CURRICULUM
FOR

BACHELOR FOR TECHNOLGY IN "ELECTRICAL ENGINEERING"

SRI SAI UNIVERSITY PALAMPUR (H.P.)INDIA

JULY 2012

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Foreword

Sri Sai University Palampur Himachal Pardesh has been established with a purpose of empowering people. The Vision and Mission of the university are:-

- **Vision**

To provide quality education for developing all round personality of students through curricular, co-curricular and extracurricular activities to meet ever growing manpower requirements of industry and other sectors of economy as per national priorities.

- **Mission**

a. To establish institutions for imparting quality education.
b. To promote creative and innovative research and development.
c. To ensure quality education by periodic review of curricula through industry- institute interaction.
d. To make efforts for updating knowledge of faculty/ staff through quality improvement programmes (Training and retraining)
e. To promote employability through development of requisite competency skills.
f. To work for cause of weaker sections, physically challenged and women welfare through education and enlightenment.
g. To make life healthier, better and modern by inculcating in students Indian values/ heritage.
h. To bring about out a holistic development of society by educating individuals.

At present programmes in Civil Engineering, Electrical Engineering, Mechanical Engineering, Electronics & Communication Engineering and Computer Science Engineering are being run here to develop manpower having global perspective, faith in our Indian values and culture and competencies desired for profession. In order to keep curriculum relevant and up to date, the University created a position of 'Director Curriculum Development' supported by Board of Studies of different discipline. The objective of this is to make teachers and students to become active partners in design of curriculum and instruction.

Director, Curriculum Development has involved Vice Chancellor, Executive Director and senior faculty members of SSU Palampur and Engineering & Technology Colleges at Pathankot and Amritsar in the revision of curriculum . This has created awareness and importance of systematic curriculum design seminar of various programmes and role expected from all the stake holders.

This curriculum has been designed by taking into account incorporating the existing programmes as being run at SSU Palampur and referring to courses of Punjab Technical University, Jalandhar; various IITs; VIT Vellore; Jamia Milia Islamabad New Delhi; PEC University of technology, Chandigarh and innovations undertaken by NITTTR Chandigarh in curriculum design.

Hope this Curriculum will bring desired results.

Dr Naresh Nagpal
Executive Director
Sri Sai Group of Institutes
Corporate office, Chandigarh.

PREFACE

Curriculum is a plan comprising of learning experiences; to be given to students for developing competencies as desired by the 'world of work' in their professional life. Curriculum for SSU programmes has been designed with active involvement of the faculty and other stake holders. This process of designing the curriculum was a unique learning experience for all those involved in the process and understands the meaning and importance of scientific and systematic design of curriculum. A group of teachers provided feedback to the coordinator to up to date Curriculum. This group also scanned employment opportunities and job skills expected from an engineering graduate for inclusion in the curriculum, so as to make it relevant. This resulted in developing in the faculty a sense of ownership due to their involvement in the process.

The steps followed in the design of Curriculum of the degree programme were:

I. Discussions of Director, Curriculum Development with Chancellor, Vice Chancellor and Executive Director regarding their views on their Vision and Mission of the University vis a vis constraints of programme as well as expectations of Director, Curriculum Development.

II. Orientation programme for senior faculty of SSU to educate them about a rational approach to Curriculum design and to know about their experience of implementing the existing curriculum.

III. Interaction with the faculty from various Institutions to know their view point on their specific discipline, areas of employment, profile of an engineer and curriculum etc.

IV. Analyze the guidelines given by AICTE. ABET and NBA for programme accreditation so as to adhere to the norms and standards for Curriculum of Engineering Degree programmes.

V. Analysis of syllabus and test questions of engineering services examination to ensure that designed curriculum include most of the broad areas and their levels of expectations from fresh graduates.

VI. SSU faculty prepared Horizontal and Vertical organization of subjects of curriculum and learnt about taking decision on various components of Curriculum and their articulation and importance in terms of time. They also understood the logical and chronological placement of subjects in the whole Curriculum.

VII. A workshop was organized at SSCET Pathankot for having understanding of the common features of the programmes; present syllabus being followed at SSU, difference between PTU Curriculum and SSU curriculum and innovation possible in implementation of curriculum.

VIII. Feedback was collected from coordinators of SSU programmes on the aspects given in VII so as to incorporate these in Curriculum document.

IX. Obtain opinion of experts from industry and academic on the proposed curriculum for degree programme in different discipline of Engineering.

X. The curriculum documents were subsequently validated and finalized in consultation with SSU Faculty.

Curriculum provides requisite experiences to students through formal, nonformal and informal activities towards development of occupational, personal, social and continuing learning skills for making students employable. Focus of teachers and students is all the time to active the objective and outcome of the programme stated in the document. Students are made responsible for their learning and teachers become facilitators in this process.

During the design of the curriculum, the constraints of resources of the system in which this curriculum has to be implemented have been considered. It is hoped that with the support of enlightened administration and motivated faculty, innovative methodology will be adopted in teaching-learning process for providing desired learning experiences to the students as stated in curriculum documents.

PROF. Y. K. ANAND
DIRECTOR, CURRICULUM DEVELOPMENT
SRI SAI GROUP OF INSTITUTES
CORPORATE OFFICE
SCO 40-41, THIRD FLOOR
SECTOR 17A
CHANDIGARH-160017

1. SALIENT FEATURES OF THE PROGRAMME

1.	Name of the programme	:	B. Tech in Electrical Engineering
2	Duration of the programme:	:	4years
3	Entry Qualification	:	12+ Physics, Chemistry and Mathematics
4	Pattern of Programme	:	Semester system (8 Semesters)
5	Duration of the Semester	:	16 weeks
6	Total hours per week:	:	32 to 36 hours
7	Ecological and Environmental Awareness Camp and follow up	:	Second Semester (2-3) days
8	Entrepreneurship Development Camp and follow up	:	Fifth Semester (2-3)days
9.	Industrial Training		*Workshop Practice of 4 weeks during summer vacation after second semester. It will also include Industrial exposure/tour also. • Industrial Training of Six weeks duration in summer vacation after fourth semester • Industrial Training of six months during seventh / eighth semester.
10.	Student centered activity S.C.A will include	:	*library study/ independent study for searching and organization Information for use. • Library study • Market survey • Information search (industry/ in trust) • Seminar • Expert lectures • Camp for ecology & Environmental awareness, entrepreneurship development and personality development.

2. JOB OPPORTUNITY FOR B. TECH IN ELECTRICAL ENGINEERING

A degree holder in Electrical Engineering is expected to get employment in:

- Electrical power generation, transmission distribution & services in Government and private sector.
- Automotive and control industry
- Mining and allied industry
- Chemical indiusry
- Process instrumentation and software industry
- Manufacturing of machine, equipment and systems
- Marketing and business Management

They also get employment in the public sector viz steel industry, oil and gas industry, Railways, BHEL, NTPC,DRDO, Electricity Boards and private sectors such as ABB and Siemens etc.

3. OUTCOME OF THE PROGRAMME

- Graduates will demonstrate knowledge of differential equations, vector calculus, complex variables, matrix theory, Probability theory, physics, chemistry and electrical and electronics engineering.
- Graduates will demonstrate an ability to identify, formulate and solve electrical engineering problems.
- Graduate will demonstrate an ability to design electrical and electronic circuits and conduct experiments electrical system analyze and interpret data.
- Graduates will demonstrate an ability to design digital and analog system and component.
- Graduates will demonstrate an ability to visualize and work on laboratory and multi-disciplinary tasks.
- Graduates will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
- Graduates will demonstrate knowledge of professional and ethical responsibilities.
- Graduate will be able to communicate effectively in both verbal and written form.
- Graduates will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
- Graduate will develop confidence for self education and ability for life-long learning.
- Graduate who can participate and succeed in competitive examinations like GATE, GRE.

4. STUDY AND EVALUATION SCHEME
(FIRST TO EIGHTH SEMESTER)

FIRST SEMESTER

S. No.	Subject_Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	Total Marks
1.1	Mathematics-I	3	1	0	40	60	100
1.2	Chemistry	3	1		40	60	100
1.3	Basic Mechanical Engineering	3	1		40	60	100
1.4	Applied mechanics	3	1		40	60	100
1.5	Basic civil engineering	3	0		40	60	100
1.6	Communication Skill	3	0		40	60	100
1.7	Chemistry Laboratory			2	30	20	50
1.8	Applied Mechanics Lab			2	30	20	50
1.9	Workshop Practice			2	30	20	50
1.10	Communication Laboratory Lab			2	30	20	50
1.11	Student Centered Activity			2			
	TOTAL	**18**	**4**	**10**	**360**	**440**	**800**

SECOND SEMSTER

S. No.	Subject_Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	Total Marks
2.1	Mathematics-II	3	1		40	60	100
2.2	Basic Electrical & Electronics Engineering	3	1		40	60	100
2.3	Physics	3	1		40	60	100
2.4	Computer Programming	3	0		40	60	100
2.5	Engineering Graphics/ Drawing	1	0	4	40	60	100
2.6	Principle of Business Economics & management	4	0		40	60	100
2.7	Basic Electrical & Electronics Engg Laboratory			2	30	20	50
2.8	Physics Laboratory			2	30	20	50
2.9	Computer programming Laboratory			2	30	20	50
2.11	Student Centered Activity			2			
	TOTAL	**17**	**3**	**12**	**330**	**420**	**750**

Note: - Workshop Training of Two weeks after 2ND year. One week for general workshop training and one week for electrical workshop training. Marks to be included in third semester.

THIRD SEMESTER

S. No.	Subject_Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	Total Marks
3.1	Applied Maths-III	4	1		40	60	100
3.2	Network Analysis & Synthesis	3	1		40	60	100
3.3	Magnetic Circuits & Transformers	3	1		40	60	100
3.4	Electrical Measurements & Measuring Instruments	3	1		40	60	100
3.5	Object Oriented Programming	3	1		40	60	100
3.6	Electronic Devices & Circuits	3	1		40	60	100
3.7	ED & N/W Laboratory			2	30	20	50
3.8	EM& MI Laboratory			2	30	20	50
3.9	Object Oriented Programming Laboratory			2	30	20	50
3.10	Workshop Training Marks				50		50
3.11	Student centered Activity			2			
	Total	**19**	**6**	**8**	**380**	**420**	**800**

FOURTH SEMESTER

S. No.	Subject_Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	Total Marks
4.1	EMEC & DC Machines	3	1		40	60	100
4.2	Linear Control System	3	1		40	60	100
4.3	Applied Electronics	3	1		40	60	100
4.4	Numerical & Statistical Method	3	1		40	60	100
4.5	Digital Electronics	3	1		40	60	100
4.6	Energy Management	3			40	60	100
4.7	Applied Electronics Laboratory			2	30	20	50
4.8	Digital Electronics Laboratory			2	30	20	50
4.9	Electric Machines-I Laboratory			2	30	20	50
4.10	Student Centered Activity			3			
	Total	**18**	**5**	**9**	**330**	**420**	**750**

FIFTH SEMESTER

Sr. No	Subject Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	TOTAL Marks
5.1	Asynchronous Machines	3	1		40	60	100
5.2	E.M Field Theory	3	1		40	60	100
5.3	Power System I (Transmission & Distribution)	3	1		40	60	100
5.4	Microprocessor and Interfacing	3	1		40	60	100
5.5	Power Electronics	3	1		40	60	100
5.6	Electrical Engg. Materials	3			40	60	100
5.7	Microprocessor Laboratory			3	30	20	50
5.8	Power Electronics Laboratory			3	30	20	50
5.9	Control Systems using MAT Laboratory			3	30	20	50
5.10	Industrial Training				40	60	100
5.11	Student centered activity and Internet Laboratory			2			
	Total	**18**	**5**	**11**	**370**	**480**	**850**

SIXTH SEMESTER

Sr. No	Subject Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	TOTAL Marks
6.1	Synchronous Machines	3	1		40	60	100
6.2	Electric Drives and Utilization	3	1		40	60	100
6.3	Power System II(Switchgear and Protection)	3	1		40	60	100
6.4	Power Plant Engg	3	1		40	60	100
6.5	Elective I	3	1		40	60	100
6.6	Fuzzy Logic and system	3	1		40	60	100
6.7	Electrical Machine II Laboratory			2	30	20	50
6.8	Software Laboratory			2	30	20	50
6.9	Power System II Laboratory			2	30	20	50
6.10	Minor Project			2	60	40	100
6.11	Student Centered Activity			2			
	Total	**18**	**6**	**10**	**390**	**460**	**850**

Elective I

1. Entrepreneurship
2. Software Engineering
3. Estimating and Costing of Electrical Installations
4. Maintenance Management and Testing

SEVENTH/EIGHTH SEMESTER

Sr. No	Subject Title	STUDY SCHEME			EVALUATION SCHEME		
		Hours/ Week			Marks		
		L	T	P	Internal Marks	External Marks	TOTAL Marks
8.1	Computer aided Power System Analysis	3	1		40	60	100
8.2	Electric Generation	3	1		40	60	100
8.3	Nonlinear and Digital control system	3	1		40	60	100
8.4	Elective II	3	1		40	60	100
8.5	Electrical Machine Design	3	1		40	60	100
8.6	CAPSA Laboratory			2	30	20	50
8.7	Power system Design Laboratory			2	30	20	50
8.8	Project work			6	120	80	200
8.9	Electrical Machine Design Laboratory			2	30	20	50
8.10	General Fitness				100		100
8.11	Student centered Activity						
	Total	**15**	**5**	**12**	**510**	**440**	**950**

Elective II

1. Biomedical Engg
2. Data Communication
3. Non conventional Energy Sources
4. Extra High Voltage Engineering
5. Data base Management system

SEVENTH/EIGHTH SEMESTER

7th / 8th Semester				
	Subject Title	Marks		
		INT	EXT	TOTAl
	6 months Industrial Training with	300	200	500
	Software Training	150	100	250
	Total	**450**	**300**	**750**

4. DETAILED CONTENT OF VARIOUS SUBJECTS

A. FIRST SEMESTER

1.1 MATHEMATICS-I

MODULE-I

Infinite series: Convergence and divergence of infinite series, geometric series test, comparison tests, p-test, ratio test, root test, Raabe's test, Logarithmic test, Gauss test, Alternating series, power series, radius of convergence, interval of convergence

Differential calculus: Partial derivatives, Homogeneous function, Euler theorem, chain rule, change of variables, Partial differentiation of implicit function, Taylor series of two variables, Maximum and Minimum values of function of two variables, Jacobin, Error and increment .curve tracing.

MODULE-II

Solid Geometry: Sphere, tangent plane, orthogonality, Cone, Cylinder, Quadratic surfaces.

Integral calculus: Rectification, quadrature, volume, Surface area of solid of revolution, double and triple integral, order of integration, change of variables, Application of double and triple integral. beta and gamma function.

MODULE-III

Vector calculus: Differentiation of vector, velocity,acceleration, Scalar and vector field, Gradient of scalar field and directional derivatives, Divergence, Curl of vector field, Physical significance, Integration of vector, Line , surface ,volume integral, Stokes theorem, Divergence theorem, green's theorem

Text Books

1. *Advanced Engg.Mathematics ,R.K.Jain,S.R.K.Iyengar Narosa publication*
2. *Higher Engg.Mathematics,B.S.Grewal,Khann publication*
3. *Higher Engg.Mathematics,N.P.Bali,Laxmi Publication*
4. *Advanced Engg.Mathematics,kreyszig,john wiley and sons*

1.2 CHEMISTRY

MODULE I

BASIC CONCEPTS AND WATER TECHNOLOGY: Atomic number, valency, molecular weight, equivalent weight ,morality, normality, how to write a molecular formula.

