Scheme of Teaching and Examination for

4 th Semester of 3 Years Diploma in Electrical Engg. and EEE

Duration of Semester   :   **14 Weeks**
Student Contact Hours   :   **36 Hrs**
Total Marks   :   **800**
 Effective from : 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Network Theory	ELE402	Theory	3			3	100	80	20	26	40
2.	Electrical Machine I	ELE403	Theory	3			3	100	80	20	26	40
3.	Microprocessor	ELE404	Theory	3			3	100	80	20	26	40
4.	Elect Estimation & Costing	ELE405	Theory	3			3	100	80	20	26	40
5.	Power System I	ELE406	Theory	3			3	100	80	20	26	40
6.	Network Lab	ELE407	Practical			2	4	50	80	20		40
7.	Machine I Lab	ELE408	Practical			2	4	50	40	10		20
8.	Digital & Microprocessor Lab	ELE409	Practical			2	4	50	40	10		20
9.	Electrical Workshop	ELE410	Sessional			4		100	60	40		50
10	Professional Practices II	401	Sessional			4		50	30	20		25
	Total Hours of Teaching per week :			**15**		**14**						

Total Marks :   Theory   :   Practical   :   Sessional   :
L   :   Lecture,   T   :   Tutorial   P   :   Practical

Note: 1. Period of Class hours should be of 1 hrs duration as per AICTE norms.

2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.

3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.

4. Board will depute examiner for Practical examination.

5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

ELECTRICAL MACHINE - I

L	*T*	*P*	**Curri. Ref. No.**
EL401			
4	*1*	*0*	

Total Contact Hours : 75	**Total Marks : 100**	**Theory :**
Theory : 60		*End Term Exam : 80*
Tutorial : 15		*I.A. : 20*

RATIONALE:

 Electrical machines are in wide use in industries and other services. In this course DC generator, DC motors, single phase transformer, auto transformer and three phase transformer is covered in details.

 AIM:

1. To acquire knowledge of construction, and control of the DC machines.

2. To acquire knowledge of performance of DC machines and transformers of all types.

CONTENTS:

1. D.C. GENERATORS   8 Hrs

> 1.1 Principles of operation

> 1.2 Constructional feature .

> 1.3 Armature winding, Back itch, Front pitch, Resultant pitch and commutator pitch.

> 1.4 Simple Lap and wave winding (problems on winding diagram)

> 1.5 Different types of D.C. Machines, Shunt, Series and Compound machines

> 1.6 Armature reaction in D.C. machine and Commutation.

> 1.7 Methods of improving commutation (Resistance and emf commutation)

> 1.8 Interpoles and compensating winding Characteristics of D.C.Generators and uses of different types of D.C. Generators. Concept of critical resistance, causes of failure of development of emf.

> 1.9 Losses and efficiency of D.C. Machines, condition for maximum efficiency.

> 1.10 Parallel operation of D.C. Generators.

2. D.C. MOTORS   8 Hrs

2.1 D.C. Motor principles

2.2 Signification of back emf in D.C. Motor

2.3 Voltage equation of Motor

2.4 Torque (equation of armature torque and shaft torque)

2.5 Performance characteristics of shunt, series and compound motors and their application.

2.6 Methods of starting shunt, series and compound Motors, study of starters (3-point, 4-point starters and Drum controller type, problems in starter.

2.7 Speed control of D.C. shunt motors

      2.7.1 Flux control Method

      2.7.2 Armature voltage (rheostatic) control method.

2.8 Ward Leonard method

2.9 Speed control of series motors — Flux control method and series parallel control method.

2.10 Efficiency of DC machine by brake test

2.11 Efficiency of DC machine by Swinburne's test.

2.12 Losses & efficiency and condition for maximum power.

3. SINGLE PHASE TRANSFORMER   10 Hrs

3.1 Working principles

3.2 Transformer construction — Arrangement of core & winding in different types of transformer - Brief ideas about transformer accessories such as conservator, tank, breather, explosion vent etc.

