.
13. Application and use of Multimeter, CRO, Audio Oscillator and Power Supply (D.C.)

[DDW-21]ENGINEERING DRAWING

1. Drawing, instruments and their uses.

1.1 Introduction to various drawing, instruments.

1.2 Correct use and care of Instruments.

1.3 Sizes of drawing sheets and their layouts.

2. (a) Lettering Techniques

1 Sheet

Printing of vertical and inclined, normal singlestroke capital letters. Printing of vertical and inclined normal singlestroke numbers. Stencils and their use.

(b) Introduction to Scales

2 Sheet

Necessity and use, R FTypes of scales used in general engineering drawing. Plane, diagonal and chord scales.

3. Conventional Presentation:

2 Sheet

Types of lines, Conventional representation of materials, Thread (Internal and External), Conventional representation of machine parts, Welded joint.

4. (a) Principles of Projection

1 Sheet

Orthographic, Pictorial and perspective. Concept of horizontal and vertical planes. Difference between I and III angle projections. Dimensioning techniques.

(b) Projections of points, lines and planes.

2 Sheet

5 (a) Orthographic Projections of Simple Geometrical Solids

3 Sheet

Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with reference planes.

(b) Orthographic views of simple composite solids from their isometric views.

(c) Exercises on missing surfaces and views

6. Section of Solids

2 Sheet

Concept of sectioning Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others. Cases involving cutting plane perpendicular to one of the reference planes and inclined to the others plane, true shape of the section

7. Isometric Projection.

1 Sheet

Isometric scale Isometric projection of solids.

8. Free hand sketching

1 Sheet

Use of squared paper Orthographic views of simple solids Isometric views of simple job like carpentry joints

9. Development of Surfaces

2 Sheet

Parallel line and radial line methods of developments. Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).

10. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS:

3 Sheet

Nut and Bolt, Locking device, Bush Bearing

11. PRACTICE ON AUTO CAD :

2 Sheet

Concept of AutoCAD, Tool bars in AutoCAD, Coordinate System, Snap, Grid and Ortho mode. Drawing Command - Point, Line, Arc, Circle, Ellipse. Editing Commands - Scale, Erase, Copy, Stretch, Lengthen and Explode. Dimensioning and Placing text in drawing area. Sectioning and hatching. Inquiry for different parameters of drawing.

NOTE :

A. The drawing should include dimension with tolerance wherever necessary, material list according to I.S. code.

25% of the drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle figure

B. Practice on AutoCAD latest software is to be done in AutoCAD lab of Mechanical Engineering Department of the Institute.

SECOND YEAR

DAS-31 APPLIED MATHEMATICS III

1. MATRICES :

1.1 Algebra of Matrices, Inverse : Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermitian, Orthogonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix. Definition and Computation of inverse of a matrix.

1.2 Elementary Row/Column Transformation : Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix : Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.

1.4 Eigen Pairs, Cayley-Hamilton Theorem : Definition and evaluation of eigen values and eigen vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. DIFFERENTIAL CALCULUS :

2.1 Function of two variables, identification of surfaces in space, conicoids

2.2 Partial Differentiation : Directional derivative, Gradient, Use of gradient f , Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians.

2.3 Vector Calculus : Vector function, Introduction to double and triple integral, differentiation and integration of vector functions, gradient, divergence and curl, differential derivatives.

3. DIFFERENTIAL EQUATION :

3.1 Formation, Order, Degree, Types, Solution : Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of a differential equation, Linear, Nonlinear equation.

3.2 First Order Equations : Variable separable, equations reducible to separable forms, Homogeneous equations, equations reducible to homogeneous forms, Linear and Bernoulli form exact equation and their solutions.

3.3 Higher Order Linear Equation : Property of solution, Linear differential equation with constant coefficients (PI for $X = e^{ax}$, $\sin ax$, $\cos ax$, X^n , $e^{ax}V$, XV).

3.4 Simple Applications : LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

4. INTEGRAL CALCULUS - II:

4.1 Beta and Gamma Functions : Definition, Use, Relation between the two, their use in evaluating integrals.

4.2 Fourier Series : Fourier series of $f(x)$, $-n < x < n$, Odd and even function, Half range series.

4.3 Laplace Transform : Definition, Basic theorem and properties, Unit step and Periodic functions, inverse Laplace transform, Solution of ordinary differential equations.

5. PROBABILITY AND STATISTICS :

5.1 Probability : Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution : Discrete and continuous distribution, Binomial Distribution, Poisson Distribution, Normal Distribution..

[DEE-31] ELECTRICAL INSTRUMENTS AND MEASUREMENTS

1 Introduction to electrical measuring instruments:

1.1 Concept of measurement and instruments.

1.2 Electrical quantities and instruments for their measurements.

2.1 Measurement and Errors. Accuracy, precision, types of errors, probability of errors and Gaussian Error curve, sensitivity, resolution and stability. Classification of errors.

- 2.2 Types of electrical measuring instruments, indicating, integrating and recording instruments.
- 2.3 Essentials of indicating instruments, deflecting, controlling and damping torques.
3. Ammeters and voltmeters (moving coil and moving iron type)
 - 3.1 Concept of ammeters and voltmeters and difference between them.
 - 3.2 Construction and working principle of moving coil and moving iron instruments. Merits and demerits.
 - 3.3 Extension of range, use of C.T. & P.T.
4. Wattmeters (Dynamometer type) and Maximum Demand Indicator:
 - 4.1 Construction, working principle, merits and demerits of dynamometer type wattmeter.
 - 4.2 Power measurement in three phase circuit by Two wattmeter and three wattmeter methods, simple problems.
 - 4.4 Construction and working principle of maximum demand indicators.
5. Energymeter (Induction type):
 - 5.1 Construction, working principle, merits and demerits of single-phase and three phase energy meters.
 - 5.2 Testing of energy meters for calibration. Errors and compensation. Simple problems.
 - 5.3 Digital Energy meter (Single Phase/Three Phase) Construction working and application
 - 5.4 Trivector Meter, Construction, Working & Its Application.
6. Miscellaneous Measuring Instruments: The construction, working principle and application of: ohm-meter, meggar, earth tester, multimeter, frequency meter (reed-type) single phase power factor meter (Electrodynamometer type), 3-phase power factor meter, phase sequence indicator, synchroscope.
7. Electronic Instruments:
 - 7.1 Cathode Ray Oscilloscope, construction, working of CRO. Simple applications (like measurement of voltage current and frequency).
 - 7.2 Introduction to electronic multimeter, analog multimeter, digital multimeters and V.T.V.M.
8. Measurement of Resistance Inductance and Capacitance
 - 8.1 Bridges: Maxwell bridge, Wein's bridge and Schering bridge.
 - 8.2 Potentiometer, Kelvin's double bridge.
9. Elements of Process Instrumentation
 - 9.1 Block diagram of process instrumentation system and purpose of each block.
 - 9.2 Basic principles of various sensors/transducers for measurement of temperature, pressure, strain and liquid level.