Water: Structure of water, water as solvent, characteristic properties of water Sources of water, Specifications for water, BOD, COD and DO, Hardness and its determination (EDTA method only), Sewage treatment, Purification of municipal water, Water softening processes – Lime – Soda process, Ion exchange method, boiler feed water, boiler problems-scale, sludge, priming and foaming, caustic mbitterment and boiler corrosion, their causes and prevention, carbonate and phosphate conditioning, colloidal conditioning, calgon treatment, Desalination of water: Reverse osmosis, electro dialysis and multiple effect evaporation. Numerical problems of hardness and Lime-Soda process (7 Hours)

CORROSION SCIENCE: Definition, cause, types and mechanism of corrosion, factors influencing corrosion protective measures against corrosion, metal finishing like electroplating of Au and Cr and electrolessplating of Ni on Al and also preparation of printed circuit board by electrolessplating. (7 Hours)

NON- METALLIC ENGINEERING MATERIALS : (i) Cement : Chemical constitution of Portland cement, functions of different constituents. Theories of the setting of cement. (ii) Abrasives : Introduction, types of abrasives and applications. (7 Hours)

MODULE II

PHOTOCHEMISTRY: Difference between thermo chemical and photochemical rxn., Lambert and beer laws , quantum yield, classification of photochemical rxn, kinetics of some photochemical rxn, Jablonski' s diagram, mechanism of photosensitization, LASER and MASER 7 Hours)

FUELS AND LUBRICANTS : Fuels: Definition, characteristics of good fuel, calorific value: gross and net calorific values and their determination by bomb calorimeter, , Classification of fuels: primary and secondary fuels (7 Hours)

Lubricants: Introduction, friction and wear, Lubricants, mechanism of Lubrications, base oils, additives, greases and emulsions Lubricants :Types of lubrication, fluid film lubrication, boundary lubrication and extreme pressure lubrication. Function of lubricants .Classification of lubricants, solid, semisolid, liquid, emulsions, synthetic lubricants. Conditions for using different types of lubricants. Properties of lubricants.

(7Hours)

MODULE III

Liquid Crystal: Classification of liquid crystals, chemical constitution and liquid crystalline behavior in PAA and MBBA, liquid crystal homologous series, molecular ordering in nematic, smectic and columnar type liquid crystals, identification of liquid crystals using optical microscopy, electro optic properties of liquid crystals, polymorphism in thermotropic liquid crystal and application of liquid crystals(7 Hours)

High Poymers: Definition, classification of polymers, types of polymerization, methods of polymerization, glass transition temp., structure of polymers, plastics, synthesis, properties and applications of few commercial thermoplastic and thermosetting polymers, techniques of plastic moulding, elastomers, adhesive, compounding of resins and plastics, conducting polymers and conduction mechanism in polyacetylene(7 Hours)

Nano-materials: Introduction to nano-materials, Graphite, fullerenes, carbon nanotubes, nanowires, nanocones, Haeckelites. Their electronic and mechanical properties .. Production methods for CNTS. .. Applications of nano materials in i) Medicine ii) Catalysis iii) Environmental Technologies iv) Electronics v) echanics. (5 Hours)

Text Books:-

1. *Shashi Chawla "Engg. Chemistry"*
2. *Vasant Gowarikar "Polymer Chemistry"*
3. *Bandyopadhyay A.K., "Nano Materials" ,New age International Publisher*
4. *Palanna "Engg. Chemistry" TMH*

Reference Books:-

1. *Misra, G.S., Introductory Polymer Chemistry, New Age International (1993).*

1.3 BASIC MECHANICAL ENGINEERING

First Law of Thermodynamics: Essence and corollaries of the first law, analytical expressions applicable to a process and cycle, internal energy, enthalpy and specific heats, first law analysis of steady flow, applications of steady flow energy equation to engineering devices.

Applications of first law of Thermodynamics: Closed and open systems, analysis of non-flow and flow processes for an ideal gas under constant volume (Isochoric), constant pressure (Isobaric), constant temperature (Isothermal), adiabatic and polytropic conditions. Analysis of free expansion and throttling processes. Representation of these processes on P-V charts and analysis of property changes and energy exchange (work and heat) during these processes.

Second Law of Thermodynamics: Limitations of first law, various statements of second law and their equivalence, application of statements of second law to heat engine, heat pump and refrigerator. Philosophy of Carnot cycle and its consequences. Carnot theorem for heat engines and heat pump. Classius inequality, concept and philosophy of entropy and entropy changes during various processes. Temperature – entropy chart and representation of various processes on it. Third law of thermodynamics.

Simple Stresses & Strains: Concept & types of Stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, Elastic constants and their relationships. Temperature stress and strain in simple and compound bars under axial loading, Numerical problems.

Shear Force and Bending Moments Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM and SF and the point of contraflexture under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads. Relation between the rate of loading, the shear force and the bending moments, Numerical Problems.

Bending Stresses in Beams: Bending Stresses in Beams with derivation of Bending equation and its application to beams of circular, rectangular I & T Section, Composite beams,

Torsion of Circular members: Torsion of Solid and hollow circular shafts, Combined bending and torsion, Equivalent torque, Numerical Problems.

Text Books:-

1. *Nag, P.K., "Engineering Thermodynamics", Tata McGraw – Hill, New Delhi.*
2. *Yadav, R., Thermal Science and Engineering, Central Publishing House, Allahabad.*
3. *G.H.Ryder "Strength of Materials" Macmillan India.*
4. *Mechanics of Materials – Dr. Kirpal Singh, Standard Publishers Distributors, New Delhi.*

Reference Books:-

1. *Popoy , "Strength of Materials", PHI,*
2. *Sadhu Singh, "Strength of Materials" , Khanna Publications.*
3. *Strength of Materials – A Rudimentary Approach – M.A.Jayaram, , Sapna Book House,*

1.4 APPLIED MECHANICS

1. Basic concepts and fundamental laws, force, moment and couple, resolution and composition of force, system of forces, resultant, Varignon's theorem and law of moments.

2. Lami's theorem, free body diagram, two force and three force members, Equilibrium of forces, equilibrium equations, surface friction.

3. Types of loads, types of supports, analysis of simple and compound beams, virtual work method for support reactions.

4. Centroid, moment of inertia of plane and composite figures, parallel and perpendicular axis theorems, moment of inertia of standard shapes from first principle, moment of inertia of composite figures, radius of gyration.

5. Kinematics of rectilinear motion, motion diagrams for under gravity constant acceleration motion, motion with variable acceleration :
6. Kinetics of linear motion, Newton's Law. De Alembert's principle, work-energy principle, Impulse - momentum principle.
7. Kinematics and kinetics of circular motion, rotation with constant and variable angular acceleration, centripetal and centrifugal force, condition of skidding and overturning.
8. Collision of elastic bodies ; direct central impact, oblique impact, coefficient of restitution, loss of kinetic

Text Books:

	Author	Title	Publisher
1.	Beer-Johnson	Engineering Mechanics	Tata McGraw Hill, Delhi
2.	Basu	Engineering Mechanics	Tata McGraw Hill, Delhi
3.	Joseph F. Shelley	Vector Mechanics for Enginerrs Vol. I& II	Tata McGraw Hill, Delhi

1.5 BASICS OF CIVIL ENGINEERING

1. **Introduction to Civil Engineering :** Introduction, branches of civil engineering, application of civil engineering in other allied fields.

2. **Building Planning :** Principles of planning, orientation of buildings, introduction to Bye-Laws regarding building line, height of building, open space requirements, F.S.I., setbacks, ventilation, sanitation as per municipal corporation area requirement.

3. **Components of Buildings :**

• Sub-structure: Types of soil and rocks as foundation strata, concept of bearing capacity, types of foundations i.e. shallow and deep and their suitability. Shallow foundation such as wall foundation, isolated foundation, deep foundation such as pile foundation.

• Super-structure : Elements of super-structures and their functions

4. **Building Design :** Introduction to types of loads, concepts of strength, stability, durability and factor of safety of building, load bearing and framed structures.

5. Building Materials : Use and properties of the following materials :

• Concrete – ingredients and grades, plain and reinforced cement concrete and ready mix concrete, bricks, steel, aluminum, plastic, timber, roofing materials etc.

6. **Surveying :**

• Principles of surveying

• Classification of surveys

• Chain Surveying

Introduction to metric chain and tapes, error in chaining, nominal scale and R.F., ranging, chaining and offsetting, index plan, location sketch and recording of field book

• Chain and compass survey

Meridian, bearing and its types, system of bearing,

Types of compass : prismatic and surveyor's compass.

Calculation of included angles, correction for local attraction.

7. Levelling :

• Terms used in leveling, use of Dumpy level, temporary adjustments.

Methods of reduction of levels, types of leveling, Contours, characteristics of contours, use of contour maps.

• Introduction to Auto level and use

• Introduction and use of EDM's with special reference to Total Station.

• Measurement of area by planimeter – mechanical and digital.

8. **Transportation Engineering:**

• Types of roads: introduction to NH, SH, MDR, ODR, VR, Express Way

• Cross section of road – in cutting and filling

• Railway – Gauges, Cross-section of railway track.

Text Books:

1. Gupta, Sushil Kumar, DR and Juneja BM;"A Text Book of Building Construction";Ludhiana, Katson Publishing House
2. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons,
3. Sushil Kumar; "Building Construction"; Standard Publishers Distribution, Delhi
4. Peurifoy, RL, "Construction Planning, Equipment and Methods" Tokyo, McGraw Hill
5. Wakhlo, ON :Civil Engineering Management", New Delhi Light and Life Publishers

1.6 COMMUNICATION SKILLS

MODULE-I

The Process of Communication: Concept and process of communication; Barriers to Communication; Different Types of Communication; Written vs. Oral Communication; Different Types of Face-to-Face Interactions; Characteristics and Conventions of Conversation; Difference between Conversation and Other Speech Events;

Telephone Techniques: Warm Up; Speaking and Listening: Commonly Used Phrases in Telephone Conversations; Reading: Conference Calls; Vocabulary; Writing and Listening: Leaving a Message; Grammar and Usage- The Perfect Tenses; Pronunciation- Contracted Forms.

Job Applications and Interviews: Curriculum Vitae; Language Focus; Some Useful Words; Preparing for an Interview; Listening and speaking in the interview.

MODULE-II

Group Discussions: How to be Successful in a Group Discussion; Study Skills ; Language Focus; Speaking; Case discussions.

Managing Organizational Structure: The Role of a Manager; Leadership; Language Focus; Writing Reports; Pronunciation.

Meetings: A Successful Meeting; Speaking: One to One Meetings; Language Focus: Opening, Middle and Close; Editing; Criteria for Successful Meetings; Reporting Verbs; Memos

MODULE-III

Taking Notes and Preparing Minutes: Taking Notes- The Essential Components, Preparing Minutes- Format of Minutes, Language and Style of Minutes, Grammar.

Presentation Skills: Presentation Skills; Importance of Body Language in Presentations; pronunciation; Structure of presentation; Visual Aids; Ending the presentation; Podium Panic Pronunciation: Emphasizing the Important Words in Context

Negotiation Skills: Idiomatic Expressions; Process of Negotiations; Phrasal Verbs; Listening: Effective Negotiations; Speaking; Writing.

Technical Report Writing: Objective; Planning; Language; format of the report and guidelines for a good report writing with illustrations of good writing.

Practice Sessions: Students should be asked to prepare and present seminars during the practice session. Group discussions and case discussions should also be used and feedback given to students.

Reference Books:-

1. *The Chicago Manual of Style, PHI*
2. *Gowers, Ernest, "The Complete Words". Penguin, 1973.*
3. *IEEE Transactions on ''Written and Oral Communications" has many papers of relevance*
4. Ludlow, R., and Panton, F., "The Essence of Effective Communication", PHI

1.7 CHEMISTRY LABORATORY

LABORATORY WORK

List of Experiments:-

1. Preparation and standardization of solutions: NaOH, HCl, H_2SO_4 and Oxalic acid
2. To determine the hardness of water sample by EDTA method. (ALL)
3. To determine the acidity of water sample.
4. To determine the amount of residual chlorine in water sample.
5. To determine the total cation conc. In natural water sample using ion exchange resin.
6. To determine COD of a effluent sample.
7. Estimation of rate of corrosion of aluminum in acidic and basic medium.
8. Calorimetric determination of Copper.
9. Verification of Beer's law
10. To determine the surface tension of a liquid using drop no. method.
11. To determine the viscosity of the given liquid by Redwood viscometer.
12. To determine the acid value of the given oil.
13. To determine flash point and fire point of a lubricating oil
14. To determine the mol. Wt. Of polystyrene by viscosity measurements.
15. To determine melting point and/or glass transition temperature of a polymer.
16. To prepare the pure and dry sample of Urea Formaldehyde resin.
17. To prepare the copper ammonia complex
18. Preparation of nano-oxide using combustion method
19. .Estimation of moisture and ash content in a given sample of coal.

1.8 APPLIED MECHANICS LABORTOARY

LIST OF PRACTICALS

Verifications of following laws

1 a. parallelogram law of forces.

(b) Triangle law of forces

© Polygon law of forces

2 To verify the forces in different members of a Jib crane.

3 To verify the reaction at the spot of a simply supported beam.

4 To find the Mechanical Advantage, Vel Ratio and efficiency in case of an inclined plane.

5 To find the MA,VR and efficiency of a screw jack.

6 To find the MA,VR,Efficiency of worm wheel.

7 To find MA,VR and efficiency of first & second system of pulleys.

8 To find out the CG of regular lamina.

1.9 WORKSHOP PRACTICES

Relevant shop floor exercises involving practice in pattern making, Sand casting, Machining, Welding, Sheet metal fabrication techniques, Fitting work and surface treatment of metals, Demonstration of Forge welding, TIG/MIG/GAS/Spot/Flash butt welding, Demonstration on Shaper, Planer and Milling machine.

1.10 COMMUNICATION LABORATORY

Teacher should give following Assignments to students to develop skills of communicating effectively:

- communation cycle(with the help of Diagram)
- Communication Situation (List of 5 Communication situation stating the type of communication.
- Barriers that hinder a particular communication situation.(state the type of barrier, and how to overcome them)
- Developing a story or a paragraph for the given topic sentence (in a group of 5-6 students)
- Describing various equipments.
- Identifying the various sentences with their types of writing (e.g. scientific, legal, colloquial etc.)
- Business letters
- Letters of suggestion
- Comparative Time Table of 2 students
- Description of two different people.
- Letter to the Librarian, Principal
- Report writing.

B. SECOND SEMESTER

2.1 MATHEMATICS-II

MODULE-I

Linear Algebra: Rank, Linear Independent and Dependent, system of liner equations, Eigen values and Eigen vector, Cayley Hamilton theorem, diagonalization, linear transformation, quadratic form and Reduction to canonical form. Complex matrices.

Complex Numbers: De-Movire's theorem and its application, Elementary function of complex variable, Summation of series.

MODULE-II

Function Of Complex Variable: Analytic function, Harmonic functions, Necessary and sufficient condition for the function w= f(z) to be analytic, Application of analytic function in flow problem, complex integrations, Cauchy's integral theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives, Power series, Taylor's and Laurent's series, Zero's & singularities of complex function, Evaluation of real integral using residues, Bilinear transformation and conformal mapping

MODULE-III

Ordinary Differential Equation: Formation of differential equation, Exact differential equation, equation of first order and higher degree equation, Claurit's equation, Linear differential equation , Bernoulli's equation, Linear differential equation with constant coefficient, Method of variation of parameter, Method of undetermined coefficient, Cauchy and Legendre equation , simultaneous differential equation, application of linear differential equation.

Partial Differential Equations And Its Applications: Formation of P.D.E , Lagrange equations, Charpit method, Higher order linear differential equation with constant coefficient.