3.3 Types of cooling methods

3.4 Care and maintenance

3.5 EMF equation

3.6 Voltage transformation ratio

3.7 Transformer on no load and on load Phasor diagrams.

3.8 Equivalent resistance, reactance and impedance.

3.9 Phasor diagram of transformer with winding resistance and magnetic leakage

3.10 Equivalent circuit

3.11 Approximate & exact voltage drop of a Transformer

3.12 Regulation at various loads and power factor

3.13 Different types of losses in a Transformer

3 .14 Open circuit test

3.15 Short circuit test

3.16 Efficiency, efficiency at different loads and power factors, condition for maximum efficiency.

3.17 All day efficiency

3.18 Determination of load corresponding to maximum efficiency.

3.19 Parallel operation of single phase transformer.

3.20 Introduction to Autotransformer, its advantages and applications

4.   INTRODUCTION TO THREE—PHASE TRANSFORMER   4 Hrs

Construction, principle of operation, parallel operation, connections , applications

5.   Three Phase Induction Motor   12 Hrs

Production of rotating magnetic field, Construction of 3 Ph induction motor, principle of operation, concept of slip, equation of rotor induced emf, current, frequency, reactance, impedance under starting and running conditions, torque equation, starting and running torque of squarrel cage and slip ring induction motor, condition for maximum and starting torque, torque slip characteristics, speed control, applications double cage induction motor, construction, characteristics and application, induction motor as generalised transformer, eqvt circuit, starting method.

LIST OF EXPERIMENTS:

l. Study of different part, identification terminals and testing of insulation resistance of a D.C. machine

2. Determination OCC and external characteristic of shunt generator.

3. Speed variation of D.C. motor by field control armature resistance variation and ward Leonard method.

4. Determination of efficiency of a DC motor by brake test.

5. Determination of efficiency of a Single phase transformer by direct loading.

6. Parallel operation of a Single phase transformers

7. Parallel operation of 3 phase transformers

8. Identification of terminals, OC test, SC test and measurement of iron loss, No load current and no load P.F. and measurement of copper loss and computation of Zeq, Req and Xeq of a 1 phase transformer and determination of regulation.

9. Study of a 3-point/ 4-point starter for connecting and running a shunt motor.

10. Study of drum controller for connecting and running of DC series motor.

REFERENCE BOOKS:

1. Electrical Technology by B.L. Thareja and A.K. Thareja

2. Electrical Technology by J .B. Gupta.

3.Electrical Machine by P S Bhimbra

4. Electrical Machine by Fitzarald

5. Electrical Machines by M G Say

6. Electrical Machine by Nagrath & Kothari

IV Sem EE / EEE

Electrical Estimation & Costing

L   T   P   **Theory Hrs 42**

3   **Full marks 80 + 20 = 100**

Chapter	Topics	Hours
01	**Electrical Installation and IE rules** 1.1 Classification of Electrical Installation. 1.2 General requirement of Electrical Installation. 1.3 Reading and Interpretation of Electrical Engineering Drawings. 1.3.1. Various diagrams, plans and layout 1.3.2. Important definitions related to Installation 1.4 IE rules related to Electrical Installation & Testing.	**04**
02	**Service Connection** 2.1 Concept of service connection. 2.2 Types of service connection & their features. 2.3 Methods of Installation of service connection. 2.4 Estimates of under ground & overhead service connections.	**04**

03	**Domestic Building Electrification**
	3.1 General rules guidelines for wiring of Residential
	          Installation and positioning of equipments.
	3.2 Principles of circuit design in lighting and power circuits.
	3.3 Procedures for designing the circuits and deciding the
	          number of circuits.
	3.4 Method of drawing single line diagram.
	3.5 Selection of type of wiring and rating of wires & cables.
	3.6 Load calculations and selection of size of conductor.
	3.7 Selection of rating of main switch, distributions board,
	          protective switchgear ELCB and MCB and wiring
	          accessories.
	3.8 Earthing of Residential Installation.
	3.9 Sequence to be followed for preparing Estimate
	3.10 Preparation of detailed estimates and costing of Residential
	          Installation.
		08