[DEE-31P] ELECTRICAL INSTRUMENTS AND MEASUREMENT LAB

- (i) To extend the range of an ammeter/voltmeter.
- (ii) To convert an ammeter into voltmeter.
- (iii) To calibrate 1-phase energymeter by direct loading method.
- iv) To make proper connections of indicating/integrating instruments in a circuit e.g. wattmeter, frequency meter, power factor meter, 1-phase and 3-phase energymeter (Analog type/Digital Type) etc.
- (v) To measure power, power factor in a 1-phase circuit using wattmeter and power factor meter and verify results with calculations.
- (vi) Measurement of power and power factor of a 3-phase balanced load by 2-wattmeter method.
- (vii) Measurement of voltage, frequency of a sinusoidal signal with C.R.O.
- (viii) Measurement of resistance, voltage, current with electronic multimeters (Analog & Digital) and compare the reading.
- (ix) To measure strain by transducer.
- (x) To measure inductance by Maxwell's bridge.
- (xi) To measure capacitance by Wein's/Schering bridge.
- (xii) To calibrate three phase energy meter with the help of standard 3 phase energy meter.
- (xiii) To connect a Tri-vector meter in a three phase circuit and make measurement of different quantities.

[DCS-31P] COMPUTER APPLICATION FOR ENGINEERING LAB

1. Introduction to Computer: Block Diagram of Computer, Types Of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy

disk drive, Hard diskdrive, CD-ROM Drive, Magnetic & Tape Drive
Number system(Conversion) Binary, Octal, Hexa decimalnumber system,Conversion from Decimal to Other System andvice-versa Bit, Byte and Word.

2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)What is operating system, its significance, Commands of DOS,Features/Application of window.

3. MS WORD:File : Open, Close, Save, Save as, Search, Send to, PrintPreview, Print and Page SetupEdit : Cut, Copy,Paste, Office Clipboard, Select All,Find, replace, Goto, etc.View : Normal/Web Layout/Print Layout; Tool Bars;Header/Footer; Zoom, etc.Insert: Break, Page Number, Date & Time, Symbol, Comment,Reference, etc.Format: Font, Paragraph, Bullets & Numbering, Borders &Shading, Column, Change case, Back ground, etc.Tools : Spelling &Grammar, Language, Word Count, Letters &Mailing, Options, Customize, etc.Table : Draw, Insert, Delete, Select, Auto Format, AutoFit,Convert, Sort, Formula, etc.

4. MS EXCEL:Introduction, Use of Tools/Icons for preparing simpleapplications.

5. MS POWER POINT :Introduction, Use of Tools/Icons for preparing simplepresentation on Power Point.

6. MS ACCESS :Introduction, Use of Tools/Icons for preparing simpleapplications.

7. Introduction to Internet:What is Network, How to send & receive messages, Use ofSearch Engines, Surfing different web sites. Creating MailID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming :Flowcharting, Algorithm techniques, etc.

List OfPractical's

1. Practice on utility commands in DOS.

2. Composing, Correcting, Formatting and Article (Letter/Essay/Report) on MS Word and taking its print out.

3. Creating, editing, modifying tables in MS ACCESS.

4. Creating labels, report, generation of simple forms in MS-ACCESS.

5. Creating simple spread sheet, using in built functions in MS-EXCELL.

6. Creating simple presentation on Power Point.

7. Creating mail ID, Checking mail box, sending/replying emails.

8. Surfing web sites, using search engines.

[DMC-31]ELEMENTARY MECH. & CIVIL ENGG.

1. Applied MechanicsGeneral condition of equilibrium of a rigid bodyunder coplanar forces. Concept of tie, strut, beamand trusses. Shear force and bending moment diagramof simply supported beam and cantilever for pointload. Concept of centre of gravity, moment of inertiaand friction. Mechanical advantage, velocity ratio,mechanical efficiency of simple machines: Liftingmachines much as pulley, differential pulley, wheeland axle, simple screw jack, worm and worm wheel.

2. Strength of Materials & Power Transmission:Stress, strain, elastic constraints, stress incircular shaft subjected to pure torsion only.Rivetted and bolted joints. Power transmission bysolid and hollow shaft. Gear trains - simple and compound, fly wheel. Rope and belts - velocity ratio,length, size of belt and power transmitted.

3. Hydraulics & Hydraulic Machines:Properties of fluids, pressure of fluid and itsmeasurement. Flow of fluids velocity and discharge,Bernaulli's theorem and its application inventurimeter, flow through pipe, head loss due tofriction.water turbines- Pelton and Reaction,reciprocating and centrifugal pump.

4. Heat Engines:External & internal combustion engines, working ofdiesel and petrol engine, horse power of IC engines,steam generator, construction and working of Bobcock& Wilcox boiler, Cochran boiler, condenser, steamturbine classification and principle of operation, gasturbine.

5. Civil Engineering Materials:General idea of raw materials, manufacturing process,properties and uses of Bricks, lime, cement andTimber.

6. Foundation

(i) Bearing capacity of soil and its importance, need offoundation for electrical machines.(ii) Foundations for heavy, light and vibrating machines.

(iii) Concrete proportion, mixing w/c ratio, workabilityRCC and its use.

7. Surveying

(i) Basics of chaining and levelling

(ii) Description of Instruments used

[DMC-31P] ELEMENTRY MECH. & CIVIL ENGG.LAB.

Part I : (Mechanical Engineering Laboratory/Hydraulics laboratory)

- (i) To operate a diesel engine (starting, running and shutting down) and to study lubricating and cooling system of the engine.
- (ii) To determine BHP of diesel or petrol engine and show that BHP is directly proportional to revolution per minute of engine shaft.
- (iii) To determine mechanical advantage, velocity ratio, efficiency and effort loss due to friction in screwjack.
- (iv) To verify Bernoulli's theorem with the help of Bernoulli's apparatus.
- (v) To determine head loss due to friction in GI pipes.
- (vi) To operate the Pelton wheel and Francis Turbine and to understand its construction and working.
- (vii) To perform tensile test on mild steel and aluminium wire specimen and compare the result.
- (viii) To do alignment and coupling of a motor generator set.

Part II: (Civil Engineering Laboratory):

- (i) Chain survey of a small area
 - (a) Ranging a line
 - (b) Chaining a line
 - (c) Taking offset on the chain line and recording the field book.
- (ii) Levelling
 - (a) To find the difference in level between several points by single setting by the use of dumpy level.
 - (b) To find the difference in level between two distant points by (i) Rise & Fall method, (ii) Line of collimation method.

Models:

- 1. Cut section models of turbine, pumps.
- 2. Cut section models boilers, condensers.
- 3. Cut section models of diesel and petrol engines.
- 4. Models showing power transmission by, rope, belt, chain and gears.
- 5. Models of clutch and brakes, shaft coupling.
- 6. Model of chain pulley block and three systems of pulleys.

[DEE-32] ELECTRICAL MACHINE – I

1. Generalised Treatment of Electrical Machines:-

- 1.1 Definitions of motor and generator.
- 1.2 Torque due to alignment of two magnetic fields and concept of torque angle
- 1.3 Elementary concept of generator and motor
- 1.4 Classification of main types of electrical machines and their generalised treatments in respect of their Working (only d.c. machine to be dealt with).
- 1.5 Common features of rotating electrical machines.