Text books:-

1. *Simmons, G.F., Differential Equations (With Applications and Historical Notes ,TMH*
2. *Jain,.R.K, .Iyengar "Advanced Engg.Mathematics" , Narosa publication*
3. *Grewal B.S,"Higher Engg.Mathematics",.,Khanna publication*
4. *Kasana, H.S., Complex Variables: Theory and Applications, PHI*

Reference Books:-

1. *Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006*
2. *Ram Babu, Engineering Mathematics, Pearson Education (2009).*
3. *Higher Engg.Mathematics,N.P.Bali,Laxmi Publication*
4. *Advanced Engg.Mathematics,kreyszig,john wiley and sons*

2.2 BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Introduction: Basic electrical quantities, Electric circuit sources and circuit elements and their behavior (Active and passive).

Supply Systems: AC Supply system (Single phase, three phase–three wire, Three phase–four wire), DC supply system, Their specifications and Comparison. D.C. Networks: Mesh and Nodal Analysis, Star–Delta Transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Step voltage response of RL and RC series circuits.

Sinusoidal Steady-State Response of Circuits: Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Series and parallel circuits, Power and power factors, Resonance in series and parallel circuits, Balanced 3–phase voltage, Current and power relations, 3–phase power measurement.

Magnetic Circuits: Concept of Magnetic circuits, B–H curve, Calculation of Magnetic Circuits, Iron Losses.

Single–Phase Transformers: Constructional feature, EMF equation, Ideal transformer, Open and short circuit tests, Voltage regulation and efficiency.

Rotating Electrical Machines: Construction, Operating principles and Applications of DC generator, DC motor, Three phase Induction motor and Single phase induction motors.

Electronic Devices: introduction to semiconductor, junction formation, P–N diode, BJT, SCR, FET, MOSFET, Their V–I characteristics and applications (Diode as rectifier, Zener diode as voltage regulator).introduction to semiconductor, junction formation

Text books:-

1. *Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Dorling Kingsley.*
2. *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, TMH*
3. *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, TMH*

Reference Books:-

1. *Chakrabarti, A., Basic Electrical Engineering, TMH*
2. *Del Toro, V., Electrical Engineering FundamentalsPHI*
3. *Sawhney A. K . "A Course in electrical and electronic Measurements & Instumentation" Dhanpat Rai & co*

2.3 PHYSICS

MODULE – I

LASER:-Basic concept of Laser, maser, principle of Laser action Population Conversion pumping its types its types. Types of Laser, Solid, gas and , Semiconductor and its application. Holography & its applications.

Optical Fibers:-Basic Principle of Optical fibre, characteristic of Optical fibre. Numerical aperture, graded Index, Step Index, its relation with Δ, propagation of light in Optical fibre. energy loss during propagations (dispersion), optical communication, through free space, wave guide, its applications.

MODULE – II

Special Theory of relativity: Postulates of specialtheory of relativity, Michelson Morley Experiment, Lerentz Transformation, Length Contraction, Time dilation, addition velocity Relativity of mass Energy equivalence.

Quantum Mechanics: Need of quantum Mechanics**,** De brogile wave phase & group velocity, particle diffraction uncertainty principle, the wave equation, postulates of Quantum mechanics. Time dependent and independent schrodinqer equation, Expectation values, Eigen value, eigen function, particle in a one dimensional box Finite potential well, Harmonic oscillator.

Quantum Statistics: Fermions & Bosons Symmetric & antisymmetric wave functions, Boltzman distribution functions, Base distribution & Fermi distributions function, Comparison of the distributions, Applications of base distribution function specific heat of solid Base-Condensation, Applications of Fermi-distribution functions, Free Electron gas thermionic emission.

MODULE – III

Superconductivity & Magnetism: Basic concept of superconductor, Meissner effect, type I & II superconductors, London equation, BSC Theory, Thermodynamic properties of superconductor Josephson Effect, flux equatization squid, orbital magnetic dipole moments orbital g-factor, magnetic dipole in uniform magnetic field, Electron spin magnetic properties of solid, diamagnetic Theory of para magnetic, susceptibility, Ferro magnetic, Antiferro Magnetic & Ferrimagnetism.

Electro Magnetism: Quantization & conservation of charge, Coulomb's Law, concept of Electric flux, Electric potential conductors, Capacitors, & dielectric materials, magnetic field, Force on a moving charge in a magnetic field, force on current Element, torqueon current Loop, Biot Savart Law, Amphere's Law, Electromagnetic Induction & Faradays Law, Magnetism in materials Maxwell equations, Divergence, gradient & Curl and Significance.

Text Books:-

1. *Beiser, A., Concept of Modern Physics, TMH*
2. *Griffiths, D.J., Introduction to Electrodynamics, PHI*
3. *Kittel, C., Introduction to Solid State Physics, Wiley,*
4. *Thyagarajan K & A K Ghatak, Lasers, , Macmillan India Ltd. Banglore.*
5. *Gerd Keiser Optical Fibre Communication, TMH*
6. *Arora C.L. Practical Physics, S. Chand & Co.*

Reference Books:-

1. *Rao, C.K, Optical Fibre System, Mc Graw Hill.*
2. *Sirohi R.S., Practical Physics, R.S. Sirohi, Wiley Eastern.*
3. *Modern Phusics, H.C.Ohanian, Prentice Hall.*

2.4 COMPUTER PROGRAMMING

Introduction: Elements of computer processing, Hardware and software, Introduction and feature wise comparison of various Operating Systems, Including DOS, Windows and Linux, Problem solving-algorithms and flowcharts.

C Programming Basics: Basic program construction, Structure of a C program, Compilation process. Various compilers available on different OS/ environments including Turbo C, Borland C, gc, gcc, MSVC. Console I/O (printf, scanf), preprocessor directives, Comments, Data types, Type conversions, Operators - arithmetic, Relational, Logical, Conditional, Increment/decrement, Library functions, Header files.

Loops and Decision Statements: *for* loop, *while* loop, *do* loop, Various forms of *if* statement, *switch* statement, *break* statement, *continue* statement, *goto* statement, arrays and strings, Declaring an array, Initializing arrays, Accessing the array elements, Working with multidimensional arrays, Declaring and initializing string variables, Arithmetic operations on characters, String handling functions (string.h), Pointers, Pointers to pointers, Declaring and initializing pointers, Pointer expressions, Pointer increment and scale factor, Pointers and arrays, Pointers and strings.

Functions: Defining functions, Passing arguments to functions, Returning values from functions, Reference arguments, Variables and storage classes, Static functions, Pointers and functions.

Structures and Union: Declaring and initializing a structure, Accessing the members of a structure, Nested structures, Array of structures, Using structures in functions, Pointers and structures, Declaring and initializing a union.

Files: Reading and writing to text and binary files, Character I/O, String I/O, File pointers, Error handling, Redirection, Command line arguments.

Structured Programming vs. Object Oriented Programming.

Text Books

1. *KernighanBrian W. and Ritchie, Dennis M, The C Programming language, Dorling Kingsley(2008) 2nd ed.*
2. *Balagurusamy, E., Programming in Ansi C, TMH.*

Reference Books:-

1. *Stroustrup, Bjarne, The C++ Programming Language,. Addison Wesley*
2. *Kanetkar, Yashavant, Let Us C, BPB*

2.5 ENGINEERING GRAPHICS

Introduction: Use of drafting tools, Lettering, Dimensions and Standards, Line Conventions.

Projection Systems: Projection Planes, Projection systems, Orthographic projections of points in first angle projection system and third angle projection system, Orthographic projections of lines on reference planes, True length of line using rotation of view method, Traces of lines, Auxiliary planes and their applications, Projections of Lamina parallel/inclined to reference planes, Projection of solids- Polyhedra, Solids of revolution, Sections of solids- Section plane parallel / inclined to reference planes, Intersection of solids.

Development of Surfaces: Development of surfaces like Prism, Pyramid, Cylinder, Cone, Sphere etc. using Parallel Line Method, Radial Line Method, Triangulation method.

Orthographic Projections: Extracting Orthographic projections from given pictorial views.

Isometric Views: Extracting Isometric projections from given Orthographic views using box method, Offset method.

Missing Lines and Missing Views: Evaluating missing lines and missing views from given orthographic views.

Computer Aided Drafting: Introduction to computer drafting tools like AutoCAD. Demonstration of commands like Line, Circle, Arc, Rectangle, MText and Dimensioning etc.

Text Books:-

1. *Gill, P.S., Engineering Drawing - Geometrical Drawings, S.K. Kataria*
2. *Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company*

Reference Books:-

1. *French, Thomas E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company*
2. *Bhatt, N.D. and Panchal, V.M., Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House*

2.6 PRINCIPLES OF BUSINESS, ECONOMICS & MANAGEMENT

MODULE-I

Economics: Definitions, Nature & scope of Economics, Economics Systems-meaning of Capitalism, Socialism & mixed economy.

Demand And Supplies Analysis: Law of demand and supply, exception to the law of demand, Elasticity of demand and supply and their types, Methods of measuring elasticity of demand and supply.

Theory of Production: Scales of production, Law of returns, Break even analysis.

Monetary System: Monetary Policy – Meaning, objectives, methods, Fiscal policy – Meaning & objectives of fiscal policy in a developing country like India, Functions of Reserve Bank of India and commercial banks.

MODULE-II

Economics & Business Environment: Privatization –Growth of private capitalism in India, Business/Trade Cycles – Meaning, Characteristics & classification, foreign capital & economic development.

Management Principles: Meaning & types of Management, Concept of Scientific Management, Management by Objectives, System Approach to Management.

Financial Management: Meaning, functional areas of financial management, Sources of Finance, Meaning of financial accounting, accounting principles-concepts & conventions, Importance of final accounts – profit & loss a/c and balance sheet, Need and importance of capital budgeting.

MODULE-III

Marketing Management: Introduction to marketing management, Market segmentation, Developing & managing advertising programs, Deciding on media & measuring effectiveness.

Production Management: Procedure for production planning & Control, Plant Location & Lay-out, Routing, Scheduling, CPM & PERT

Quality Management: Statistical Quality Control, introduction Control Charts, X Charts, R Charts, Control Charts for C (N. of defects per unit), Control chart for P(Fraction defective), Advantages & Limitations of SQC, Quality Circles:- Structure, functions & Limitations.

Text Books:-

1. Dewett , K.K., Modern Economic Theory , S.Chand & Co
2. Singh. P. and Habra, T. N., Business Organization & Management, Dhanpat Rai & Sons
3. Kotler, Philip., Marketing Management, PHI
4. I.M. Pandey., Financial Management, Vikas Publishing House Pvt. Ltd.

Reference Books:-

1. Ruddar Dutt, K.P.M.Sundaram., Indian Economy, S.Chand & Co.
2. Ahuja, H.L, Advanced Economic Theory, S.Chand & Co.
3. Grant, Leaven worth, Statistical Quality Control ,TMH
4. Edwin B.Flippo, Personnel Management , TMH
5. Koontz Harold, Management – A Global Perspective, TMH

2.7 BASIC ELECTRICAL & ELECTRONICS ENGG LABORATORY

LABORATORY WORK

Kirchhoff's laws, Network theorems, A.C. series and parallel circuits, Resonant circuit, Measurement of power 3–phase circuits, Reactance calculation of variable reactance choke coil, Tests on transformers, Starting methods of DC motor, Three phase induction motor and single phase induction motor, Identification and testing of devices (R,L,C, Diode and Transistor), V–I Characteristics of P–N diode, Zener diode , BJT as amplifier, Use of diode as half wave and full wave rectifier.

2.8 PHYSICS LABORATORY

LABORATORY WORK

List of Experiments

1. To find the frequency of A.C. mains using Electric Vibrator.
2. To determine the resistivity & Hall coefficient of a Semi Conductor by four probe method at different temperature.
3. To study the variation of magnetic field of a circular coil Carrying current I & Calculate the radius of coil.
4. To study the divergence of a Laser beam.
5. To determine the wave length of Laser using diffraction grating.
6. Determine the numerical aperture of an optical fibre.
7. To determine attenuation and propagation Lasses in optical fibre.
8. Making up the hologram using advanced Laser hit.
9. To find the susceptibility of ferro magnetic material (Fecl3) by quince Method.
10. To study Laser interference using Michelson Morley Interferometer
11. To study the photovoltaic cell & hence to verify the inverse square law.
12. To convert a galvanometer into an ammeter of a given range.
13. To find the value of plank's constant by using a photo electric cell.
14. To find the Low resistance by Carry Foster's Bridge.
15. To fine the temperature coefficient of resistance by using platinum resistance thermometer by bridge.

2.9 COMPUTER PROGRAMMING LABORATORY

LABORATORY WORK

Introduction to Hardware - CPU, Storage devices & media, VDU, I/O Devices.Basic Operating System (DOS/UNIX) commands. Simple programs to demonstrate the use of constants, Variables, printf, scanf and operators. Programs using Loops: Solution of quadratic equation, Summation of finite series, Fibonacci series, Prime numbers, Factorial. Menu driven programs using switch statement. Use of continue and break statements, Conditional operators. Passing variables to functions by values and by reference, Number conversion using array, Sorting, Merging, Arithmetic operations on matrices. String manipulation: Comparing, Copying, Reversing , Finding length, Extracting characters. Simple programs demonstrating the concept of Pointers, Passing values to functions using pointers for arrays, Structures. Creating various types of records using structures. Storing and retrieving records from a file, Copying a data file. Randomly accessing a record, Use of command line arguments.

C. THIRD SEMESTER

3.1 APPLIED MATHEMATICS-III

1. Fourier Series Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.
2. Laplace Transforms Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.
3. Special Functions Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation, Error function and its properties.
4. Partial Differential Equations Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients Applications: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation, solution by the method of separation of variables. Laplacian in polar coordinates.
5. Functions of Complex Variable Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions; Conformal Mapping: Mapping of a complex function, conformal mapping, standard transforms, mapping of standard elementary transformations, complex potential, applications to fluid flow problems; Complex Integration : Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions, singular points, poles, residue, complex integration using the method of residues, evaluation of real integrals by contour integration.

Text Books

1.Advanced Engineering Mathematics by Kreyszing Erwin ; Wiley Eastern, New Delhi
2. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
3. Numerical Solutions of Differential Equations by NK Jain ; Prentice Hall, Delhi.
4. Differential Equations by Sharma and Gupta ; Krishna Prakashan Media (P) Ltd., Meerut.

3.2 NETWORK ANALYSIS AND SYNTHESIS

Circuits Concepts : Circuits Elements,
Independent and dependent sources, signals and wave forms; periodic and singularity voltages, step, ramp, impulse, Doublet. Loop currents and loop equations, node voltage and node equations, Network Theorems, Superposition, Thevenin's, Nortan's, Maximum Power Transfer, Reciprocity.

Time and Frequency Domain Analysis :
Representation of basic circuits in terms of generalised freq. & their response, Laplace transform of shifted functions, transient & steady response. Time domain behaviors from poles and zeros. Convolution Theorem.

Network Synthesis :
Network functions, Impedance & Admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network. Sinusoidal network in terms of poles & zeros. Real liability condition for impedance synthesis of RL & RC circuits. Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Filters Synthesis :
Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T section, IT section, terminating half section. Pass bands and stop bands. Design of constant-K, mderived filters. Composite filters.

Text Books:

1. Network Analysis & Synthesis by Van Valkenberg
2. Network Analysis and Synthesis by Sudhakar Sham Mohan
3. Network Synthesis by IVS Iyer
4. Electric Circuits by JA Administer
5. Circuit Theory by Chakraborty

3.3 MAGNETIC CIRCUITS & TRANSFORMERS

1**. ELECTROMAGNETISM:**
Review of electromagnetism, Magnetic field strength, Magnetic force.
2. **MAGNETIC CIRCUITS**:
Magneto motive force , reluctance, laws of magnetic circuits , determination of ampere-turns for series and parallel magnetic circuits , magnetic leakage and fringing, hysteresis and eddy current losses.
3. **ELECTROMAGNETIC INDUCTION:**
Faraday's laws, Lenz's law, statically and dynamically induced E.M.F., Energy stored in magnetic field.
4**. TRANSFORMERS:**
Introduction, Principle of working, construction of single phase transformer, EMF equation, phasordiagram on no-load, leakage reactance transformer on load, equivalent circuit, voltage regulation, power and energy efficiency, open circuit and short circuit tests, equivalent circuit parameters estimation. Effect of saturation on exciting current, in-rush current phenomenon.
Parallel operation of single phase transformer.