04	**Electrification of commercial Installation** 4.1　　Concept of commercial Installation. 4.2　　Differentiate between electrification of Residential and commercial Installation. 4.3　　Fundamental considerations for planning of an electrical Installation system for commercial building. 4.4　　Design considerations of electrical Installation system for commercial building. 4.4.1　Load calculations & selection of size of service connection and nature of supply. 4.4.2　Deciding the size of cables, busbar and busbar chambers. 4.4.3　Mounting arrangements and positioning of switchboards, distribution boards main switch etc. 4.4.4　Earthing of the electrical Installation 4.5　　Selection of type wire, wiring system & layout. 4.6　　Sequence to be followed to prepare estimate. 4.7　　Preparation of detailed estimate and costing of commercial Installation.	08
05	**Electrification of factory unit Installation** 5.1　　Concept of Industrial load. 5.2　　Concept of Motor wiring circuit and single line diagram. 5.3　　Important guidelines about power wiring and Motor wiring. 5.4　　Design consideration of Electrical Installation in small Industry/Factory/workshop. 5.4.1.　Motor current calculations. 5.4.2.　Selection and rating of wire, cable size & conduct. 5.4.3　Deciding fuse rating, starter, distribution boards main switch etc. 5.4.4.　Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing. 5.5　　Sequence to be followed to prepare estimate.	08
06	**Testing of Installation** Testing of wiring Installation for verification of current; earthing, insulation resistance and continuity as per IS	04
07	**Contracts, Tenders and Execution** 7.1　Concept of contracts and Tenders 7.1.1 Contracts, types of contracts, contractors. 7.1.2　Valid Contracts, Contract documents. 7.1.3　Tender and tender notices. 7.1.4　Procedure for submission and opening tenders. 7.1.5　Comparative statements, criteria for selecting contractors, General conditions in order form. 7.2　　Principles of Execution of works 7.3.1　Administrative approval, Technical sanctions. 7.3.2. Billing of executed work.	06
	Total	42

Reference Books

Sr. No.	Author	Title	Publisher & Address
1	K.B. Raina	Electrical Design; Estimating and costing	New Age International (p) Limited, New Delhi
2.	Surjit Singh	Electrical Estimating and costing	Dhanpat Rai and company, New Delhi
3.	N. Alagappan S. Ekambaram	Electrical Estimating and costing	Tata Mc Graw Hill Publication, New Delhi
4.	S.L. Uappal	Electrical wiring Estimating and costing	Khanna Publication.
5.	B.D.Arora	Electrical wiring, Estimating and costing	R.B. Publication, New Delhi

Electrical Workshop (Sessional)
Full Marks- 100, No. of week-04

1. Identify the different electrical tolls & Accessories used in electrical Installation.
2. Different types of Joints used in overhead levis/under ground cable/electrical wiring.
3. Different types of wiring like casing, conduct beat, concealed conduct.
4. Fluorescent tube wiring.
5. wire up a call bell/buzer.
6. Identify, this mantle, sketch and assemble different electrical appliances.
7. Preparation of distribution board having 3 pin socket, tube controlled by independently switch.
8. Wire lightening ckt for staircase.
9. Wire up cousurestr main Board with ICDP (main switch) and distribution fuse Box with MCB.
10. Prepare and wire, amount single phase energy meets.
11. Study and install house hold earthing.
12. Measurement of Earth Resistance.

Subject Title : Professional Practices-II   **Subject Code : 401**

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:
Student will be able to:
1. Acquire information from different sources
2. Prepare notes for given topic
3. Present given topic in a seminar
4. Interact with peers to share thoughts
5. Prepare a report on industrial visit, expert lecture

Sl	Activity Heads	Activities	Suggested Hrs
1	Acquire information from different sources	Topic related to the branch and current area of interest i.e. articles in internet on which research or review is undergoing may be decided for the students group. The group may be restricted to maximum 5 students. Literature survey from Internet , print media and nearby practices may be undertaken. Minimum of 10 to 15 papers may be suggested for reading to get an overview and idea of matters.	12
2	Prepare notes for given topic	Making review or concept to be penned down in form of a article .(the article or review may be of 8 – 10 pages length in digital form of 12 font size in Times New Roman font)	4
3	Present given topic in a seminar	A seminar or conference or work shop on branch related topic is to be decided and all students in group of 5-6 students may be asked to present their views.	4

4	Interact with peers to share thoughts	A power point presentation of the article prepared in stage 2 may be presented before the classmates and faculty members.	4
5	Prepare a report on industrial visit, expert lecture	A topic on best practices and product / software development may be assigned to the student group. The group may be asked to prepare a survey, come to opinion making and list out the activities to develop the activities with SWOT analysis.	12

Fundamentals of Microprocessor

L   T   P   Full marks Th 80 + 20 = 100 : Pr 40 + 10 = 50

3   2

1. **NUMBER SYSTEM & CODES-** Binary,Octal,Hexadecimal number systems and their inter- conversion, Binary Arithmetic (Addition, Subtraction,Multiplication,and Division),Diminished radix and radix compliments,BCD code , Gray code,Excess-3 code.