2. D.C. Machines

- 2.1 Construction of d.c. machines.
- 2.2 E.M.F. equation
- 2.3 Electromagnetic torque (torque equation)
- 2.4 Principle of generating and motoring action.
- 2.5 Speed and torque equation
- 2.6 Armature reaction and commutation in d.c. m/cs.
- 2.7 Factors controlling speed of d.c. motor.
- 2.8 Speed control methods and starters for d.c. m/cs.
- 2.9 Characteristics and application of D.C. generators and motors.

3. Transformer

- 3.1 Classification, construction, principle and working of 1 ph. and 3 ph. transformer.
- 3.2 E.M.F. equation.
- 3.3 Phasor diagram on no load and load.
- 3.4 Transformer connections.
- 3.5 Losses and efficiency.
- 3.6 Voltage drops and regulation.

3.7 Connections for parallel operation.

3.8 Cooling

3.9 Testing of transformer as per IS specification (Type test and routine test, etc.)

3.10 Special transformer - current transformer, potential transformer uses of C.T. and P.T., auto transformer, rectifier transformer, dry type transformer, furnace transformer earthing transformer, traction transformer and its use.

3.11 Welding transformer: constructional detail, comparison between power and welding transformer.

4. A. C. Generator (Alternator) Working principle, construction, Full pitch and short pitch winding, pitch factor or coil span factor, distribution or winding factor, E.M.F. equation, rating of alternators, armature reaction, voltage drops in alternator, vector diagram of loaded alternator, voltage regulation and its determination, Efficiency of alternator, conditions for parallel operation, Methods of parallel operation, operation of alternators when connected to infinite bus bar. Voltage regulator like Tirril and Brown Bovery type.

[DEE-32P] ELECTRICAL MACHINE LAB

1. Measurement of induced e.m.f and magnetising current under open circuit condition in D.C. generators.
2. Determination of the relationship between terminal voltage and load current keeping speed constant for
 - (a) Separately excited generator keeping excitation constant
 - (b) D.C. shunt generator.
3. To measure the variation in no load speed of a separately excited d.c. motor for the variation in
 - (a) Armature circuit resistance
 - (b) Field circuit resistance.
4. Measurement of the speed of a d.c. series motor as a function of the load torque.
5. (a) No-load and short circuit test on a single phase transformer.
 - (b) Determination of efficiency and regulation of transformer.
6. To determine the insulation resistance of a transformer at no load and at full load condition.
7. Determination of the magnetisation curve of an alternator (a) at no-load rated speed, (b) at no load half rated speed and (c) at full non-inductive load and rated speed.
8. Determination of the relationship between terminal voltage and load current of an alternator keeping excitation and speed constant.
9. Determination of regulation and efficiency of an alternator from open circuit and short circuit tests.
10. Parallel operation of polyphase alternators and load sharing.

IV Semester **[DEC-41]ELECTRONICS - II**

1. Digital Electronics:

(i) Introduction-Basic difference between analog and digital signal; Advantages of digital system and its field of applications.

(ii) Number system - Binary, Decimal, Octal and Hexadecimal and their need.

(iii) A. Logic Gates - Symbol and truth tables of AND, OR, NOT, NAND, NOR and EX-OR gates. Boolean theorems and postulates (without proof) Realisation of small Boolean functions and reduction using Karnaugh's map upto 3 variables using logic gates and vice-versa.

B. Logic Families- TTL, CMOS, MOS, ECL, DTL, HTL, IIL.

(iv) Half Adder and full adder circuits and their operations, Display Devices.

(v) Encoder, Decoder, Multiplexer and De-multiplexer.

(vi) Need of Flip-Flops, Detail idea of counters and (Synchronous and Asynchronous) and register with purpose.

(vii) A/D and D/A conversion.

2. Operational Amplifiers

Specifications of ideal operational amplifier and its block diagram as an inverter, scale changer, adder, subtractor, differential amplifier, buffer amplifier, differentiator integrator, Schmitt trigger.

3. Microprocessors

(i) Microprocessors and its need in modern technology.

(ii) Functional block diagram of microprocessors and function of its various blocks with reference to 8085 microprocessors. Concepts of and Assembly language programming with 8085.

4. Communication Engineering

(i) Basic block diagram of a modern communication system and its working.

(ii) Concept of modulation/demodulation its need and types.

(iv) Introduction to digital and data communication.

(v) Introduction to modern ways of communication- Brief idea and concept of optical Fibre communication, Microwave communication, Satellite communication and Mobile communication.

5. INTEGRATED CIRCUITS

5.1 Introduction to IC and its importance in modern electronics, types of IC's.

5.2 Difference between SSI, MSI, LSI, VLSI.

[DEC-41P]ELECTRONICS II LAB

1. Familiarisation with bread-board. Familiarisation with TTL and MOS ICs.

2. Identification of IC-Nos, pin nos, IC types.

3. Use of Op-Amp. (for IC 741) as inverting and noninverting amplifier, adder, comparator, buffer, scale changer.

4. Use of IC 755 as timer. Display Devices and Associated Circuits

5. Verification of truth tables for 2 Input NOT, AND, OR, NAND, NOR, XOR GATES.

6. To construct half adder and half subtractor using XOR and NAND gates verification of their truth tables.

7. To construct a full adder circuit with XOR and NAND gates.

8. To verify the truth table for selected positive edge triggered and negative edge triggered F/F of J-K and D type.

9. To construct and verify truth table for asynchronous bin and decade counter using J-K flip flops.

10. Familiarization with 8085 and 8088 Trainer.
11. Add two 8 bit numbers.
12. Obtain 2's complement of 8-bit numbers.
13. Check even parity and odd parity.
- 14 Write a program to find out sum of first n-multiplier of a number.
15. Use of Op-Amp. (for IC-741) as Inverting and non-inverting amplifier, adder, comparator, buffer, scale changer.

[DEE-41] ELECTRICAL DESIGN, DRAWING & ESTIMATING-I

Electrical Symbols and Diagrams :

(i) Need of symbols; List of symbols for electrical equipment's and accessories used in electrical light, fan and power circuits, alarm and indicating circuit, contactor control circuits as per I.S.S.

(ii) Type of diagrams - Wiring diagrams (multiple and single line representation) and schematic diagrams as per I.S.S.

* One Drawing Sheet for at least - 50 symbols.

2. Wiring materials and accessories:

(i) Brief description, general specifications (as per I.S.S.) and approximate cost of different types of wires, cables, switches, distribution board, switchboard, boxes, batten and its accessories, conduit and its accessories, lamp holders, socket outlets, plug ceiling roses, fuse and energy meter used in domestic and power wiring installations.

(ii) Brief description, general specifications and approximate cost of switches, push buttons, bells, indicating lights, indicating panels, relays etc. used in alarm circuits.

* Study of materials and accessories in work shop.

3. Light and Fan Circuits :

Schematic and wiring diagrams (multiline and single line both) using junction boxes and looping systems for the following types of circuits:-

(i) Light and fan controlled by necessary switches and regulators.

(ii) Stair case wiring

(iii) Corridor lighting

(iv) One lamp controlled by three or more switches.

* One drawing sheet for at least 4- problems.