5. **AUTO TRANSFORMER:**
Principle of operation, comparison with two winding transformers.
6. **THREE-PHASE TRANSFORMERS:**
Different winding connections, Voltage and current ratios, comparative features, effect of connections on exciting current, Parallel operation.
Three winding transformer-equivalent circuit, off-load and on-load tap changing transformer, Scott connections.

Reference Books :

1. Electric Machinery ----Fitzgerald, Kingsley & Kusko (Mcgraw Hill)
2. Transformer Engineering---- L.F. Blume
3. Performance design & Testing of A.C. Machines ---- M.G. Say (CBS, Delhi)
4. Magnetic Circuits and Transformers---- MIT staff
5. Electrical Machines---- Nagrath & Kothari (TMH)
6. Theory of Alternating Current Machines ---- A.S. Langsdorf(TMH)

3.4 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTS

1. General Theory of Analog Measuring Instruments:

Operating torque, damping & controlling torque, T/W ratio, Pointers & Scales. Principles of operation of various types of electro mechanical indicating / registering instruments viz. PMMC, dynamometer, induction, thermal, etc. for dc & ac measurement of V,I, W, frequency, phase & power factor etc., energy meter, their sources of error & compensation, shunts & multipliers, multi- meter.

2. Potentiometers:

Basic Potentiometer circuit, multiple range potentiometers, constructional details of potentiometers, applications of d-c potentiometers; self balancing potentiometers. A-C potentiometers, polar and co-ordinate types.

3. Bridges:

Sources and Detectors, General equation for bridge balance, Measurement of R,L,C,M, F etc by Wheatstone, Kelvin, Maxwell, Hay's, Anderson, Owen, Heaviside, Campbell, schering, Wien bridges. Bridge sensitivity. Errors, , Wagner Earthing Device.

4. ELECTRONIC INSTRUMENTS :

Electronic voltmeter and current probes, tuned type and sampling type voltmeter, current probes for D.C. and A.C. measurements, electronic multimeter - construction, measurement of D.C. and A.C. voltage and current, measurement of resistance.

CRO- Construction, synchronisation, measurement of voltage,current, phase and frequency.

Digital Instruments -Comparison of analog and digital instruments, digital voltmeter, multimeter and frequency meter.

5. TRANSDUCERS:

Terminology and definition, classification, transducing principles and elements, ultrasonic, optical and infrared sensors, inductive, capacitive and resistive transducers.

6. END DEVICES:

Recorders: x-y recorders, strip-chart recorder, magnetic and potentiometric recorder. Digital displays- LED & LCD Introduction to Data Acquisition systems.

Text BOOKS

1.A Course in Electrical & Electronics Measurement & Inst. By. A. K. Sawhney,
Dhanpat Rai & sons.
2.Electronic Inst. & Measurement techniques. By W.D. Cooper.

3.5 OBJECT ORIENTED PROGRAMMING

1. Basics of C & C++

Introduction, Basics, Data Type, Bit Field integer, Operations, Control Structures, Storage Classes, User Defined Data Type, Reserved Words and Standard 110 Statements in C & C++.

2. Object Orient Programming With C++

Introduction, Object Oriented Programming Concept, Objective of OPP, Programming Structure in C++, Data Abstraction

3. Overloading and Information Hiding

Introduction, Function Overloading, Information Hiding

4. Memory Management in C++:

Introduction, Constructor-Automatic Initialization of Objects, Dynamic Memory Management, Default Constructor, Copy Constructor, Constructor and Information Hiding, Destructor-Automatic Clear up of an Object

5. Inheritance

Introduction, Inheritance-Data and Code Sharing , Class Derivation ,Ambiguity in Class Member Access ,Virtual Base Class-A Remedy , Class Initialization in Inheritance ,Arguments for the Base Class

6. Bindings and Polymorphism

Introduction , Bindings in C++, Polymorphism

7. Generic Facility

Introduction, Concept of Generic Facility, Generic Function ,Overloading a Generic Function, Generic Classes

8. File Handling in C++

Introduction, Concept of Stream in C++, File Positioning Functions , Error Handling During File Operation.

Reference Books:

1. The C++ Programming Language by B.Stroustrup, Pearson Education
2. Thinking in C++ by Bruce Eckel, Pearson Education
3. Object Oriented programming in C++ by N.Barkakati, PHI
4. Mastering C++ by Venugopal and et all, Tata McGraw Hill
5. C++ How to program by Detail and Detail, Pearson education

3.6 ELECTRONIC DEVICES AND CIRCUITS

1. Semiconductor Physics :

Energy Band Theory of crystals, Insulators, Semiconductor, metals, Types of semiconductors, mobility and conductivity, charge densities in Semiconductors, Electrical properties of Ge and Si, Hair effect, generation and recombination of electrons and holes, diffusion, Continuity equation, Injected minority carrier charges, Mass Action Law.

2. Junction Diode Characteristics :

Open circuited P-N junction as rectifier (forward .and.. reverse biasing) current components in P-N diode, V-I characteristics, Space charge and diffusion.capacitance, Junction diode switching times, Breakdown diodes, Tunnel diode, LED, LDC, photo diode, varactor diode. Reverse recovery diode, Schottky diode, Fermi level in intrinsic and extrinsic semiconductor, Band structure of an P-N junction, Basic Semi-conductor equations.

3. Diode Circuits:

Diode as circuit element, Load Line concept, Clippers and Clampers, rectifiers other full wave rectifiers, Capacitive filters, Choke input filter L- C filter, filter, diode circuits for OR, AND (both positive and negative logic).

4. Transistor Characteristics:

Junction transistor, transistor current component, CB, CE, CC configurations, comparison of the configurations, transistor as an amplifier, Photo transistor, Junction FET, JFET Characteristics, Pinch – off voltage Vp diode and transistor circuit for NOT gate.

5. Transistor Biasing and Thermal Stabilization:

Operating point, Selection of Operating points, Different Techniques, Self bias, collector to Base Bias, Emitter bias, divider circuit, Bias compensation, Thermistor and compensation, Thermal runaway and thermal stability.

6. Feedback Amplifiers:

Classification of amplifiers, Feedback concept, positive and negative feedback, General characteristics of negative feedback, Details of voltage series, voltage shunt, current series and current shunt feedbacks, concept of oscillators.

7. Operational Amplifiers:

Basic OP-AMP, Differential amplifier, Emitter coupled Differential Amplifier, transfer characteristics of differential OP-AMP, IC operational Amplifier, Offset error voltage and currents, Temperature drift of input offset voltage and current.

Text BOOKS

1.Integrated Electronics - Jacob Millman & T.M.H.
2.Analog and digital circuits And systems Christos C. Halkias
3. Electronic Principles (6th edition) Albert Paul Malvino T.M.H.
4.OP-AMPS and Linear Integrated Circuits Ramakant A. Gayakwad PHI

3.7 ELECTRONIC DEVICES AND NETWORKS LABORTOARY

1. To study V-I characteristics of PN junction diode (Ge, Si, switching and signal).
2. To study Half wave, full wave and Bridge Rectifier.
3. To study transistor characteristics in common base and common emitter configurations.
4. To study the FET characteristics.
5. To design, study and compare various transistor biasing techniques.
6. To study of an emitter follower circuit.
7. To study and compare the frequency response of single stage and two stage RC coupled amplifier.
8. To study the effect of negative feedback on the behavior of amplifiers.
9. To study the frequency response of an amplifier and compute gain bandwidth product.
10. To find Offset Voltage, Gain, CMRR of an Op-amp and study techniques of \ Offset null adjustment.
11. To verify Superposition, Thevenin, Norton and maximum power transfer theorems.
12. To study the response of constant K-filters.
13. To study the response of m-derived filters
14. To study various voltage and current feedback schemes.
15. Diode clippers and clampers.

3.8 ELECTRICAL MEASUREMENTS & MEASURING INSTRUMENTATIONS LABORTOARY

List of experiments:

1. Study of principle of operation of various types of electromechanical measuring instruments.
2. Measurement of resistance using Wheatstone Bridge.
3. Measurement of resistance using kelvin's Bridge.
4. Measurement of self inductance using Anderson's Bridge.
5. Measurement of capacitance using Schering Bridge.
6. Plotting of Hysteresis loop for a magnetic material using flux meter.
7. Measurement of frequency using Wein's Bridge.
8. To study the connections and use of Current and potential transformers and to find out ratio error.
9. Determination of frequency and phase angle using CRO.
10. Measurement of unknown voltage using potentiometer.
11. To find 'Q' of an inductance coil and verify its value using Q- meter.

3.9 OBJECT ORIENTED PROGRAMMING LABORTOARY

List of experiments:

To write following programs in C / C++ :

1. Using basic statements like control statements , looping statements, various I/O statements and various data structures.
2. Creating classes in C++ for understanding of basic OOPS features.
3. Representing concepts of data hiding, function overloading and operator overloading.
4. Using memory management features and various constructors and destructors.
5. Representing Inheritance, virtual classes and polymorphism.
6. Writing generic functions.
7. File handling programs.

D. FOURTH SEMESTER

4.1 ELECTROMECHANICAL ENERGY CONVERSION AND D.C. MACHINES

1. ELECTRO-MECHANICAL ENERGY CONVERSION :

Energy stored in electric and magnetic fields, energy conversion in singly and multiple excited systems, reluctance torque, reluctance and hystersis motors.

2. GENERAL DESCRIPTION OF ELECTRICAL MACHINES :

Description of electric circuits in cylindrical rotor and salient pole machines, MMF of Single and multiple coils, harmonic analysis of induced voltages and armature MMF, Effect of slots, winding factors, Torque in terms of flux and mmf.

3. D.C. MACHINES :

Armature windings, single and double layers, windings & winding diagrams, E.M.F. and torque equations, interaction of fields produced by excitation circuit and armature, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of d.c. generators and their characteristics.

D.C. motors: characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, Ward Leonard method, Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency.

4. CROSS-FIELD MACHINES :

Principle of working, analysis of cross-field generator, typical characteristics with different compensations. Applications.

Reference Books :

1. Electric Machinery Fitzgerald Kingsley & Kusko
2. Principles of D.C. machines Langsdorff
3. Electrical Machines Nagrath & Kothari
4. Electrical Machinery P.S. Bhimbhra

4.2 LINEAR CONTROL SYSTEMS

Introductory Concepts :

Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control systems, closed loop control systems, linear and non- linear systems, time variant & invariant, continuous and sampled data control systems, illustrative examples.

Modellinq :

Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic systems, electrical and mechanical analogies. Use of Laplace transform, Transfer function, concepts of state variable modelling. Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Time Domain Analysis :

Typical test -input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and co-efficient, polezero location and stability, Routh-Hurwitz Criterion.

Root Locus Technique :

The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain & sketch of the root locus plot. .

Frequency Domain Analysis:

Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specification, Relative stability, Relation between time and frequency response for second order systems. A and N- circles, log. Magnitude versus Phase angle Plot, Nyquist criterion.

Compensation : Necessity of compensation, series and parallel compensators, compensating network, application of lag and lead compensation.

Control Components: Error detectors- potentiometers and synchros, servo motors, A.C. and D.C. techogenerators, Magnetic amplifiers.

Reference BOOKS

1. Modern Control Engineering by K. Ogata, Prentice Hall, N. Delhi, 1974
2. Control System components by J.F. Gibsen, McGraw Hill, 1963
3. Automatic Control System by B. C. Kuo. Prentice Hall 3rd Ed, 1978
4. Control System Engineering by I.J. Nagrath & Gopal, Wiley Eastern Ltd. N. Delhi, 1975

4.3 APPLIED ELECTRONICS

Small Signal Low Frequency Transistor Model

Transistor Hybrid model, Determination of h-parameters, Analysis of transistor amplifier circuit using parameters, comparison of transistor amplifier configurations. Linear analysis of a transistor circuit, physical model of CB transistor.

Low Frequency Transistor Amplifier Circuits

Effect of an emitter bypass capacitor on low frequency response, effect of coupling capacitor on low frequency response, cascading of transistor amplifiers, CE hybrid model, analysis of CC and CB configurations, CE amplifier with emitter resistance, Emitter follower, Miller's theorem, high input-resistance transistor circuits, cascade transistor configuration, difference amplifiers.

High Frequency Transistor

The high frequency T model, common base short circuit current frequency response, alpha cut off frequency, common emitter short circuit current frequency response, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters, CE short circuit current gain obtained with hybrid pi model, current gain with resistive load.

Large Signal Amplifiers

Class A direct coupled with resistive load, Transformer coupled with resistive load, design theory, power amplifier design, harmonic distortion, power output, variation of output power with load, thermal runaway, output transformer saturation, push-pull amplifiers, operations of class A push-pull amplifier, class B pushpull amplifier, crossover distortion, class AB push-pull amplifier, transistor phase inverter, conversion efficiency of class B amplifier, design of class B push-pull amplifier, complementary symmetry amplifier.

Oscillators

Effect of positive feed back, requirements for oscillations, phase shift oscillator, colpitts oscillator, Hartley oscillator, Wein bridge oscillator, general form of oscillator circuit, crystal oscillators, frequency stability, negative resistance in oscillators.

Regulated power supplies

Unregulated power supplies, zener diode voltage regulators, transistor series and shunt regulators, current limiting, Op-Amp voltage regulators, integrated circuit voltage regulators, line and load regulations, introduction to SMPS and its various topologies.

Reference Books

1. Electronic Devices & Circuits by Millman- Halkias, Tata Mcgraw Hill
2. Electronic Devices & Circuit Theory by Boylestad, PHI
3. Electronic Devices & Circuits by Allen Mottershead, PHI

4.4 NUMERICAL & STATISTICAL METHOD

1. **Errors in Numerical Calculations**

Errors and their analysis, general error formula, errors in a series approximation

2. Solution of algebraic and Transcendental equations: Bisection method, iteration method, Method of false position,, Newton -Raphson method, solution of systems of non linear equations, method of iteration

3. **Interpolation method:**

Errors in polynomial interpretation, finite difference , forward, backward and central difference, Difference of a polynomial, Newtons formulae for interpolation, central difference intepolation formulae, Interpolation with unevenly spaced points, Newton's general interpolation formula, interpolation by iteration

4. **Curve Fitting:**

Cubic splines and approximation:introduction, Least square curve fitting,,Procedures -fitting a straight line, non linear curve fitting, curve fitting by a sum of exponentials, Data fitting with cubic splines-derivation of governing equation, end conditions

5.**Numericl Differentiation and Integration**

Numerical differentiation- cubic spline method: maximum and minimum values of a tabulated function; Numerical Integration- trapezoidal rule, Simpson1/3 rule, Simpsons 3/8 rule, Newton-cots integration formulae; Euler-Meclaurin formula, Gaussian integration(One dimensional only)

6.**Matrices and Linear systems of equations**

Introduction, Inverse of Matrix, Solution of linear systems, Matrix inversion method, Gaussian Elimination method(fall and banded symmetric and unsymmetric systems), Eigen value problems

7. **Numerical solution of ordinary differential equations:**

Solution by Taylor's series, Prediction -correction method, Boundary value problems, Prediction corrector method, Euler's and modified Euler's method, Runge-Kutta method, finite difference methods

8. **Numerical solution of Partial differential equations**

Finite difference approximation to derivatives, Solution to Laplaces equation- Jacobi's method, Gauss - Siedel method, S.O.R method, Parabolic equation and their solution using iterative methods

Text Books:

1. Computer Oriented Numerical Methods- V. RajaRaman
2. Numerical Methods in Fortran -Mc Cromik and Salavadory
3. Elementary Numerical Analysis, S.D. Conte, & Cari De Boor. Mc Graw Hill.
4. Applied Numerical Methods, Cornahn B., Et al, John Wiley.