    4hr

2. **LOGIC GATES, BOOLEAN ALGEBRA-** Axiomatic definition of Boolean algebra, Basic Theorems & properties of Boolean algebra, Boolean function Canonical and Standard forms, Digital logic Gate.   **4hr**

3. **COMBINATIONAL LOGIC DESIGN:-** The K-map method,Two,Three,Four variable K-map, Sum of product and product of sums Simplification, Binary Adder and Subtractor ,Multiplexers, Demultiplexers, Decoder.   **4hr**

4. **INTRODUCTION TO SEQUENTIAL LOGIC: -** Introduction, S-R Flip-flops, JK flip-flop, D flip-flops, T flip-flop, master slave flip-flop, Flip-flop excitation table. Classification of sequential circuits, Registers and A to D and D to A converter circuits, counters, detector and sequence generator.   **6hr**

5. **SEMICONDUCTOR MEMORIES:-** Introduction, Memory organization, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories charged-coupled memories**.**   **4hr**

6. **MICROPROCESSOR -8085:-** Evolution of microprocessors, Terminology used in microprocessor- Hardware, software Firmware, Bus, Address Bus, Data Bus, control Bus, Comparison of machine language, assembly language and high-level language. Architecture & Features of 8085 microprocessor, Schematic diagram of microcomputer and microprocessor based system, Pin definition of 8085 microprocessor. Control signals, demultiplexing of address & Data Bus.

    8hr

7. **8085 INSTRUCTIONS AND PROGRAMMING: -** Instruction Format (one byte, two byte and three byte instruction), Addressing modes of 8085, 8085 Instruction set. Definition of machine cycle, T state and instruction cycle. Different operations of 8085 with respect to the status of IO/M, S_1, S_0, RD, WR signals. Instructions related with interrupt. Timing diagram of opcode fetch cycle or memory read cycle, Memory write, I/O read and I/O write cycle, MVI A, 8 bit data; LXI rp, 16 bit data; STA, 16 bit address. Concept of stack, subroutine and interrupts. Hardware and software interrupts, mask able and non-mask able interrupt vectored interrupts.

    8hr

8. **Introduction to 8086 microprocessor: Paging concept , max and min mode concept.**

    4 hr

List of Practical's:

1. To verify the truth table of logic gates realize AND, OR, NOT gates.
2. To realize AND, OR gates using diodes and resistors.
3. To verify the Boolean algebra function using digital IC gates (consensus theorem).
4. To realize the function F (A, B, C, D) =(C+D) (A+B) (B+D) using NOR gates.
5. Design a half/full adder circuit using FF for 2 bits.
6. Design a half/full sub tractor circuit using FF for 2 bits.
7. Design a binary to gray code converter.
8. Design a function using K-map and verify its performance using SOP & POS.
9. Design BCD to seven segment display using 7447 IC.
10. Implement F (A, B, C) = E (1, 3, 4, 5, 6) with a multiplexer.
11. To study 8085 based microprocessor system
12. To load content in one register 8 shift it to another.
13. To move the content of one memory location to another.
14. To develop and run a program for finding out the largest/ smallest number from a given set of numbers.
15. To develop and run a program for arranging in ascending/descending order of a set of number
16. To perform multiplication/division of given numbers.
17. To perform floating point mathematical operations (addition, subtraction, multiplication, and division).
18. To perform computation of square root of a given number.