* Wiring practice for at least 3-circuits.

4. Alarm Circuits:

Reading, designing and drawing schematic and wiring diagrams (multiline and single line) of following alarm circuits:-

(i) Circuits meant to convey information by means of light only.

(ii) Circuits meant to convey information by means of bell signals only. (One bell controlled by one push button switch, Bell responds circuits using one bell and relay, Bell responds circuits of an office or three rooms)

(iii) Circuits meant to convey information by means of bell and light both for call signals.

(iv) Circuits meant to convey information by means of bell and light to give 'stop' and 'go' signals.

(v) Traffic control light system for 2 road crossing

(vi) A light circuit which gets automatically connected to DC supply in case of power failure.

* 8-Drawing sheets for at least 6-problems of each type.

* Wiring practice for at least - 2-circuits of each type.

5. Estimation of Domestic Internal Wiring Circuits :(Small Houses)

(i) Description of various wiring systems and methods.

(ii) Need of earthing and point to be earthed in internal wiring system as per IE rules.

(iii) I.S. specifications, calculation of No. of points (light, fan, socket outlet), calculation of total load including domestic power, determination of no. of circuits, size of wires and cables, switches and main switch, distribution board and switch board, batten conduit and other wiring accessories.

(iv) Layout of installation plan, single line wiring diagram, calculation of length of batten/conduit of different sizes and wire length; schedule of materials.

(v) Estimating for small houses using PWD/CPWD electrical schedule rates (E.S.R.)

* The drawing sheet for at least 4-layouts and circuits

* Estimation practice for at least - 2 installations each for small houses.

6. Assembly Drawings:-

(i) Assembly drawing of simple electrical equipment from actual piece or from a pictorial view (carbon brush holder, open knife switch, miniature circuit breaker, motor terminal block, and similar other electrical items).

* 2-Drawing sheets

(ii) Poles, towers cables and insulators

* 2- Drawing sheets

7. Electrical Design :

Design of small transformers upto 1 KVA and chokes, heaters. Transformer connections and bushing. 2 sheet

8. Armature Winding of D.C. Machines: Definition of terms used in winding, simple 2 Sheet Lap and Wave winding exercises for d.c. motor and generator.

[DEE-41P] ELECTRICAL DESIGN, DRAWING & ESTIMATING-I

1. To prepare a folder/display board of accessories used in domestic wiring with complete specifications.
2. To prepare a display board of tools used in wiring and fabrication shop.
3. Batten wiring containing light, ceiling fan, socket points.
4. Staircase wiring using two way switches.
5. Connection of a fluorescent tube using starter, choke and single way switch and its fault detection.
6. Practice of domestic conduit wiring.
7. Testing of wiring installation by meggar.
8. Connection of mercury lamp along with accessories.
9. Making of an extension board containing two 5 A and 15 Amp plug points controlled by individual switches using MCB/ELCB (Earth Leakage Circuit Breaker).

[DEE-42] POWER PLANT ENGINEERING

1. Thermal Stations:

Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water, choice of pressure of steam generation and steam temperature, selection of appropriate vacuum; economiser, air pre-heater feed water heaters and dust collection. Characteristics of turbo alternators, steam power plant heat balance and efficiency.

2. Hydro-Electric Plants:

Hydrology, stream flow, hydrograph, flow duration curves. Types of hydroelectric plants and their fields of use, capacity calculations for hydropower, Dams, head water control, penstocks, water turbines, specific speeds. Turbine governors. Hydroplant auxiliaries, plant layout, automatic and remote control of hydroplants, pumped storage projects, cost of hydro-electric project. Cooling of alternators.

3. Nuclear Power Plants:

Elements of nuclear power plant, nuclear reactor, fuels, moderators, coolants, control. Classification of nuclear power stations. Cost of nuclear power.

4. Diesel Power Plants:

Diesel engine performance and operation. Plant layout. Log sheets, applications selections of engine size.

5. Gas Turbine Plants:

Plant layout, methods of improving output and performance. Fuels and fuel systems. Methods of testing. Open and closed cycle plants. Operating characteristics. Applications. Free piston engine plants, limitation and applications. Non conventional energy sources.

6. Combined Working of Power Plants:

Advantages of combined working of different types of power plants. Need for co-ordination of various types of power plants in power systems, base load stations and peak load stations.

7. Non Conventional Source of Energy:

Introduction, Concept of Solar Energy, Bio Mass Energy, Wind Energy, Tidal Energy, Geothermal Energy, Microhydel Energy, Biodiesel Energy.

8. Recent Development :

Interconnection of P.S. - Meaning of Interconnection, combined operation of hydro power station with interconnected base load and peak load, parallel operation of inter connectors.

[DEE-43] TRANSMISSION AND DISTRIBUTION OF ELECTRICAL POWER

1. Electrical Design of Lines :

Layout of different transmission and distribution systems, advantages of high voltage transmission, HVDC converter transformer concept of short medium and long lines, parameters of lines, performance of short lines (Regulation, efficiency, vector diagrams) corona formation and its effects on performance of lines. Effect of provision of protection and demand side management on reduction of T & D logic.

2. Constructional Features of Transmission Lines:

Constructional features of transmission lines, types of supports, types of conductors, types of insulators, their properties, selection and testing, voltage distribution of string insulators, equalisation of potential. Vibration dampers.

3. Economic Principle of Transmission:

Kelvin's law, limitations of Kelvin's law, Modification in Kelvin's law.

4. Mechanical design of lines :

Sag : Sag measurement, use of sag template Indian Electricity Rules pertaining to clearance, stringing of lines.

5. Distribution System:

Feeders distributors and service mains, radial and ring main distributors, A.C. distributors fed from one end and both ends. Simple problems on size of feeders and distributors.

6. Construction of Distribution Lines:

Construction of distribution lines i.e. erection of pole, fixing of insulators on conductors, testing, operation and maintenance of lines.

7. Power Factor Improvement:

Effect of low power factor, causes of low power factor, necessity for improvement of power factor, methods for improving power factor. Advantages of improved power factor by installing capacitors at consumer end.

8. Underground Cables:

Power cable construction, comparison of overhead lines and underground cables, laying of cables, cable jointing, using of approx resin kits. fault location, Murray loop test, testing of cables, specifications.

9. Carrier Communication:

Principle of carrier communication over Power Lines, purposes, equipment, difference between radio transmission and carrier communication, block diagrams. Voltage control.

Faults and Protection:

Causes and types of fault i.e. L-L, L-G, L-L-G. Awareness and concept of energy conservation.

THIRD YEAR

V SEMESTER

[DIM-51] INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

1. PRINCIPLES OF MANAGEMENT :

Definition of management, Administration organisation, Functions management, Planning, Organizing, Co-ordination and control, Structure and function of industrial organisations, Leadership- Need for leadership, Factors to be considered for accomplishing effective leadership, Communication -Importance, Processes, Barriers to communication, Making communication, Effective, formal and informal communication, Motivation - Factors determining motivation, Positive and negative motivation, Methods for improving motivation, Incentives, Pay promotion and rewards, Controlling - Just in time, Total quality management, Quality circle, Zero defect concept. Concept of Stress Management

2. HUMAN RESOURCE DEVELOPMENT :

Introduction, Staff development and career development, Training strategies and methods.