4.5 DIGITAL ELECTRONICS

1. Number System And Binary Code: Introduction, Binary, Octal and hexadecimal number system. Signed and unsigned number, Binary operations-addition; Subtraction, Multiplication and division; Subtractions using 1's and 2's compliment; ASCII code; Excess 3 code, Gray code.

2. Minimization of logic function: OR, AND,NOT,NOR,NAND,EX-OR, Basic theorem of Boolean Algebra, sum of products and product of sums, canonical form, Minimisation using theorems, minimization using Kmap and Q-M method. Incompletely specified functions.

3. Combinational Logic Circuits: Introduction, Combinational circuit design, multiplexers, demultiplexer, encoders, decoders, adders, substractors and code converters, parity checker, BCD display drive, magnitude comparators.

4. Sequential Circuits : Introduction, flip flop SR, JK, D, T edge triggered and decked flip-flop, Registers. Type of Registers, circuit diagram, timing wave form and operations counters, counter design with state equation and state diagrams.

5. D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter Successive approximation A/D converter. Single and dual slope A/D converter A/D accuracy and resolution, Voltage of frequency conversion, Voltage of time conversion.

6. Semiconductor Memories : Introduction, Memory organization, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories. Content addressable memories. Programmable logic arrays, Charged-Coupled device memory.

7. Logic Families : RTL, DCTL, DTL, TTL, ECL and its various types, Comparison of logic families.

Reference Books :

1. Digital principle and applications Malvino (TMH)
2. Modern digital electronics R. P. Jain (PHI)
3. Digital electronics principle Malvino (THM)
4. Modern digital systems design Cheung & ----- (WPC)
5. An Engg. Approach to digital design Fletcher (PHI)

4.6 ENERGY MANAGEMENT

SECTION-A

Significance of Energy Management in the present scenario, Role and responsibilities of an Energy Manager, Basic Principles of supply side Management (SSM) and demand Side Management (DSM).

SECTION-B

ENERGY AUDIT: Types of Energy Audits, National Energy Plan and its impact on Energy Conservation, Energy accounting and analysis.

SECTION –C

MEASURING INSTRUMENTS: Temperature measuring instruments, combustion system measuring instruments, measurement of heating, ventilation and air conditioning system performance.

SECTION-D

ENERGY AUDITS PRACTICE: Energy Audits of building systems, electrical systems, maintenance and Energy Audits.

SECTION-E

Energy Conservation and Management

6. Need for energy conservation with brief description of oil and coal crisis
7. Environmental aspects
8. Energy efficiency its significance
9. Energy efficient technology an overview
10. Energy conservation in domestic sector lighting home appliance
11. Need for energy efficient devices
12. Energy conservation in industrial sectoe- Motrs, Induatrial lighting Distribution system, pumps, fan, Blowers etc
13. Energy conservation in Agriculture sector, Tube well Pumps, diesel generating sets standby energy sources
14. Macro level approach for energy for energy conservation at design stage.

Reference BOOKS

1. Handbook of Energy Audits by Albert Thuman – Fairman Press Inc.
2. Energy Technology by S. Rao, Khanna Publishers.
3. Renewable Energy sources and conversion Technology by NK Bansal, Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co Ltd New Delhi
4. Energy today and tomorrow; Maheshwar Dayal; Publications Divison, Ministry of Information and Broadcasting, Govt of India, New Delhi
5. Manual on energy efficiency at Design Stage, CII energy Mangement Cell
6. Energy Conservation case studies in ceramic industry, suger industry, fertilizer industry cement industry. CII, Energy Management Cell etc.

4.7 APPLIED ELECTRONICS LABORTOARY

List of Experiments:

1. To study various coupling techniques for transistor amplifiers.
2. To measure small signal parameters of the BJT.
3. To observe the transfer function of the output voltage v/s frequency around the critical frequency in coupling and bypass circuits.
4. To observe the change in critical frequency of a CE amplifier because of feed back capacitances in a BJT (Miller Effect).
5. To study the characteristics of a class A amplifier.
6. To study the characteristics of class B amplifier.
7. To study the characteristics of class C amplifier.
8. To study the characteristics of a class AB amplifier.
9. To study the characteristics of a class B push-pull amplifier.
10. To study the characteristics of a complementary symmetry amplifier.
11. Study of an emitter follower.
12. To design and study various types of oscillators.
13. Zener diode voltage regulator.
14. To design a transistor series voltage regulator with current limit and observe current feedback characteristics.

4.8 DIGITAL ELECTRONICS LABORTOARY

List of Experiments:

1. (a) Verification of the truth tables of TTL gates, e.g., 7400, 7402,7404, 7408, 7432,7486.
(b) Design, fabrication and testing of low frequency TTL clocks using NAND gates.
2. (a) Verification of the truth table of the Multiplexer 74150.
(b) Verification of the truth table of the De-Multiplexer 74154.
3. Design and verification of the truth tables of half adder and full adder circuits using gates 7483.
4. Study and verification of the operations of ALU 74181 with regards to addition/ subtraction / comparison.
5. Design fabrication and testing of differentiator and integrator circuits using OP AMP.
6. Design fabrication and testing of clipper and clamper circuits using OP AMP.
7. Design fabrication and testing of
(a) Monostable multivibrator of t=0.1 msec.approx.) using 74121/123. Testing for both positive and negative edge triggering, variation in pulse with and retriggering.
(b) Free running multivibrator at 1 KHz and1 Hz using 555 with 50% duty cycle. Verify the timing from theoretical calculations. 8. Design fabricate and test a switch debouncer using 7400.
9. (a) Design and test of an S-R flip-flop using TOR/NAND gates.
(b) Verify the truth table of a J-K flip-flop (7476)
(c) Verify the truth table of a D flip-flop (7474) and study its operation in the toggle and asynchronous modes.
10. Operate the counters 7490, 7493 and 74192. Verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.
11. (a) Verify the truth table of decoder driver 7447 / 7448. Hence operate a 7 segment LED display through a counter using a low frequency clock.
(b) Repeat the above with the BCD to Decimal decoder 7442 and an array of LEDs.

4.9 ELECTRICAL MACHINES-I LABORTOARY

List of Experiments:

1. Load test on a single phase transformer .
2. To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent circuit , voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of three phase transformer.
6. To study the constructional details of D.C. machine and to draw sketches of different components.
7. To measure armature and field resistance of d.c. shunt generator and to obtain its open circuit characteristics.
8. To obtain load characteristics of d.c. shunt/series /compound generator.
9. To draw speed-torque characterisitcs of d.c. shunt/series /compound generator.
10 . To study d.c. motor starters. To perform swinburne's test (no load test) to determine losses of d.c. s

4.10. Industrial training of six week after second year

Students will undergo 6weeks industrial trtaining in industry to develop their skills .

E. FIFTH SEMESTER

5.1 ASYNCHRONOUS MACHINES

1. BASIC CONCEPTS:

Field distribution of space distributed three-phase winding, concept of rotating field, production and concept of asynchronous and synchronous torques.

2. POLYPHASE INDUCTION MACHINES:

Constructional features, operation, equivalent circuit, phasor diagram , leakage reactance and it's importance on machine performance, effect of rotor circuit resistance, starting torque, cage motors, double cage and deep bar motor.

Generator action, methods of excitation, space harmonics and their effect on motor performance, starting methods, speed control: (i) control of speed of rotating field, (ii) control of slip speed. Estimation of equivalent circuit parameters Effect of voltage injection in rotor circuit of slip ring induction motor, action of commutator, scherbius and kramer schemes of speed and P.F. control of induction motors.

3. STEPPER MOTORS AND LINEAR INDUCTION MACHINES

Stepper Motors: construction, principle of operation and applications. Linear Induction Machines: construction, principle of operation and applications.

4. SINGLE –PHASE MOTORS:

Single phase induction motor, double revolving field theory, equivalent circuit, characteristics. phase splitting, shaded pole motor, single phase series and repulsion motor: working and characteristics.

Reference BOOKS:

1. Electric machinery A.E. Fitzgerald and C. Kingsley.
2. Theory of A.C. machines A.S. Langsdorf.
3. The performance and design of A. C. E.O. Taylor.
Commutator Machines. PTU/BOS/EE/101/08-05-2004

5.2 ELECTROMAGNETIC FIELD THEORY

1. Review of Vector Analysis

Vector analysis, Physical interpretation of gradient, divergence and curl; vector relations in other coordinate systems, integral theorems: divergence theorem, stoke's theorem, green's theorem and Helmholtz theorem.

2. Electrostatics

Introduction to fundamental relations of electrostatic field; Gauss's law and its applications; potential function; Field due to continuous distribution of charges; Equipotential surfaces; Divergence theorem; Poisson's equation and Laplace's equation, capacitance, electrostatic energy, Conditions at Boundary between dielectrics, Uniqueness theorem.

3. The Steady Magnetic Field

Magnetic induction and Faraday's laws; magnetic Flux Density; magnetic field strength and magneto motive force; Ampere's work Law in the differential vector form; permeability; energy stored in a magnetic field ; ampere's force law; magnetic vector potential, Analogies between electric and magnetic fields.

4. Maxwell's equations and Pointing vector

Equation of continuity for time varying fields, Inconsistency of ampere's law, Maxwell's equations, conditions at a Boundary surface, Pointing Theorem, Interpretation of ExH

5. Electromagnetic Waves

Solutions for free-space conditions; Uniform plane Wave Propagation; Wave equations for a conducting medium; Sinusoidal time variations; Polarization; Conductors and Dielectrics; Direction Cosines; Reflection by Perfect Conductor -normal and oblique incidence, Perfect Dielectric-normal incidence, Perfect Insulator –Oblique incidence; Reflection at a surface of Conductive medium.

REFERENCES Books

1. Electromagnetic Waves and Radiating Systems By Edward C. Jordan
2. Electromagnetics By John D. Kraus
3. Elements of Engineering Electromagnetics By N. Narayana Rao
4. Schaum's theory and problems of Electromagnetics By Joseph A. Edminister

5.3 POWER SYSTEMS - I

(Transmission and Distribution)

1. **SUPPLY SYSTEM**

Introduction to Transmission and Distribution systems, Comparison between DC and AC systems for Transmission and Distribution, comparison of cost of conductors, choice of working voltage for transmission & distribution, economic size of conductors - Kelvin's law, Radial & mesh distribution networks, Voltage regulation.

2. GENERAL

Conductor materials; solid, stranded, ACSR, hollow and bundle conductors. Different types of supporting structures for overhead lines. Elementary ideas about transmission line construction and erection. Stringing of conductors, spacing, sag and clearance from ground, overhead line insulators, concept of string efficiency.

3. TRANSMISSION LINE PARAMETERS

Introduction to line parameters, Resistance of transmission line, inductance of single phase two wire line, concept of G.M.D., Inductance of three phase line, Use of bundled conductor, transposition of power lines, capacitance of 1-phase and 3-phase lines. effect of earth on capacitance of conductors.

4. PERFORMANCE OF TRANSMISSION LINES

Representation of short transmission line, medium length line (nominal T & II circuits). long length line by hyperbolic equations and equivalent T & II circuits. Power flow through transmission lines, ABCD constants, Voltage regulation.

5. CIRCLE DIAGRAM AND LINE COMPENSATION

Receiving end circle diagram for long transmission lines based on ABCD constants, equivalent T circuits ,power loci, surge impedance loading, reactive power requirement of system series and shunt compensation, Synchronous phase modifiers , rating of phase modifiers.

6. UNDERGROUND CABLES

Classification of cables based upon voltage and dielectric material, insulation resistance and capacitance of single core cable, dielectric stress, Capacitance of 3 core cables, methods of laying, heating effect, Maximum current carrying capacity, cause of failure, comparison with overhead transmission lines.

Reference Books

1. Electrical Energy System Theory - An introduction O.L. Elgerd(TMH)
2. Elements of Power System Analysis W.D. Stevenson Jr.(TMH)
3. Course in Electrical Power C.L. Wadhwa New Age Int.(P)Ltd.
4. Power System Analysis Nagrath and Kothari (TMH)
5. Power System Analysis & Design B.R. Gupta, Wheeler Publishing.

5.4 MICROPROCESSORS AND INTERFACING

1. **Introduction to Microprocessors**

Types of computers, Microprocessor Evolution and types, CPU operation and terminology, idea of 8- bit, 16-bit, 32-bit and 64- bit Microprocessors from Intel, Motorola and Zilog and their comparisons.

2. Introduction to 8-bit Microprocessor

8085 mpu architecture, instruction classification, instruction & Data format, overview of the 8085 instruction set.

3. Introduction to 16-bit Microprocessor

8086 Internal Architecture, Addressing modes, program development steps, 8086 instruction set Assembler directives, Assembly language, program development tools.

4. Programming of 8086

Simple sequence programs, jumps, flags, conditional Jumps, if then, If-then-else, Multiple If-then-else, while-Do, Repeat-until, Instruction Timing and delay loops, strings, procedures, Macros.

5. 8086 System Connections, Timing, Trouble shooting.

Pin-diagram, maxImin. modes, timing diagrams, use of logic analyzer to observe Bus Signals, trouble shooting a simple 8086 based system

6. 8086 Interrupts & Applications

8086 Interrupts, responses & applications, 8254 software- programmable timer/counter, 8259 A priority Interrupt Controller

7. Interfacing of 8086

Programmable parallel ports & handshake, Interfacing a Microprocessor to Keyboards and alphanumeric displays, D/A converter operation, interfacing and applications, A/D converter specifications, Types and Interfacing.

Reference BOOKS

1. Microprocessor Architecture, Programming and Applications with the 8085 By Ramesh S. Gaonkar, Penram International

2 . Microprocessors and interfacing: programming & Hardware By Douglas V. Hall, Tata McGraw Hill

5.5 POWER ELECTRONICS

1. Thyrlstors and their characteristics :

Introduction to thyristor family V-I characteristics of SCR, SUS, PUT, SCS, GTO, LASCR, DIAC and TRIAC. Principle of operation of SCR. Two transistor analogy. Turn on methods of a thyristor Switching charactgeristics of thyristors

during tum-on and turn-off. Gate characteristics. Firing of thyristors. Gate triggering circuits. Series and parallel, operation of SCRs and their triggering circuits. Thyristor specifications; such as latching current and bolding current, dv/dt and di/dt, PTV etc. Protection of SCR from over voltage and over current. Snubber circuits. Power dissipation.

2. Thyristor commutation techniques :

Load commutation (Class A), Resonant-Pulse commutation (class B), impulse commutation (class D), Line commutation (class F).

3. Phase controlled techniques :

Introduction to phase angle control. Single phase half wave controlled rectifiers. Single phase half controlled and full controlled bridge rectifiers. Three phase full controlled bridge rectifiers. Effect of resistive, inductive and resistive cum inductive loads. Basic circuit and principle of operation of Dual Converter, circulating current mode and non-circulating current mode of operation. Applications of rectifiers and dual converters to speed control of DC motor drives.

4. Choppers

Introduction and principle of chopper operations. Control strategies, two quadrant chopper, Four quadrant chopper. Regenerative chopper. Steady state time domain analysis of type A-chopper, voltage commutated chopper or classical Jones chopper.

5. Cycloconverters

Basic circuit and operation of single phase cycloconverter. Single phase bridge cycloconverter. Three phase to single phase to single phase cycloconverter. Advantages disadvantages of cycloconverters.

6. Inverters :

Introduction to inverter. Operating principle and already state analysis of single phase, voltage source, bridge inverter. Modified Mcmurray half-bridge and full bridge inverter. Three phase bridge inverter. Voltage control (PWM control etc.) and reduction of harmonics in the inverter output voltage. Series inverter.