Books Recommended:-
1. Digital Principles-- Tata McGrew Hill (TMH)—Malvino & Leach
2. Modern Digital Electronics—TMH--- R. P. Jain
3. Digital Logic and Computer- PHI-- M. Morris Mano
4. Fundamentals of Microprocessors and Microcomputers- Dhanpat Rai Publications---- B. Ram
5. Microprocessor Architecture, Programming and Applications with 8085-- Penram International-- Ramesh S. Gaonkar
6. Microprocessor & Pheperipherial Devices D V Hall
7. Microprocessor by Lui & Gibson
8. Digital Computer System by Malvino
9. Logic Circuit Design by Mano

Chapter	Name of the Topic	Hours
1	Introduction : State and explain Network elements — passive and active elements State and explain types of network Laplace transform fundamentals Concept of s parameters	6
02	**Network Theorems (Statement, procedure, applications and areas of applications, Simple Numerical on Circuits)** 4.1 Superposition Theorem 4.2 Thevenin's Theorem 4.3 Norton's Theorem 4.4 Maximum power transfer Theorem 4.5 Reciprocity Theorem 4.6 Compensation Theorem	**08**
03	**TRANSIENTS (DC & AC):** **5.1 Steady state & transient response** **5.2 DC response to R-L, R-C & RLC circuit** **5.3 Application of Laplace transform for solution of D.C transient circuits.**	04
04	**6. TWO-PORT NETWORK:** **6.1 Open circuit impedance (z) parameters** **6.2 Short circuit admittance (y) parameters** **6.3 Transmission (ABCD) parameters** **6.4 Hybrid (n) parameters** **6.5 Inter relationships at different parameters** **6.6 Inter connection of two port networks** **6.7 T and π representation**	06
05	**Network Synthesis** **Network Functions , Poles and zeros.** **Positive real function** **Driving point synthesis with LC elements** **Two terminal pair synthesis by ladder development**	8

6	**6 FILTERS:**	08
	7.1 Classification of filters	
	7.2 Filter networks	
	7.3 Equations of filter networks	
	7.4 Classification of pass Band and stop Band	
	7.5 Characteristic impedance in the pass and stop bands	
	7.6 Constant – K low pass filter	
	7.7 Constant – K high pass filter	
	7.8 M- derived T section	
	7.9 Band pass filter	
	7.10 Band elimination filter	
	Total	**42**

List of Experiments

1) To observe A.C. waveform on C.R.O.and calculates average & R.M.S. Values, frequency, and observe the response of 'Resistance' to AC
2) To observe response of 'Inductor' and 'Capacitor' to AC
3) To determine impedance & Plot the phasor diagram of R-L series circuit.
4) To determine the current and P.F. of R.C. series circuit.
5) To determine the current and P.F. in R.L.C. series circuit.
6) To obtain resonance in R-L-C series circuit.
7) To determine the current and P.F. in R.L. Parallel circuit.
8) To determine the current and P.F. in R.C. Parallel circuit.
9) To determine the current and P.F. in R.L.C. Parallel circuit.
10) To obtain resonance in R-L-C parallel circuit.
11) To verify the line and phase values for star connected balanced load.
12) To verify the line and phase values for delta connected balanced load.
13) To verify the Superposition theorem.
14) To verify Thevenins theorem and Norton's theorem.
15) To verify the maximum power transfer Theorem.

L T P   Full marks 80 + 20 = 100
3

01 Basics of Power Generation   (02 Lectures)
1.1 Importance of electrical power in day today life
1.2 Different forms of energy
1.3 Comparison of sources of energy
1.4 Power crisis in India and Future Trend
1.5 Overview of method of electrical power generation

02 Thermal Power Stations   (05 Lectures)
2.1 List of thermal power stations in the state with their capacities
2.2 Selection of site for thermal power stations.
2.3 Layout and working of thermal power station with block diagram.
2.4 Operation of following components: Boiler, Economizer, Air pre heater, Super-heaters & re-heaters,
Steam prime movers, Condensers and Spray ponds & cooling towers.
2.5 Quality of fuel and its effect on quality of power generation.
2.6 Merits and demerits of Thermal Power Plants.
2.7 Simple Problems.

03 Nuclear Power Stations   (04 Lectures)
3.1 Selection of site for Nuclear Power plants.
3.2 Nuclear fission process
3.3 Block diagram and working of Nuclear Power station.
3.4 Construction and working of nuclear reactor.
3. 5 Fuels used in Nuclear Power Station
3. 6 Merits and demerits of Nuclear Power Plants
3. 7 List of Nuclear power stations in state & county with their capacities.