3. HUMAN AND INDUSTRIAL RELATIONS : Human relations and performance in organisation, Understand self and others for effective behaviour, Industrial relations and disputes, Characteristics of group behaviour and Trade unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

Responsibilities of human resource management - Policies and functions, Selection - Mode of selection - Procedure - training of workers, Job evolution and Merit rating - Objectives and importance wage and salary administration - Classification of wage, Payment schemes, Components of wage, Wage fixation.

5. FINANCIAL MANAGEMENT :

Fixed and working capital - resource of capital, Shares, types preference and equity shares, Debenture types, Public deposits, Factory costing, Direct cost, Indirect cost, Factory over head, Fixation of selling price of product, Depreciation- Causes, Methods.

6. MATERIAL MANAGEMENT :

Objective of a good stock control system - ABC analysis of inventory, Procurement and consumption cycle, Reorder level, Lead time, Economic order quantity, Purchasing procedure, Stock keeping, Bin card.

7. LABOUR, INDUSTRIAL AND TAX LAWS :

Importance and necessity of industrial legislation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Income Tax.

8. ENTREPRENEURSHIP DEVELOPMENT :

Concept of entrepreneurship, need of entrepreneurship in context of prevailing employment conditions of the country. Successful entrepreneurship and training for entrepreneurship development. Idea of project report preparation.

[DEE-51] SWITCH GEAR AND PROTECTION:

1. Faults:

Types of faults, three phase symmetrical faults, effects of faults on system reliability and stability abnormalities, short circuits and their effects, representation of fault conditions through single line diagrams.

2. Switch Gear:

2.1 Purpose of protective gear, characteristics of a protection system.

2.2 Classification of fuses H.V. Fuses, application and working, grading and co-ordination L.V. fuses, selection of fuses, characteristics.

2.3 Isolators and switches, out door isolators, functions, air break switches braking capacity of switches.

2.4 Circuit breakers :- requirements of circuit breakers definition of terms associated with circuit-breakers, reasons for arc formation, principles of arc extinction, types of circuit-breakers, comparison with oil circuit breaker classification, rating of circuit breakers, working of different types of air and oil circuit breaker, specification of circuit breakers, maintenance schedule. SF-6 and Vacuum circuit breakers.

2.5 Relays : Requirement of relays, operation principles induction type over current, directional over current, differential, percentage differential relays working, applications and characteristics, basic principles of static relays. Introduction of distance relay.

3. Protective Schemes:

3.1 Protection of alternators, stator faults, rotor faults, mechanical conditions, external faults their reasons, effect and protections used.

3.2 Protection of power transformer : types of faults, its effects, types of protective schemes over current earth fault, differential protection, Buchholz devices, winding temp. protection.

3.3 Motor protection: types of faults and protection in motors, thermal relays, protection of small motors, under voltage protection.

3.4 Protection of feeders : radial, parallel and ring feeders protection, directional time and current graded schemes differential protection.

4. Protection Against Over Voltages:

4.1 Causes of over voltages, travelling waves earth wire, protective zone, lightning arrestors, space-gap and electrolytic arrestors, surge absorber, location and rating of lightning arrestors. Thirties lightning arrestor.

5. Different Type of Sub-Stations:-

5.1 Layout, single line diagram busbar arrangement, equipments their functions, accessories, study of protective schemes, etc. batteries and their maintenance, operation of small sub-station.

5.2 Reactors: types of reactors, busbar reactor, tuning reactor, arc-suppression reactor, connection of reactors in power stations. uses of reactors.

5.3 Neutral grounding :- types of grounding solid grounding, reactance grounding, arc suppression coil grounding, choice of method of neutral earthing. grounding of sub-station, grounding of line structure and sub station equipment.

5.4 Concept of G.I.S. (Gas Insulated Substation).

FIELD EXPOSURE

[DEE-52] INDUSTRIAL ELECTRONICS & CONTROL

1. Introduction:-

- (i) Control system classification and method of control.
- (ii) Concept of open loop and closed loop control.
- (iii) Introduction to automatic control.
- (iv) Role of power electronics in the field of control Engg.

2. High power switching devices

- (a) Power diode characteristics application of general purpose diode, fast recovery diode. and Schott key diode.
- (b) Control switching devices, construction characteristics and application of S.C.R., power transistor.

3. Thyristor and their Operation:-

- (i) Thyristor and its types.
- (ii) SCR, Diac, Triac, their construction, characteristics and applications.
- (iii) UJT and its characteristics, LDR, LED and photo electric relay.
- (iv) Methods of switching ON and switching OFF SCR.
- (v) Phase control using SCR, Diac and Triac and concept of firing angle and its control. Heating, Welding and Temperature control using SCR.

4. Thyristor Application:-

- (i) Basic circuit and working of single phase, three phase, half wave, full wave and bridge power converters (rectifiers) using SCR.
- (ii) Basic circuit and working of single phase and three phase bridge invertors using SCR.
- (iii) Basic circuit and working of D.C. and A.C. Choppers.
- (iv) Basic circuit and working of cycloconverter.

5. Thyristor Control of Electrical Machines :-

A. Speed control of:

- (i) Single Phase & Three Phase Induction motors.
- (ii) D.C. motors

B. Industrial Control:-

- (i) Heating control using SCR.
- (ii) Welding control using SCR.
- (iii) Temperature, illumination and level control.
- (iv) Use of SCR and Triac as static switch.

6. PROGRAMMABLE LOGIC CONTROLLER (PLC) :

Introduction, Principle of operation, Architecture of programmable controller, Programming the programmable controller, Application of programmable controller.

7. Servo Mechanism:-

Introduction to servomechanism, block diagram open loop & closed loop system, DC & AC servo mechanism, servomotors, application, synchros & application.

INDUSTRIAL ELECTRONICS & CONTROL LAB.

- 1. Fabrication and testing of electronic fan speed regulator.
- 2. Power control using Diacs and Triacs.
- 3. Characteristics of SCR.
- 4. Speed control of DC shunt motor.
- 5. Characteristics of U.J.T. firing circuit of S.C.R.
- 6. Study of light operated relay using LDR or photo diode.
- 7. Experiment on Time Delay- Relay using SCR & UJT.
- 8. Study of servo motor and synchros.
- 9. Thyristor speed control of 3 phase induction motor.
- 10. Fabrication and Testing of inverter circuit.

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ELECTRICAL MACHINE II

1. Induction Motor

- 1 Rotating magnetic field for 3 ph. concept of motors and its reversing.

2 Construction and working of 3 ph. induction motor (squirrel cage and wound rotor motor). Double squirrel cage induction motor.

3 Rotor frequency, rotor e.m.f., rotor current and rotor power factor.

4 Torque equation

5 Torque slip characteristics.

6 Principle and methods of speed control

7 Methods of starting of induction motor. On line, auto transformer, star delta manual/automatic starters for induction motor. Starter for slip ring ind. motor.