Reference Books

1. P.S. Bimbhra, Power Electronics, Khanna Publishers.
2. M.D. Singh, K.B. Khanchandani, Power Electronics, Tata Mc Graw Hill Publishing company limited.
3. M.H. Rashid, Power Electronics, PHI.
4. P.C. Sen, Power Electronics, Tata Mc Graw Hill Publishing company limited.

5.6 ELECTRICAL ENGINEERING MATERIALS

1. Dielectric Materials:

Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectric materials and spontaneous polarization, piezo- electricity. frequency dependence of electronics, ionic and orientational polarization, complex dielectric constant and dielectric losses.

2. Conductivity of Metals:

Ohm's Law and relaxation time of electrons, collision time and mean free path. Electron scattering and resistivity of metals. Heat developed in current carrying conductor, thermal conductivity of metals, superconductivity.

3. Magnetic Materials :

Magnetisation from microscopic view point, orbital magnetic dipole movement and angular momentum materials, diamagnetism, origin of permanent magnetic dipoles in material. paramagnetic spin systems.

4. Properties of ferromagnetic materials:

Spontaneous magnetisation and the curie-Weils Law. Ferromagnetic Domains and coercive force, antiferromagnetic and ferromagnetic materials. magnetic materials for electrical devices, introduction to permanent magnets.

Reference Books

1. Electrical Engineering materials by A.J. Dekker.
2. Electrical Engineering Materials by G.P. Chhalotra.
3. Electrical Engineering materials by S.P. Seth and P.V. Gupta.

5.7 MICROPROCESSORS LABORTOARY

List of experiments:

1. Familiarisation with the microprocessor kits.
2. Simple programs for sorting a list of numbers in ascending and descending order.
3. Program for addition of BCD number.
4. Interface an LED array & 7-segment display through 8255 and display a specified bit pattern or character sequence.
5. Generate different waveforms using a DAC.
6. Stepper motor Control using 8085.
7. Rolling display using 8279.
8. Interfacing of 8085 with ADC.
9. Using 8255 display devices.
10. Using DMA controllers, transfer the data from memory to the output LED.
11. Transmit the given data to the 8251 and retransmit it to the CPU and display on the screen.

5.8 POWER ELECTRONICS LABORTOARY

List of Experiments :

1. To study principle of operation of SCR, plot V-I characteristics and study the effect of gate triggering on turning on of SCR.
2. To draw V-I characteristics of an UJT and to use UJT as relaxation oscillator.
3. To study the effect of free-wheeling diode on power factor for single phase half-wave rectifier with R-L load.
4. To plot waveforms for output voltage and current, for single phase full-wave, fully controlled bridge rectifier, for resistive and resistive cum inductive loads.
5. Study of the microprocessor based firing control of a bridge converter.
6. To study three phase fully controlled bridge converter and plot waveforms of output voltage, for different firing angles.
7. Study of Jones chopper or any chopper circuit to check the performance.
8. Thyristorised speed control of a D.C. Motor.
9. Speed Control of induction motor using thyristors.
10. Study of series inverter circuit and to check its performance.
11. Study of a single-phase cycloconverter.
12. To check the performance of a Mc Murray half-bridge inverter.

5.9 CONTROL SYSTEMS USING MATLAB

To perform exercises related to the following using Control System Toolbox by writing computer programs and functions in MATLAB:

- Time and Frequency response of control systems
- Plotting of Bode, Nyquist and Root Loci diagrams.
- Design of Control Systems using MATLAB and SIMULINK

F.SIXTH SEMESTER

6.1 SYNCHRONOUS MACHINES

1. **GENERAL ASPECTS**

Construction & working principle of synchronous machines, Excitation systems, production of sinusoidal E.M.F., flux & mmf phasors in syn. machines; cylindrical & salient pole rotors.

2. WINDINGS

Classification of windings, pitch factor, distribution factor. E.M.F. equation.

3. ALTERNATORS

Construction, Phasor diagram of cylindrical rotor alternator, ratings, nature of armature reaction, determination of synchronous reactance; open circuit characteristics, short ckt characterstics, shortcut ratio, short ckt. loss. Effect of variation of power factor on voltage. Determination of voltage regulation: EMF method, M.M.F. method. Z.P.F. method. Alternator on infinite bus bar, operating characteristics, operation at constant load and variable excitation, power flow through inductive impedance.Power-angle characteristics of syn. machines:- cylindrical & salient pole. Two reaction theory of salient pole machines, power factor control.

4. SYNCHRONOUS MOTORS

Operating characteristics, power-angle characteristics, conditions for maximum power developed .V-curves and inverted V-curves, methods of starting, synchronous motors applications, synchronous condensers.

5. PARALLEL OPERATION OF ALTERNATORS

Conditions for proper synchronizing for single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing. Hunting and damper windings.

6. TRANSIENTS

Transients Analysis, transient reactances & time constants from equivalent circuits, synchronous machine reactances & their determination,Short ckt. Oscillogram, Synchronisation with the grid system, Qualitative introduction to the transient stability of the synchronous machines.

7. SINGLE PHASE SYNCHRONOUS MOTORS Reluctance & Hysteresis motors.

Reference Books

1. Electric machines Fitzgerald & Kingsley (Mc Graw Hill)
2. Electric machinery and transformer M.Kosow. (PHI)
3. Theory of alternating current machines A.S. Langsdorf
4. Electrical machines Nagrath & Kothari (TMH)
5. Performance,design and testing of A.C. machines MG Say (CBS,Delhi)

6.2 ELECTRIC DRIVES AND UTILIZATION

1**. Electric Drives:**

Basic features of industrial drives, review of operating and starting characteristics of different types of electric motors for various drives. Estimation of rating, Load equalization (Fly wheel effect), Drives for particular services.

2. Electric Traction:

Various types of Traction system, 25KV, 50Hz, single phase feeding arrangement prevalent in India.Substation. arrangements, Different Types of Catenary construction and line insulation, Span and dropper design Calculations.

3. **Electric Heating and Welding:**

Methods of electric heating, constructional details & performance of resistance heating furnace. Dielectric heating, A.C.& D.C. Welding, Resistance and Arc Welding. Electric Beam Welding ,Laser Welding.

4**. Illumination:**

Production of light by different methods, terms used, laws of illumination, Different Artificial light sources, their construction and operating principles, Design of lighting schemes and equipment used for indoor, industrial and flood lighting.

5. Refrigeration and Air conditioning:

Refrigeration system, Domestic refrigeration, Air conditioner, Comfort Air conditioning, Effective temperature.

6. Electrolysis:

Laws of Electrolysis, Process voltage, current, energy, efficiency, Applications of electrolysis.

Reference Books:

1. Electric Traction H.Partab
2. Electric Drives & Utilization H. Partab
3. Electric Drives De &Sen(PHI publication)
4.. Electric Motor Drives M.S.Berde(Khanna Publishers)
5. Utilization of Electric Power J.B. Gupta(S.K.Kataria &Sons)
6. Electric Energy Utilization Tripathi(Tata Mc Graw. Hill) & Conservation
7. Electric Energy Utilization E.O.Taylor

6.3 POWER SYSTEM-II(Switchgear & Protection)

1. **Sub-Station:**

Types, Main equipment in Substation, substation layout, Busbar- arrangements.

2. Isolators & Fuses:

Isolating switches functions, Types, Rating and operation. Fuse-types, Rating, Selection, theory and characteristics, applications.

3. Circuit Breakers:

Need for Circuit Breakers, Arc phenomenon, Theory of Arc Interruption, Recovery Voltage and Restriking Voltage, Various Types of Circuit Breakers. Principles and Constructional Details of Air Blast, Minimum Oil, SF6, Vacuum Circuit Breakers etc.

4. Protective Relays:

Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction, Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negative sequence relay, introduction to static and up-based relays.

5. Protection of Feeders:

Time graded protection, Differential and Distance protection of feeders, choice between Impedance, Reactance and Mho relays, Elementary idea about carrier current protection of lines.

6. Protection of Generators & Transformers:

Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss of excitation and overload protection. Types of fault on transformers, percentage differential protection, Gas relays.

7. Protection against over voltage and earthing:

Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/Surge Absorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.

Reference Books

1) Switchgear and Protection Sunil S. Rao (Khanna Publishers)
2) Power System Engg. Soni Gupta & Bhatnager (Dhanpat Rai&Sons)
3) A Course in Electrical Power C.L.Wadhawa (New Age international Pvt. Ltd)
4) Power system Protection & Switchgear Badriram & D.V.Vishwakarma (TMH)
5) Switchgears & Protection M.V. Deshpande (THM)

6.4 POWER PLANT ENGINEERING

Steam Generators, Condensers and Turbines:

Classification of steam generators, selection, operation of locomotive, Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbine efficiencies, compounding, governing and control.

Steam Power Plant:

Classification, Operation, Description of Rankine cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, Selection of plant site and its layout, coal handling system, combustion system, Fluidised bed combustion, Ash handling, Feed pumps, Heat exchangers, Economizers, Super heaters, Reheaters, Air preheaters, Feed water heaters, Evaporators.

Hydro-Electric Power Plants:

Hydrological Cycle, Hydrograph, Flow duration curve, Selection of site, Essential features, Classificatioon of hydro plants, Selection of water turbines for hydro power plant, Automatic and remote control of hydrostation, layout of hydro power plant.

Nuclear power plants:

Nuclear physics, Binding energry,Radio active decay.Fertile material,Mass defect,Nuclear reactions type and appilication,Genration of nuclear energry by fission, Nuclear reaactors. Site selections, safety measures, plant layout,Fusion reaction,Future of nuclear power.

Gas Turbine:

Elements of gas turbines, Open and closed cycles for gas turbines, Performance terms, Thermal refinement to gas turbines cycle, Plant layout, applications, gas turbines Cycle calculations.

Diesel Power Plants:

Classifications of IC Engines and their performance, Four stroke and two stroke diesel engines, combustion phenomenon; Essential components, Celane number, knocking, super charging, operation and layout of diesel power plant.

Combined Operation of Different Power Plants:

Advantages of combined operation of plants, load division between power stations, coordination of different types of Power Plants.

Pollution Control:

Pollution from thermal & nuclear plants, Particulate emission and control, electrostatic precipitator, solid waste disposal.

Reference Books:

1. A course in Electrical Power Soni,Gupta & Bhatanagar (Dhanpat Rai & Sons)
2. Power Plant Engineering P.C. Sharma (Kataria & Sons)
3. Power Station Engineering and Economy B.G.A. Skrotzki & W. A Vapot (TMH)
4. Power Plant Engineering R.K. Rajput (Luxmi Publications)
5. Power Plant Engineering M.M. EI Wakit (Mc Graw Hill, USA)

6.5 ELECTIVE 1

1. Entrepreneurship

CONCEPT OF ENTREPRENEURSHIP: Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality, characteristics of entrepreneurship.

IDENTIFICATION OF INVESTMENT OPPORTUNITIES:

Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, monopolies and restrictive trade practices act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start a SSI, list of items reserved for SSI. Scouting for project ideas, preliminary screening, project identification for an existing company.

MARKET AND DEMAND ANALYSIS: Information required for market and demand analysis, market survey, demand forecasting, uncertainties in demand forecasting.

TECHNICAL ANALYSIS: Materials and inputs,production technology,product mix, plant capacity, location and site, machinery and equipment, structures and civil works, need for considering alternatives.

COST OF PROJECT AND MEANS OF FINANCING:

Cost of project, means of financing, planning the capital structure of a new company, term loan, financial institutions, cost of production.

FINANCIAL MANAGEMENT:

Concept and definition of financial management, types of capital, source of finance, reserves and surplus, assets and liabilities, profit and loss statement, balance sheet, depreciation, methods of calculating depreciation, break-even analysis and charts.

MARKETING MANAGEMENT:

Marketing mix, strategies; product, place, price and promotion (four p's), market segmentation, product policies; types of product, product mix, packaging, branding, promotion; advertising, advertising media, personal selling, sales promotion, distribution channels.

COMPANY LAWS:

The basic principles of company laws, formation of company, choice of name, memorandum of association, articles of associations, registration and incorporation, alteration of object clause, situation clause, name clause and articles, kinds of companies, board meetings, power of board and delegation of powers, general meetings; postponement and adjournment and quorum for general meetings, revocation of proxy, kinds of general meetings.

Reference Books:

1. Entrepreneurship of Small Scale Industries Deshpande, M.D.
2. Marketing Management Kotler Philip
3. Dynamics of Industrial Entrepreneurship Hadimoni, R.N

2. SOFTWARE ENGINEERING

COURSE CONTENTS

Software Engineering Principles: How is software engineering an engineering discipline, Information system characteristics, software development process models, life cycle concepts, software phases and deliverables, software development strategies. [15 %]

Technical Development: Structured systems analysis and design requirements collection and specification, data flow and logical data modeling, cost benefit analysis, feasibility study, architectural and detailed design, process, data, network, control and user interface designs, physical data design, dynamic modeling for real-time systems. [15 %]

Software Project Management: principles of software project management organizational and team structure, project planning, project initiation and project termination; technical, quality and management plans, project controls, cost estimation methods-function points and COCOMO, tools. [15 %]

Software Quality Management: quality control, quality assurance, quality standards, software metrics, verification and validation, testing, quality plans, tools Configuration Management [15 %]

Software Development Method & CASE: formal, semi-formal and informal methods; data function, and event-based modeling, some of the popular methodologies such as Yourdon's
SAD, SSADM etc. CASE tools, CASE standards.[20 %]

Implementation: in 3GL environment, in 4GL environment, in client-server environments, coding styles. [20 %] Documentation, Software Maintenance [5 %]

TEXT BOOKS:

1) Pressman R. S., Software Engineering: A practitioner's Approach, Third Edition McGraw Hill, New York, 1987.
2) Jalota, Software Engineering.
3) Sommerville I., Software Engineering, Fourth Edition, Addison - Wesley Pub. Co., 1992.

REFERENCES Books:

1) Ghezzi C., Jazayeri M. And Mandrioli D.: Fundamentals of Software Engineering,
Prentice Hall, N. J. 1991
2) Pfleedger S. L., Software Engineering: The Production of Quality software, Second
Edition, Macmillan Publishing Company, 1991.
3) Oehm B. W., A Spiral Model of Software Development and Enhancement, IEEE Computer, 21.pp 61-72, May 1988.
4) Fairley R., Software Engineering Concepts, McGraw Hill, New York, 1985.

3. ESTIMATING AND COSTING OF ELECTRICAL INSTALLATIONS

Drawing and IE rules

- Classification of Electrical Installation
- General requirement of Electrical Installation
- Reading and Interpretation of Electrical Engineering Drawing
    - Various diagrams, plans and layout
    - Important definitions related to Installation
- IE rules related to Electrical Installtion & Testing

Service Connection

- Concept of service connection
- Types of service connection & their features
- Methods of Installtion of service connection
- Estimates of underground & overhead service connection

Residential Building Electrification

- General rules guidelines for wiring Residential Installation and positioning of equipment
- Principles of circuit design in lighting and power circuits
- Procedures for designing the circuits and deciding the number of circuits
- Method of drawing single line diagram
- Selection of types of wiring and rating of wires & cables
- Load calculations and selections of size of conductor
- Selection of rating of main switch, distribution board protective switchgear ELCB and MCB and wiring accessories
- Earthing of Residential Installation
- Sequence to be followed for preparing Estimate
- Preparation of detailed estimates and costing of Residential Installation

Electrification of commercial Installation

- Concept of commercial Installation
- Differentiate between electrification of Residential and commercial Installation
- Fundamental consideration for planning of an electrical Instalation system for commercial building
- Design consideration of electrical Instllation system for commercial building
- Load calculation & selection of size of service connection and nature of supply
- Deciding the size of cables, busbar and busbar chambers
- Mounting arrangements and positioning of switchboards, distribution boards main switch etc.

Topics

- Earthing of the electrical Installation
- Selection of types wire, wiring system & Layout
- Sequence to be followed to prepare estimate
- Preparation of detailed estimate and costing of commercial Installation.