04 Hydro Power Stations   (04 Lectures)
4.1 Selection of site and classification of Hydroelectric Power Plants
4.2 Layout and working of Hydro Power Station.
4.3 Types of Turbines & generators used
4.4 Pumped storage Power Plant
4.5 Merits and demerits of Hydro Power Station
4.6 List of Hydro Power stations with their capacities & number of units in the state.
4.7 Simple Problem.

05 Diesel & Other Electric Power Stations   (04 Lectures)
5.1 Selection of site for Diesel Electric Power Station.
5.2 Elements of diesel Electric power plants and their working.
5.3 Operation, maintenance & trouble shooting chart of diesel Electric plant.
5.4 Merits, demerits and applications of diesel electric power stations
5.5 Performance and thermal efficiency of Diesel Electric Power Plant.
5.6 Solar , Wind, Tidal , and Geo thermal power stations concept only

06 Economics of Power Generation   (04 Lectures)
6.1 Terms commonly used in system operation: connected load, firm power, cold reserve, hot
     reserve, spinning reserve.
6.2 Terms used in system operation such as Loadcurve, load duration curve, integrated duration
     curve. (Simple numerical based on plotting above curves.)
6.3 Factors affecting the cost of Generation: Average demand, Maximum demand, plant
     capacity factor & plant use factor, Diversity factor & load factor.
     (Simple numericals based on above)

07 Interconnected Power Systems   **(02 Lectures)**

7.1 Advantages of Interconnection.

7.2 Base load & peak loads, load allocation among various types of power stations

7.3 Load sharing and transfer of load between power stations.

7.4 Inter connection of power stations at state and national level

08 Basics of Transmission Line and Component   **(08 Lectures)**

8.1 Introduction to transmission.

8.2 Necessity of transmission of electricity.

8.3 Classification & comparison of different transmission systems.9.1 Introduction to line components.

8.2 Types of conductors-Copper, Aluminum & state their trade names.

8.3 Solid, Stranded & bundled conductors.

8.4 Line supports – requirements, types, and field of applications.

8.5 Line insulators – requirements, types, and field of applications.

8.6 Failure of insulator & reasons of Failure.

8.7 Distribution of potential over a string of suspension insulators.

8.8 Concept of string efficiency, Methods of improving string efficiency.

8.9 Corona – corona formation, advantages & disadvantages, factors affecting corona, important terms related to corona.

8.10 Spacing between Conductors.

8.11 Calculation of Span length & sag Calculation
(Numerical based on 2.7 , 2.8 & 2.11)

8.12 Skin effect, proximity effect & Ferranti effect and Concept of transposition of conductors & necessity.

9 Performance of Transmission Line   **(04 Lectures)**

9.1 Classification of transmission lines.

9.2 Losses, Efficiency & Regulation of line.

9.3 Performance of single phase short transmission line. (Numerical based on it)

9.4 Effect of load power factor on performance.

9.5 Medium transmission lines-End condenser, Nominal T & Nominal л Network with vector diagram.

9.6 General circuit & Generalized Circuit Constants (A, B, C, D)

10. Substations   **(05 Lectures)**

10.1 Introduction.

10.2 Classification of indoor & outdoor sub-stations.

10.3 Advantages & Disadvantages.

10.4 Selection & location of site.

10.5 Main connection schemes.

10.6 Equipment's circuit element of substations.

10.6.1 In coming & outgoing lines, Transformers, CT&PT, Relays, CB's, fuses, Isolators, batteries, lightning arresters. Insulators.

10.6.2 Bus bar's material, types in detail.

10.7   Connection diagram and layout of sub-stations.

Sr. No.	Author	Title
1	Dr. S. L. Uppal	Electrical Power
2	Soni – Gupta - Bhatnagar	A course in Electrical Power
3	Prof. G. D. Rai	Non conventional Energy sources
4	Prof. Arrora and Dr. V. M. Domkundwar	A course in Power Plant Engineering
5	J B Gupta	Power System
6	C L Wadwah	Power System
7	Asfaque Hussain	Power System