8 Application of induction motor .

9 Testing of motor as per I.S. Performance of 3 phase induction motor with the help of circle diagram.

10. Losses and efficiency (simple problems only)

11. Phasor diagram of induction motor.

2. Synchronous Motor

Construction, working principle, effect of load on synchronous motor, vector diagram of synchronous motor, effect of change in excitation on the performance of synchronous motor, V curves, torque & mechanical power developed, condition for max. mechanical power, synchronous condenser, hunting and its elimination, comparison between ind. motor and synch. motor, starting methods and uses of synch. motor.

3. F.H.P. Motors

1. Classification of F.H.P. motors

2. Production of rotating Magnetic field in 1 ph. motors.

3. Double revolving field theory.

4. Construction working and application of

(i) Capacitor motor (all types)

(ii) Shaded pole motor

(iii) 1 ph. synchronous motor

(iv) 1 ph. series and universal motor

(v) Servo Motor

4. Electric Drives :

(i) Advantages of electric drives.

(ii) Characteristics of different mechanical loads.

(iii) Types of motors used in electric drive.

(iv) Use of fly wheels for fluctuating load (only physical concept).

(v) Types of enclosures.

(vi) Methods of power transfer by devices like belt drive, gears, pulley.

(vii) Examples of selection of motors for particular loads.

(viii) Applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift.

(ix) Specifications of commonly used motors (squirrel cage induction motors, slip ring induction motors, AC series motors).

5. Converting Apparatus

Introduction to different types of converting apparatus e.g. metal rectifier etc.

ELECTRICAL MACHINE II LAB

1. To determine performance characteristics of a polyphase induction motor. (load v/s efficiency, load v/s power factor, load v/s slip)

2. To start a 3 phase induction motor and to determine its slip at various loads.

3. To determine V curves of a synchronous motor.

4. To connect and start an induction motor by using star delta starter, auto transformer starter, rotor starter and to change its direction of rotation.

5. To perform open circuit and block rotor test on a 3 ph. induction motor and to determine its efficiency.

6. Determination of performance curve and hence the core loss of a single phase series motor.

7. Voltage and current ratio of metal rectifier.

8. To perform open circuit and short circuit test on a 3 ph. synchronous machine and to determine synchronous impedance and regulation at lagging/leading power factor.

9. Sequential operation of motors using timers.

10. Achieving high starting torque in case of 3 phase slip ring motor by increasing external resistance in rotor circuits and determine speed regulation at different loads

RENEWABLE SOURCES OF ENERGY

1.0 INTRODUCTION:

- 1.1 Global energy scenario
- 1.2 Depletion trends of fossil fuels
- 1.3 Need for alternative sources of energy
- 1.4 Differences between renewable and non-renewable sources of energy examples thereof.

2.0 SOLAR ENERGY:

2.1 Concept

2.2 Solar radiation

- * solar radiation at the earth surface, direct and diffused radiation, solar constant

2.3 Basic Earth angle

- * Altitude and Latitude angle

2.4 Solar radiation geometry

- * Declination angle, Azimuth angle, Zenith angle, Solar altitude angle, Tilt angle, Hour angle, Sun rise time and sun set time and day length

2.5 Solar radiation measurement

- * Pyroheliometer, Pyranometer Solar radiation data
- * Estimation of solar radiation(hourly, daily and monthly)(Introduction)

2.6 Fundamental heat transfer equation

2.7.1 Flat plate collector

- * Working principle
- * Types of plate collector
- * Sources of losses from a flat plate collector
- * Collector efficiency(concept)

2.7.2 Concentrating collector

2.8 Application of flat plate collector

Basic Principles of these devices

- * Solar cooker
- * Solar water heater
- * Solar dryer
- * Solar distillation unit

2.9 Advantages and disadvantages of concentrating collector over flat plate collector

2.10 Application of solar concentrating collector like solar water heating, space heating and cooling and electric power generation(Basic principles)

2.11 Solar photovoltaics system

- * Principle and Physics of PV cells
- * PV module, panel and array
- * Series and parallel connection
- * Power output calculations
- * Operation and maintenance of PV systems
- * Solar Battery- construction, operation, maintenance and effect of sp. gravity of electrolyte.

3.0 BIOMASS:

3.1 Introduction to biomass energy and photosynthesis

3.2 Sources of biomass

3.3 Fuel characteristics of biomass-moisture content, proximate and ultimate analysis of fuel

3.4 Biomass conversion: Thermal/Biological

3.5 Biomass pyrolysis

3.6 Charcoal making process

3.7 Gasification and main types of gasifiers

3.8 Combustion of biomass: review of combustion equations-calculations of air requirement flue gas analysis

3.9 Working of anaerobic digestors

3.10 Different types of bio gas generating plant

- * Fixed Dome Type
- * Floating Dome Type
- * Janta Model Type

* Deen Bandhu Model

4.0 WIND ENERGY:

4.1 Wind map of India

4.2 Intensity of wind energy

4.3 Types of windmills

4.3.1 Vertical axis windmills Darrius and Sarrus types

4.3.2 Horizontal axis windmills

4.4 Applications of wind energy

4.4.1 Water pumping

4.4.2 Electric power generation

5.0 MICROHYDEL ENERGY:

5.1 Meaning and concept of microhydel power

5.2 Site selection for a microhydel project

5.3 Methods of power generation in a microhydel power station

6.0 TIDAL ENERGY:

6.1 Meaning of wave and tidal power

6.2 Methods of power generation from waves

6.3 Methods of power generation from tides

7.0 GEOTHERMAL ENERGY:

7.1 Potential and classification of geothermal energy and equalayer

7.2 Conversion of geothermal energy into electric power

7.2.1 Components of a power station (Geothermal)

7.2.2 Study of battery storage system

7.3 Multipurpose uses

* Crop Drying

* Bathing

* Refrigeration

8.0 Appropriate Technology:

8.1 Introduction: Concept of appropriate technology, modern technology v/s appropriate technology, its need, review of the traditional technologies and their possible modifications.

8.2 Water lifting devices: Traditional methods used in the rural areas for lifting water. Rahat, inertia pumps, low lift pumps, diaphragm pumps, use of appropriate technology in their design and construction. Hand and pedal operated devices, water pumping wind mills.

9. Bio Diesel

9.1 "Jatropha Karkas" oil as a substitute of diesel fuel.

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VI Semester

ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

1. INTRODUCTION :

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigation, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.

- Lowering of water level , Urbanization.

- Biodegradation and Biodegradability, composting, bio remediation, Microbes .Use of biopesticides and biofungicides.

- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc.

2. POLLUTION :

Sources of pollution, natural and man made, their effects on living environments and related legislation.

2.1 WATER POLLUTION :

- Factors contributing water pollution and their effect.

- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.

- Physical, Chemical and Biological Characteristics of waste water.

- Indian Standards for quality of drinking water.

- Indian Standards for quality of treated waste water.

- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION :

Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, CO, CO₂, NH₃, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.

A. Settling chambers

B. Cyclones

C. Scrubbers (Dry and Wet)

D. Multi Clones

E. Electro Static Precipitations

F. Bog Fillers.

- Ambient air quality measurement and their standards.

- Process and domestic emission control

- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION :

Sources of noise pollution, its effect and control.