Electrification of factory unit Installation

- Concept of Industrial load
- Concept of Motor wiring circuit and single line diagram
- Important guidelines about power wiring and Motor wiring
- Design consideration of Electrical Installation in small Industry / Factory/ workshop
- Motor current calculations
- Selection and rating of wire, cable size & conduct
- Deciding fuse rating, starter, distribution boards main switch etc
- Deciding the cable route, determination of length of wire, cable, conduct, earth wire and earthing
- Sequence to be followed to prepare estimate
- Preparation of detailed estimate and costing of small factory unit/ workshop

Testing of Installation

Testing of wiring Installation for verification of current; earthing, insulation resistance and continuity as per IS

Contracts , Tenders and Execution

- Concepts of contracts and Tendors
- Contracts, types of contracts, contractors
- Valid contracts, contract document
- Tender and tender notices
- Procedure for submission and opening tendors
- Comparative statements, criteria for selecting contractors, General condition in order form.
- Principles of Execution of works
- Administrative approval, Technical sanctions
- Billing of executed work

Problems on estimation and costing:

- Electrical Installation scheme flat, independent bungalow and small house. Draw wiring diagram and prepare detailed estimate and its costing
- Electrical Installtion scheme for commercial building. Draw wiring diagram and prepare detailed estimate and its costing
- Electrical Installation scheme for small factory unit. Draw single line layout and prepare detailed estimate and its costing.

Reference Books:

Author	**Title**	**Publishers & Address**
1. K.B. Raina S.K. Bhattacharya	Electrical Design; Estimating and costing	New Age International Ltd NewDelhi
2. Surjit Singh	Electrical Estimating and costing	Dhanpat Rai & Co.NewDelhi
3. N.Alagappan S.Ekambaram	Electrical Estimating and costing	Tata McGraw Hill Publication NewDelhi
4. S.L. Uappal	Electrical wiring Estimating & Costing	Khanna Publication

4. MAINTENANCE MANAGEMENT AND TESTING

1.**Introduction:** Objective and characteristics of maintenance function; Organization of the maintenance system; Operating practices in maintenance. Maintenance record keeping.
2. **Cost Aspect of Maintenance:** Costs of machine breakdown; estimation of life cycle costs; Application of work measurement in maintenance; Manpower planning and training, Incentive payments for maintenance
3. **Planning of Maintenance Activities**: Evaluation of alternative maintenance policies breakdown, preventive and predictive maintenance; fault diagnosis and condition monitoring techniques; simulation of alternative practices; Development of preventive maintenance schedule; House keeping practices; total productive maintenance
4. **Maintenance Engineering:** Maintenance requirements of mechanical, electrical, process and service equipment; Safety aspect in maintenance; Aspect of lubrication; chemical control of corrosion; Computerized maintenance information systems 5. Reliability concept and definition, configuration of failure data, various terms used in failure data analysis in mathematical forms, component and system failures, ;uses of reliability concepts in design and maintenance of different system.
5. **safety and prevention of Accidents:**
Definition of terminology used in safety; safety, hazard, accident, major accident hazard, responsibility , authority, accountability, monitoring, I.E act and statutory regulations for safety of persons and equipment working with electrical installation,Dos and Don'ts for substation operators as listed in IS Meaning and causes of electrical accidents factors on which severity of shock depends. Procedure for rescuing the person who received an electric shock, methods of providing artificial respiration, precautions to be taken to avoid fire due to electrical reasons operation of fire extinguishers.

4.10 Testing-Basic

Objectives of testing significance of ISS concepts of tolerance, routine tests, types tests, special tests. Methods of testing (a) Direct (b) Indirect (c) Regenerative. Concept of routine, preventive and breakdown for developing preventive maintenance schedule. Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.

4.11 Testing and Maintenance of rotating machines

Types tests, routine and special tests of 1 & 3 phase induction motors, Routine, preventive and breakdown maintenance of 1 & 3 phase induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators and synchronous machines as per IS 4884-1968 Brake test on DC series motor.

Reference Books:

Author	Title	Publishers
1. B.L. Theraja	Electrical Technology Vol I to IV	S.Chand & Co. New Delhi
2. B.V.S.Rao	Operation & Maintance of Electrical Machines Vol-I	Medis Promoters & Publisher Ltd Mumbai
3. B.V.S.Rao	Operation & Maintance of Electrical Machines Vol-II	Medis Promoters & Publisher Ltd Mumbai
4. C.J. Hubert	Preventive Maintenance Hand Books & Journals	_____

6.6 FUZZY LOGICS AND SYSTEMS

Introduction: Grip sets and fuzzy sets, properties of x-cuts, Representation of Fuzzy sets.
Operations on Fuzzy sets: Types of operations, Fuzzy complements, intersections and unions.
Fuzzy Arithmetic: Grip versus Fuzzy Relations, binary fuzzy relations, Fuzzy Equivalence. Compatibility and ordering relations, Fuzzy Morphisms, Fuzzy relation Equations and Approximate solutions.
Fuzzy Logic: Multi-valued Logics, Fuzzy propositions, Fuzzy Quantifier, Linguistic Hedges.
Fuzzy Systems: Controllers: An overview and example, Fuzzy dynamic systems, Pattern Recognition, Fuzzy data bases and information, Retrieval Systems.

Reference Books:

1. Fuzzy Sets and Fuzzy Logic : Theory and Applications by G. J. Klir and B. Yuan, PHI.
2. Fuzzy Logic with Engineering Applications, Timothy Ross(Mc-Graw Hill)

6.7 ELECTRICAL MACHINES II LABORTOARY

List of experiments:

1. To Perform load-test on 3 ph. Induction motor & to plot torque V/S speed characteristics.

2. To Perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. Parameters & to draw circle diagram.

3. To study the speed control of 3 ph. Induction motor by Kramer's Concept.

4. To study the speed control of 3 ph. Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.

5. To study star- delta starters physically and
   (a) to draw electrical connection diagram
   (b) to start the 3 ph. Induction motor using it.
   (c) To reverse the direction of 3 ph. I.M.

6. To start a 3 phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And to plot torque –speed characteristics.

7. To perform no-load & blocked –rotor test on 1 ph. Induction motor & to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.

8. To Perform load –test on 1 ph. Induction motor & plot torque –speed characteristics.

9. To Perform no load & short ckt. Test on 3- phase alternator and draw open ckt. And short ckt. Characteristics.

10. To find voltage regulation of an alternator by zero power factor (z.p.f.) method.

11. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw V & inverted V curves of motor.

5. To measure negative sequence & zero sequence reactance of Syn. Machines.

6.8 SOFTWARE LABORTOARY(VISUAL BASIC PROGRAMMING)

Overview of Integrated Development Environment and its elements – menu bar, tool bars, project explorer, tool box , properties of windows , form designer, form layout etc. The Visual Basic language and its elements, variables, constants, arrays, collections, subroutines, functions, arguments and control structures . Designing a VB application:- Working with Visual Basic forms, adding , deleting & managing forms at run time, coding event procedures , menu designing ,adding menu interface to forms, attaching events to code ,dynamic menu appearance. Students are to develop some projects related to Electrical Engineering .

Books:-

1. Visual Basic 6 Programming Black Book, Dream tech Publication by Steven Holzner.

Note:-Only Practical Exam. is to be conducted. No theory exam. is to be conducted.

6.9 POWER SYSTEMS- II LABORTOARY

List of experiments:

1. To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (HRC or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when
   (a) Fed at one end.
   (b). Fed at both ends
8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

6.10 MINOR PROJECT

Electrical estimation and costing of electrical installations in domestic, commercial and industrial sector: Installation plans, single line representation, wiring diagrams, list of materials required with specifications, Protective devices and earthing practices. Estimation and costing for installation / erection of a typical transmission line.

G. SEVENTH/ EIGHTH SEMESTER

8.1 COMPUTER AIDED POWER SYSTEM ANALYSIS

1. SYSTEM MODELLING:

System modelling of synchronous machines, transformers, loads etc, per unit impedance, single line diagram of electrical networks, single phase impedance diagrams corresponding to single line diagram. Formation of impedance and admittance matrices for the electrical networks.

2. LOAD FLOW STUDIES:

Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutions by the Gauss-Seidal Method & by Newton Raphson Method.

3. FAULT ANALYSIS:

Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers, Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequence networks of power systems. Symmetrical Analysis of Unsymmetrical LG, LL, LLG faults using symmetrical components.

4. POWER SYSTEM STABILITY:

Steady state stability, Dynamics of a synchronous machine , Power angle equations , Transient stability, equal area criterion, Numerical solution of swing equation , factors effecting transient stability.

Text Books :

1. Electric Energy Systems Theory O.I.Elgerd, TMH
2. Modern Power System Analysis I.J.Nagrath,D.P. Kolthari, TMH
3. Elements of Power System Analysis W.D.Stevenson, McGraw Hill
4. Power System Engineering I.J.Nagrath,D.P.Kothari.
5. Computer Aided Power System J.Arrillaga and C.P.Arnold.
6. Computer Aided Power System Analysis Glenn W.Stagg. & Elabiad
7. Computer Aided Power System Analysis Kusic.

8.2 ELECTRIC GENERATION

1. Introduction:

Electrical energy sources, organization of power sector in India, single line diagram of thermal, hydro and nuclear power stations.

2. Loads and Load curves:

Maximum demand, Group diversity factor, Peak diversity factor, Types of load, chronological load curves, load-duration Curve, mass curves, load factor, capacity factor, utilization factor, base load and peak load plants, load forecasting.

3. Power Plant Economics:

Capital cost of plants, annual fixed cost, operating costs and effect of load factor on cost of energy, depreciation.

4. Tariffs and power factor improvement:

Objectives of tariff making, different types of tariff for domestic, commercial, agricultural and industrial loads. Need for p.f. improvement, p.f. improvement using capacitors, determination of economic p.f.

5. Selection of plant:

Plant location, plant size, no. and size of units in plants, economic comparison of alternatives , annual cost , rate of return, present worth and capitalized cost methods.

6. Economic operation of steam plants:

Methods of loading turbo-generators, input- output curve, heat rate, incremental cost , method of lagrangian multiplier, effect of transmission losses, co ordination equations, iterative procedure to solve co-ordination equations.

7. Hydro-thermal co-ordination:

Advantages , combined working of run off river plant and steam plant , reservoir hydro plants and thermal plants-long term operational aspects, scheduling methods.

8. Pollution and environmental problems:

Energy and environment, Air pollution, Aquatic impacts,nuclear plant and hydro plant impacts.

9. Cogeneration:

Definition and scope, Topping and Bottoming Cycles, Benefits, cogeneration technologies.

Text Books:

1. Generation of Electric Energy B.R. Gupta, S.Chand Publishers
2. Power Plant Engineering Dom Kundwar.
3. Power Plant Engineering R. K. Rajput.
4. Power System Engineering A. Chakrabarti, M. L. Soni, P. V.Gupta, U.S. Bhatnagar.

8.3 NON LINEAR AND DIGITAL CONTROL SYSTEMS

STATE VARIABLE TECHNIQUES :
State variable representation of systems by various methods, solution of state variable model. Controllability and observability.

PHASE PLANE ANALYSIS:
Singular points, Method of isoclines, delta method , phase portrait of second order nonlinear systems, limit cycle.

DESCRIBING FUNCTION ANALYSIS :
Definition, limitations, use of describing function for stability analysis, describing function of ideal relay, relay with hystersis, dead zone, saturation, coulomb friction and backlash.

LYAPUNOV'S STABILITY METHOD :
Lyapunov's direct method, generation of Lyapunov's function by Krasovskii's and Variable Gradient methods

SAMPLED DATA SYSTEMS:
Sampling process, mathematical analysis of sampling process, application of Laplace transform. Reconstruction of sampled signal, zero order, first order hold.
Z-transform definition, evaluation of Z-transform, inverse Z-transform, pulse transfer function, limitations of Z-transform, State variable formulation of discrete time systems, solution of discrete time state equations. Stability definition, Jury's test of stability, extension of Routh-Hurwitz criterion to discrete time systems.

Text Books :

1 Modern control engineering. K.Ogata
2. Control system engineering I.J. Nagrath, M.Gopal
3. Modern control principles and application J.C.Hsu and A.U.Meyer
4. Digital Control and State Variable Methods M. Gopal
5. Automatic Control System. B.C.KUO

8.4 ELECTIVE II

1. BIOMEDICAL ENGINEERING

Transducers: Strain gauge for respiratory flow transducer, piezo resistive transducer for intracardiac catheter, thermistor as temperature sensing elements - its characteristics and compensation for non-linearity.

Piezoelectric transducer: its equivalent circuits and impedance frequency characteristics. Its applications as intra cardiac microphone, heart assist device and ultrasonic instruments. Variable inductance transducer, different configuration and application for measurement of muscular tremor. LVDT and its signal processing circuitry. Magnetostrictive and variable capacitance transducers, stretched diaphragm transducer and its characteristics.

Measurement and recording of bioelectric signals:

ECG,EMG,EEG and other instruments for picking up and reproducing bioelectric signals, specific design characteristics, sources of noise and its removal.

Measurement and recording of non-electric signal:

Measurement and recording of pressure, temperature, respiration rate, pulse rate and blood flow. Electromagnetic blood flow meter, thermography, ph measurements, gas analysis, ESR measurement, plethysmograph, X-Ray, tonometer and dialysis. Ultrasonics and echoencephalography radiography imaging isotopes and nuclear medicine.

Equipment for effecting the human body:

Stimulator, defibrillator, pacemaker, diathermy.

Prosthetics: Upper and lower extremity prostheses, harness control, EMG-controlled externally powered prosthesis, basic concept of monofunctional and multifunctional devices.

Biotelemetry: Radio-telemetry of biological signal, signal source, antenna and frequency design considerations, example of single channel FM units.

Text Books:

1. Biomedical Instruments, theory and design. Walter Welkowitz and Sid Deutch.
Academic press 1976.
2. An Introduction to Medical Electronics S.K.Guha, Bharti Publishers, Patna.
3. Handbook of Boimedical Instrumentation and Measurement Harry E. Thomas, Reston
Publishing Company, 1974.
4. Biomedical Instrumentation Marvin D. Weisis, Chilton Book Company, 1973.
5. Principles of Applied Medical Instrumentation L.A. Geddes, L.E. Barker.
John Willey and Sons, 1968.

2 DATA COMMUNICATIONS

I) INTRODUCTION:

Basic Concepts of analog and digital signals, data transmission concepts, Analog and digital transmission, transmission impairments.

II) TRANSMISSION MEDIA:

Guided and Un-guided media, Performance, Shannon Capacity, Media Computerisation.

III) ENCODING AND MODULATING:

Digital –to-Digital conversion, Analog and digital conversion, Digital to Analog conversion , Analog to Analog conversion.

IV) DIGITAL DATA COMMUNICATION:

Digital data transmission , DTE-DCE Interface, EIA-449,EIA-530,X.21, Modems, Cable Modems.

V) MULTIPLEXING AND SWITCHING:

FDM, WDM,TD, Multiplexing application- telephone systems, DSL, Par Circuit switching , Packet Switching & Message switching virtual circuits.

VI) SPREAD SPECTRUM:

Concept ,Frequency hoping spread spectrum ,direct sequence spread spectrum, codedivision Multiple Access.

VII) ERROR DETECTION AND CORRECTION :

Types of Errors ,Detection ,VRC,LRC,CRC, Checksum, Error Correction.

VIII) PROTOCOL ARCHITECTURE:

Protocols, Standards,…….OSI,TCP/IP Protocol Architecture.

Text Books:

1. “Data Communications and Networking”–Behrouz A Ferouzan- 2nd Edition, TATA McGraw Hill.
2. “Data and Computer Communication” – William Stallings 7th Edition Pearson Eduction.