2.4 RADISACTIVE POLLUTION :

Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT :

Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. LEGISLATION :

Preliminary knowledge of the following Acts and rules made thereunder-

- The Water (Prevention and Control of Pollution) Act - 1974.

- The Air (Prevention and Control of Pollution) Act - 1981.

- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.

The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000

The Hazardous Wastes (Management and Handling) Amendment Rules, 2003.

Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.

The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.

Municipal Solid Wastes (Management and Handling) Rules, 2000.

The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) :

- Basic concepts, objective and methodology of EIA.

- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. DISASTER MANAGEMENT :

Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan. Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

INSTALATION,MAINTENANCE AND REPAIR OF ELECTRICAL MACHINES

1. Scope and Organisation of Electrical Maintenance Department:

Requirement of electrical maintenance department, organisation of work of electrical m/c department, office work and record keeping of electrical maintenance department, history & plant maintenance log book & job cards.

2. Installation and commissioning:

General guidelines for loading and unloading of heavy electrical machines. Brief description of the accessories used for loading and unloading of heavy electrical equipment. List of precautions to be taken while executing such jobs. Handling & transport of electrical machine, equipment & line accessories to site. Installation of electrical equipment like induction motors, transformers, switch gears, transmission and distribution lines etc. Allingment of the equipment, testing and commissioning of different types of electrical

equipment, transmission and distribution lines etc. Precautions while installation is in progress. Testing of installation before declaring it to be fit for energising.

3. Preventive Maintenance of Electrical Equipment and other installations:

Meaning of preventive maintenance, advantages of programmed preventive maintenance, preparation of preventive maintenance schedule for transformers, transmission lines, induction motors, circuit breakers, underground cables, storage batteries etc.

4. Trouble Shooting:

Causes for failure of electrical equipments, classification of faults under (i) electrical, (ii) magnetic (iii) mechanical, tool and instruments used for trouble shooting and repair. Use of trouble shooting charts. Diagnosis of faults in (i) d.c.machines (ii) Synchronous machines (iii) trans- formers, (iv) induction motors, (v) Circuit breakers, (vi) Overhead & underground distribution lines(vii) Storage batteries (viii) other appliances.

5. Earthing Arrangements.

Reasons for earthing of electrical equipment, earthing systems, permissible earth resistance for different types of installations, methods of improving the earth resistance, measurement of earth resistance. System earthing and equipment earthing.

6. Insulation Testing:

Classification of insulation as per ISS 1271/1958. Insulation resistance measurement, effect of temperature on resistance, reasons for determination of insulation resistance, methods of improving insulation resistance, vacuum impregnation, transformer oil testing and interpretation of the test results.

7. Electrical Accidents and Safety:

Classification of electrical accidents, statutory regulations (IS 5216-1969), treatment for electric shock, artificial respiration, types and use of different types of fire extinguishers. Dangerous currents and voltages, effect of current on human body. Step and touch potentials, R.C.Ds. and earth leakage circuit breakers. General ideas about protection against lightning, explosive safety against static and current electricity, important Indian electricity rules.

E. M. R. Lab:

1. Setting handling of tools and accessories for installing heavy equipment.
2. Commissioning of electrical equipment.
3. Measurement of earth resistance.
4. Testing of transformer oil.
5. Fault finding and repairing of different types of electrical wiring.
6. Disassembling and assembling of electrical machines e.g. electric iron, washing machines, geyser, submersible pumps, coolers etc.
7. Trouble shooting and repairing of different types of domestic and industrial electrical equipment.
8. Winding of small ac motor/transformers/chokes.
9. Cable jointing using epoxy resin kits.
10. Repair and maintenance of circuit breakers up to 11 kv.
11. Trouble shooting and repair of direct on line and star delta starter.

PROJECT

Sr. No.	Units	Coverage	Time
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			L__T__P_____
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- | |
|-------------------------------------------|
| 1. Developmental projects - - 42 (any |
| 2. Fabrication projects - - 42 two) |
| 3. Estimating and costing projects - - 42 |

Total 84

DETAILED CONTENTS

1. Developmental Projects:

Students are expected to design the item, identify the material and the manufacturing process, prepare one prototype and test it for its satisfactory operation. The report of such projects should be written as per requirement laid down by state. Department of industries may consider for sanctioning of loan and other subsidies for entrepreneurs. It should include feasibility report, costing, sales strategy, monetary requirements, design,

manufacturing process, materials and testing.

2. Fabrication Projects:

Under these projects, students will fabricate the item or set up facilities for carrying out specific job. The report will include basic principles and concepts used in describing the working of the item/activity, specification of materials being used, detailed description of manufacturing process and specifications of machine tools used, testing procedure and test report, total cost of the item etc.

3. Estimating And Costing Projects:

Under such projects students will prepare an estimate of providing Electrical installations in the given building using standard norms and practices. The report should include: assumptions; designing of electrical layout, layout plan, detailed circuit diagram, list of material required and their specification, cost estimation, testing procedure etc. The project report should be prepared on the pattern it is prepared by state electricity board/PWD for similar jobs.

NOTE:

It is pointed out that the projects mentioned under each group are some suggestions only. Teachers may choose other similar projects under each group and get them approved by a committee headed by the Head of Electrical Engineering Department.

1. DEVELOPMENT PROJECTS:

- 1.1 Small transformers (upto 250 VA)
- 1.2 Tube light choke (40 W)
- 1.3 Automatic star-delta starter
- 1.4 Fan regulators (choke type)
- 1.5 Fan regulator (resistance type)
- 1.6 Desert cooler (using standard fan and pump)
- 1.7 Storage water heaters (geysers) 25 Lt.
- 1.8 Air blower type room heater (2 Kw)
- 1.9 Electroplating unit (nickel, chromium)
- 1.10 Repair and maintenance shop for domestic gadgets.
- 1.11 Voltage stabilizers for refrigerators (.5 Kw)
- 1.12 Emergency light
- 1.13 Thyristor control of electric motor.

2. FABRICATION PROJECTS:

- 2.1 Phase sequence indicator.
- 2.2 Inductive loading choke, 5 kw, 230 V.
- 2.3 Automatic curtain operator for a stage
- 2.4 Automatic water level controller for an overhead Tank
- 2.5 Rewinding of variac
- 2.6 Rewinding of FHP motor
- 2.7 Rewinding of ceiling/exhaust fan.
- 2.8 Rewinding of refrigerator motor (hermetically sealed)
- 2.9 Low cost intercom for home
- 2.10 Regulated power supply
- 2.11 Solid state fan regulator
- 2.12 Automatic battery charger
- 2.13 Burglar alarm
- 2.14 Hearing aid
- 2.15 Automatic street light controller (On/OFF only)
- 2.16 Inverter circuit (500 W)
- 2.17 Digital clock
- 2.18 2-band radio receiver (transistorised)
- 2.19 Stereo amplifier
- 2.20 Electronic door bell (chordless)
- 2.21 Light dimmer
- 2.22 Automatic control of water pump using timer
- 2.23 Object counter
- 2.24 Musical door bell with IN-OUT indication
- 2.25 Battery eliminator
- 2.26 Erection of overhead distribution over a small distance.

3. ESTIMATING AND COSTING PROJECTS

- 3.1 Electrical installation in a domestic building including service mains, and earthing.

- 3.2 Electrical installation in a small workshop including power wiring.
- 3.3 To provide distribution system through under ground cable in a residential colony.
- 3.4 5KVA, 3 phase, 11 KV/.415 V pole mounted substation for a farm house.
- 3.5 Electrical installation in a public building such as school, hospital, community centre, cinema, library, auditorium, club, dispensary, polytechnic etc.
- 3.6 Electrical installations in a high building.
- 3.7 Electrical installations in a small govt. Colony comprising of different category of houses.
- 3.8 33 KV/.415 V, 3 ph, 1000 KVA, indoor substation for a bulk consumer.

ELECT. DESIGN DRAWING & ESTIMATING II

DETAILED CONTENTS

1. Principles of Estimating and Costing:

Purpose of estimating and costing, essentials of estimating and costing-market survey, price list and net prices, preparation of list of materials, calculation of material and labour cost, contingencies, overhead charges, profit and total cost, quotations-comparative statement and orders, idea about tender forms. Use of E.S.R (state PWD and CPWD)

2. Earthing:

Need for earthing of electrical installations, advantages and disadvantages, effect of improper earthing, I.S. specifications regarding earthing of electrical installations, points to be earthed as per I.E. rules. Methods of earthing-plate and pipe earthing. Determination of size of earth wires and earth plates for different capacities of electrical installations, specification of earthing materials and their cost, Earthing of power plant and grid substation.

3. Estimation of Internal Wiring Installation:

Estimation of wiring installation for commercial and industrial buildings such as multi-storied hotels, hospitals, schools, colleges, cinema, community centers, public library, high rise residential buildings etc. including design of layout, load estimation, Demand factor and diversity factor, power distribution scheme, list of material with specifications, estimation of cost preparing relevant electrical schedule of rate (CPWD or PWD) using latest practices, materials and accessories.

4. Estimation of Power Wiring

I.S. specifications and I.E. rules, calculation of current for single and three phase motors. Determination of sizes of cables, conductors distribution board, main switches and starters for power circuits. Cost of equipments and accessories and schedule of materials. Estimation and cost of material and work for motors upto 20 H.P., pumpsets and small workshops.

5. Estimation of Overhead and Underground Distribution Lines :

Main components of overhead lines-line supports, cross-arm, clamps, conductors and staysets, lightening arrestors, danger plates, anticlimbing devices, bird guards, jumpers etc., concreting of poles, earthing of transmission line, formation of lines, specification of materials for O.H. lines, I.S. specification and I.E. rules. Cost of material and work for overhead and underground lines upto 11 KV only.

6. Estimation of Service Connections:

Service connection, types of service connections-overhead and underground for single story and double story buildings, estimate of materials required for giving service connection to domestic consumers, commercial consumers and industrial consumers at L.T. and H.T. costing of material and work in above cases.

7. Estimation of Small Sub-Station

Main equipments and auxiliaries installed on the sub station. Estimation of materials required for a small distribution substation (indoor and outdoor type-platform and pole mounted). Costing of material and work of above substations.

DRAWING WORK :-

- 1. Earthing 1 sheet
- 2. Commercial and industrial buildings 2 sheets
- 3. Power wiring layout and circuits 2 sheets
- 4. Stays, line crossings, line earthing, end poles and terminal poles, junction poles/towers and transposition pole/towers. 2 sheets
- 5. Service connection domestic, industrial and 2 sheets agriculture.
- 6. Substation layout and busbar arrangements 2 sheets
- 7. Machine drawings-induction and synchronous machines. 2 sheets
- 8. Winding of induction machine, 3 ph; 1 ph. 2 sheets
- 9. Reading and interpreting practical drawing of wiring installation and control circuits.
- 10. Winding of synchronous machine 3 ph. 2 sheet (alternator and synchronous motor)

UTILISATION OF ELECTRICAL ENERGY

DETAILED CONTENTS

1. Illumination:

- (i) Nature of light, curve of relative sensitivity of human eye and wave length.
- (ii) Definitions : flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor coefficient of utilisation, space to height ratio, reflection factor, laws of illumination.
- (iii) Calculation of number of light points for interior illumination; calculation of illumination at different points; considerations, involved in simple design problems and illumination schemes; levels of illumination. Methods to increase illumination efficiency
- (iv) Different sources of light: Difference in incandescent and discharge lamps – their construction & characteristics, fittings required for filament lamp, mercury lamp, fluorescent lamp sodium lamp, neon lamp.
- (v) Main requirements of proper lighting; illumination level, absence of flare, contrast and shadow.

2. Electric Heating ;

- (i) Introduction.
- (ii) Advantages of electrical heating.
- (iii) Heating methods:
 - (a) Resistance heating (direct resistance heating, indirect resistance heating, electric ovens, their temperature range) salt bath heaters properties of heating elements, domestic water heaters and other heating appliances.
 - (b) Induction heating, principle, core type and coreless induction furnace.
 - (c) Electric arc heating, direct and indirect arc heating, arc furnace.
 - (d) Dielectric heating. Applications in various industrial fields, microwave ovens.
 - (v) Simple design problems of resistance heating element.

3. Electric Cooling

- (i) Concept of refrigeration and airconditioning.
- (ii) Brief description of vapour compression refrigeration cycle.
- (iii) Description of electrical circuit used in
 - (a) Refrigerator,
 - (b) Airconditioner, and
 - (c) Water cooler.

4. Electric Welding:

- (i) Welding methods, principles of resistance welding, welding equipment.
- (ii) Electric arc welding principle, characteristics of arc; carbon and metallic arc welding, power supply, advantage of coated electrode, comparison of AC and DC arc welding; welding equipment.

5. Electrochemical Processes:

- (i) Need of electro-deposition.
- (ii) Faraday's laws in electrodeposition.
- (iii) Objectives of electroplating.
- (iv) Description of process for electroplating.
- (v) Factors governing electro deposition.
- (vi) Equipments and accessories for electroplating plant.
- (vii) Principle of anodising and its applications.
- (viii) Electroplating on non-conducting materials.

6. Electric Traction:

- (i) Concept and configuration of Electric drive and types of electric drive.
- (ii) Advantage of electric traction.
- (iii) Different systems of electric traction, D.C. and A.C. system.
- (iv) Different accessories for track electrification; such as overhead wires, conductor rail system, current collector-pantograph.
- (v) Electrical block diagram of an electric locomotive with description of various equipments and accessories.
- (vi) Electric braking, plugging, rheostatic and regenerative braking.
- (vii) Different types of battery driven vehicles and their application.

7. Economic Consideration

- 7(a) Load estimation, load curves, load duration curve, demand factor, load factor, diversity factor, Plant capacity factor, and utilisation factor, simple problems involving interpretation and application of above factors.
- 7(b) Cost of generation, fixed cost, running cost, cost per unit, effect of load and diversity factor on over

all cost of generation. Economic load division between power stations for a given load duration curve.

7(c) Tariffs : meaning of different tariffs and their application, block rate, flat rate, max. demand, and two part tariffs.

Bill preparation.

8. ENERGY CONSERVATION :

Need for energy conservation, over view of energy management, Basic idea about energy audit.

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