References Books:

1. “Data Communication and Distributed Networks”- Ulylers D Balck- 3rd Edition PHI.
2.“Computer Networks” – Andrew S. Teanebaum, PHI.

3.**NON – CONVENTIONAL ENERGY SOURCES**

INTRODUCTION: Limitation of conventional energy sources, need and growth of alternative energy source, basic scheme and application of direct energy conservation.

MHD GENERATORS: Basic principles, gaseous, conduction and hall effect, generator and motor effect, different types of MHD generator, types of MHD material, conversion
effectiveness, analysis of constant area MHD generator, practical MHD generator, application and economic aspects.

THERMO-ELECTRIC GENERATORS: Thermoelectric effects, Seeback effect, Peltier effect, Thomson effect, thermoelectric converters, figures of merit, properties of thermoelectric material, brief description of the construction of thermoelectric generators, application and economic aspect.

PHOTO VOLTAIC EFFECT AND SOLAR ENERGY: Photovoltaic effect, different
types of photovoltaic cells, cell fabrication, characteristics of photovoltaic cells, conversion efficiency, solar batteries, application, solar radiation analysis, solar energy in India, solar collectors, solar furnaces and applications.

FUEL CELLS: Principle of action, Gibb's free energy, general description of fuel cells,
types, construction, operational characteristics and application.

MISCELLANEOUS SOURCES: Geothermal system, characteristic of geothermal resources, choice of generator set, electric equipment precautions low hydro-plants, definition of low head hydrometer, choice of site, choice of turbine wind power, history of wind power, wind machines, theory of wind power, characteristic of suitable wind power site, tidal energy, idea of tidal energy, tidal electric generator.

Text Books:

1.Non convential Energy Sources G. D. Rai, Khanna Publishers.
2.Power System Engineering A Chakrabarti, M. L. Soni, P. V. Gupta and U. S.
3.Bhatnagar, Dhanpat Rai & Co.
4. Generation of Electrical Energy B. R. Gupta, S. Chand.

4. **EXTRA HIGH VOLTAGE ENGINEERING**

E.H.V. Transmission and Corona Loss:

Need for EHV Transmission. Use of bundled conductors, corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss. Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.

HVDC Transmission:

Advantages, disadvantages and economics of HVDC Transmission system. Types of D.C. links, converter station equipment, their characteristics.

Insulating materials used in H..V. Engg.:

Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.

Conduction and breakdown in Gases, Liquids & Solid Dielectrics:

Solids - Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice.

Liquids:- Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice.

Gases:- Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases. Gases used in practice.

Generation of High Voltages:

D.C., A.C. (Power frequency and High frequency) Impulse voltage and impulse current Generation Tripping and contact of Impulse Generator.

Test procedures in H.V. Engg. Lab.

Testing of cables, insulators, bushings, circuit breakers and transformers.

References Books:

1. E.H.V. A.C. Transmission Engg. By Rakesh Das Bagamudre, New Age International Publishers.
2. HVDC Transmission by Kimbark.
3. H.V. Engg. By Kamaraju and Naidu.
4. H.V. Engg. By R.S. Jha.
5. H.V. Engg, by Kuffel & Abdullah.
6. H. V. Engg. by C. L. Wadhwa.

5.**DATABASE MANAGEMENT SYSTEM**

Part1 Basic Concepts

Databases And Database Users: -

Introduction, Characteristics of Database Approach, Advantages And isadvantages of Using DBMS.

Database System Concepts And Architecture:-

Data Models, Schemas And Instances, DBMS Architecture And Data Independence, Database Language And Interfaces, Classification of Database Management Systems. (L-3)

Data Modeling Using The Entity Relationship Model:-

Entity Types, Entity Sets, Attributes And Keys, Relationships, Relationship Types, Roles, And Structural Constrains, Weak Entity Types, ER Diagrams, Naming Conventions And Design Issues. (L-4)

Part – 2 Relational Model, Language And Systems

The Relational Data Model, Relational Constrains, The Relational Algebra and Relational Calculus:-

Relational Model Concepts, Relational Constraints And Relational Database Schema, Update Operations And Dealing With Constraint Violations, Basic Relational Algebra Operations, Example of Queries in Relational Algebra, The Tupple Relational Calculus, The Domain Relational Calculus. (L-6)

SQL Relational Database Standard:-

Basic queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Views in SQL, Additional Features of SQL. (L-6)

Part – 3 Database Design Theory and Methodology

Functional Dependencies and Normalization for elational Databases:-

Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms. (L-4)

Part – 4 System Implementation Techniques Transaction Processing Concepts:-

Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Schedules and Recoverability, Serializability of Schedules. (L-3)

Concurrency Control Techniques:-

Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering, Validation Concurrency Control Techniques, Granularity of Data Items and Multiple Granularity Locking.(L-3)

Database Recovery Techniques:-

Recovery Concepts, Recovery Techniques Based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging (L-4)

Database Security and Authorization:-

Introduction to Database Security Issues, Discretionary Access Control Based on Granting/Revoking of Privileges, Introduction to Statistical Database Security. (L-3)

Text Books :

1. Fundamentals of Database Systems, Third Edition, by Elmasri/Navathe
2. Korth and Silberschatz Abraham, Database Concepts, McGraw Hall,1991
3. An introduction to Database Systems by C.J.Date.

References Books:

1. An introduction to Database Systems by Bipin C. Desai.
2. SQL,PL/SQL ,The programming language of oracle, Ivan Bayross BPB Publication

8.5 ELECTRICAL MACHINE DESIGN

GENERAL: ISI specifications for conductors, Transformer, transformer oil and induction motors. Standard specifications for rotating electrical machinery as perIEC publications. Temperature Rise Calculations and Measurement Sources and position of heat generation, Solid body heating, Heating and cooling processes. Calculation of steady temperature rise of induction motor armature and transformer core. Machine ratings based on thermal considerations. Typical temperature gradients in transformers and three phase induction motors. Methods of measuring temperature in Electrical machines.

Ventilation :

Methods of cooling transformer. design of tank. Types of ventilation methods of cooling 3-phase induction motors, cooling circuits and type of enclosures. Quantity of cooling medium, Air, Hydrogen, water and Oil.

Magnetic Circuits:

Magnetic circuits of transformers and three phase induction motor. Specific slotpermeance and slot leakage reactance of a three phase induction motor leakage reactance of cylindrical coils and equal length and sandwich coils of equal width in a transformer. Variation in magnetic losses with changes with changes in supply voltage frequency of a transformer.

Electric Circuits:

Types of low voltage and high voltage winding transformer. Calculation of
resultant mechanical forces in transformer under normal and abnormal
conditions. Characteristics of armature windings. Types of windings used for induction motors, winding factors.

Transformers:

Design of single phase and three phase core type poser and distribution transformers, single phase shell type transformer, Magnetic and electric circuit,leakage reactance, regulation, no load current, cooling system, overall
dimensions and weight. Recent advances in design of transformer.

Induction Motors:

Design of squirrel cage and wound rotor type of three phase induction motors. Stator and its winding, slot and its insulation, squirrel cage and slip ring rotors, no load current, short circuit current, efficiency, circle diagram, Stator temperature rise, weight. Recent advances in the design of induction motors.

Reference Books:

1. A Course in Electrical Machine Design A. K. Sawhney, Dhanpat Rai.
2. Principles of Electrical Machine Design, R. K. Aggarwal, S. K. Kataria & Sons.

8.6 CAPSA LABORTOARY

List of experiments:

1. Developing a Single line Diagram of a Power System Using Computer Software.
2. Developing Algorithms/Flowcharts/Computer programmes for:

I. Load Flow Studies using
  (a) Gauss Siedel Method
  (b) Newton Raphson's Method
  (c) Fast Decoupled Method
II. Short Circuit Studies for
  (a) Symmetrical Faults
  (b) Line to Ground Fault
  (c) Line to Line Faults etc.
III Swing Equation for transient Stability Studies
IV. Economic Load Dispatch.

8.7 POWER SYSTEMS DESIGN LABORTOARY

Students will complete design problems in the following topics:

1. Design of transmission systems for given power and distance.
2. Short circuit calculations and calculations of circuit breaker ratings for a power system network.
3. Design of substations
4. Design of distribution systems.

8.8 PROJECT WORK

Design, Fabrication, Simulation, Evaluation, Testing etc. of any Electrical equipment, system is to be carried out under the supervision of guide(s).

8.9 ELECTRICAL MACHINE DESIGN LABORTOARY

- Design of Transformer core, windings and calculations of performances.
- Calculations of main dimensions of Induction motors and design of stator windings and selection of slots. Design of (i) squirrel cage and slip-ring rotors.
- Design of lap and wave windings

5. SUGGESTIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

Curricula for degree programmes in engineering and technology have been designed by SSU Palampur faculty with close cooperation of SSE Badhani and Amritsar They have understood the systematic approach of curriculum development and implementation. While designing the curriculum they have taken in to account employment scenario, equivalence with PTU curriculum and experience of implementing existing curriculum.

Some of the suggestions for effective implementation of curriculum are:

1. Vision and mission of institute, Philosophy objective and outcome of curriculum of programmes should be understood by all teachers and students. These should be displayed in the Department so that expectation of all stake holders are clear to everyone.

2.Principal with Head of Departments should analyze the curriculum to find out the requirement of resources for its implementation and prepare an action plan for their availability in time. Institute should network with other organizations for sharing resources and adopt innovative approaches for managing whole courses.

3.HOD's and teachers are managers of whole programmes and subject teaching respectively. Their success in achieving objectives depends on preparing academic plan and its judicious execution.

4.Teachers should prepare rationale and objective of their respective subjects, structure of content, method and media and table of specification for evaluation. This should be given to student so that they are aware of the outcome of the course.

5.Set up a group of teachers and final year students for sharing experiences of curriculum implementation and suggest further improvement.

6.Teachers are required to plan as follows for carrying out teaching learning process effectively: -

(a) Prepare profile of students for knowing their background and strengths so as to facilitate them in fulfilling their dreams of jobs and life.

(b) Analyze programme and develop teaching plan.

(c) Plan for guided self study exercises for student and available learning resources like journals, web site, educational video programming etc in addition to visit to industries and organizing industrial training, arranging expert lecture by alumni and experts from industry/ field.

(d) The co-curricular activities like organizing different camp, social gathering study tour, hobby club etc may be used to develop generic skills like communication skills, task

Management, problems solving, managing self, stress Management, Time Management and collaborating with others etc.

1. A project bank may be developed by the concerned department of the university in consultation with industry, research and other relevant field organizations.

2. Student may be given practical assignment and project to develop practical skills. This will help them in developing creativity and confidence for their gainful employment, (wage and self).

3. (a). Teachers and students should be aware of objectives and outcomes of whole programme and the role played by each subjects in achieving them as part of the curriculum.

   (b). Identification of project and their details should be prepared by all teachers in consultation with students at the beginning of the year. The projects should relate to state of art technology and require use of theoretical and advance planning practical knowledge.

   ©. Self learning and learning beyond syllabus should be encouraged by including optional subjects with scope of learning.

   (d). Department should develop a feedback Mechnism for teaching performance and a reward system for doing excellence work.

   (e) Academic calendar should include remedial classes and additional make up test to help academically weaker students. Students involved in mentoring junior students should be should be rewarded, who are actively doing mentoring.

6. APPENDIX

A. STUDENT CENTERED ACTIVITIES

Student centered activity play an imported role in the development of students of independent learning and self confident among students. Consulting library and visit to market or industry for gathering search information. This information will be presented by students during seminars. Expert lectures by eminent person from technical education, industry, culture areas; and alumni of the institute will also be arranged. Students will also undertake activities like mentoring students poor in academics, community service in respect of technology transfer entrepreneurship development and environmental awareness for fulfilling the outcome of programme.

B. MAJOR PROJECT WORK

(Industry/field oriented-practice based)

As far as possible students shall be assigned live project problem with a view to:

1 Develop understanding regarding the size and scale of operation and nature of field work in which Students are going to plan their role after completing the programme of study.

2 Develop understanding of subject based knowledge given in the classroom in the control of its application at work place.

3 Provide first hand experience to develop confidence amongst the students to enable them to use and apply classroom based knowledge skills to solve practical problem of the world of work.

4 Develop social skills and abilities like interpersonal skills, communication skills, attitude and values.

For the fulfillment of above objective, SSU University will establish close linkages with 20-25 relevant organizations and provide such experience to students. It is necessary that each organization is visited well in advance by respective teachers and projects activities to be performed by students are well defined. Efforts should be made to identify actual field problems to be given as project work to the students. Project selected should be challenging. Such chosen projects assignment should be entrusted to students which are of professional value to industrial/field organization. Each teacher would supervise and guide 10-15 students.

. The placement of students for such a practical cum project work should match with the competency profile and interest of students. Students are to be assessed both by industry and engineering college faculty.

The suggested performance criterion is given below:

a)	Punctuality and regularity	10
b)	Initiative in learning/ working at site	10
c)	Level/processing of practical skills acquired	10
d)	Sense of responsibility	10
e)	Self expression/ communication skills	10
f)	Interpersonal skills	10
g)	Reports writing skills	20
h)	Viva voce	20

Note :The above is a guideline only. SSU palampur may devise its own criteria in consultation with industry.

C. ENTREPRENEURSHIP DEVELOPMENT CAMP AND SETTING SELF BUSINESS CLUB IN INSTITUTE

A large population of degree holders has to think of setting up their own enterprises or businesses due to lack of opportunities in organized sector. They have to be motivated and trained to search for new opportunities and avail these for becoming an entrepreneur. For this they must be acquainted with entrepreneurship development, scope of setting up self enterprise, existing business opportunities, financial support available and various aspects of managing business. In this context an entrepreneurship awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. Should be invited to deliver expert lectures. Successful entrepreneurs should also be invited to interact with the students. Students may be encouraged to read papers or give seminar during the camp, on entrepreneurship development related topics.

1. The camp is to be organized for two to three days at a stretch during fifth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

- Who is an entrepreneur?
- Need for entrepreneurship, entrepreneurial career and self employment.
- Scenario of development of small scale industries/service organization in India and other countries.
- Entrepreneurial history in India, Indian values and entrepreneurship.
- Consideration for product/business selection.
- Opportunities for business, seminar and industrial ventures.
- Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs).
- Managerial aspects of small business.
- Legal aspects of small business.

2. Assistance from District Industries Centers, Commercial banks, and state Financial Corporation's Small industries service Institutes, Research and developments laboratories and other financial and Development Corporation.

3.In order to arrange successful entrepreneurship awareness camp, a group of interested students for setting up their self business may be identified and given responsibility of undertaking the above .A follow up mechanisms should be evolved at the institute in order to enable student to set up and manage their enterprise. This group should regularly meet after a month to see the progress of their project and get inputs from mentors.

D. ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A degree holder must have knowledge of different types of pollution caused due to public, Industries and construction activities. So that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This can be done by organizing a camp at a stretch for 3-4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject. Students interested to contribute in improving ecology and environment of the institute or community through various projects, may be allotted marks out of 20 (a part of final year project)

1. Sources of pollution natural and manmade, their effects on living and non living organisms.
2. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods, methods of vermin composting.
3. Pollution of air-causes and effects of man, animal, vegetation and non living organisms.
4. Pollution of water causes, effects of domestic waste and industrial effluent on living and non-living organisms.
5. Legislation to control pollution and protect environment.
6. Recycling for taking advantage of waste and reducing pollution.

It is suggested that, at the institution level, a voluntary group be formed for taking care of ecological balance by undertaking waste management projects- which would result in additional revenue to the institute, besides presenting a more friendly environment.

E. INDUSTRIAL TRAINING

Industrial Training shall be accomplished through attachment with an industry/ service sector organization. Teachers in consultation with industry/ service sector will identify the problem/ project for students. A Group of students placed in city will be monitored by the faculty or expert appointed for the purpose. During the 6 month training, the students will be required to maintain a training diary which will be required to be duly authenticated by his supervisor in the industry.