 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN ELECTRICAL ENGINEERING																	
COURSE CODE : EE																	
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2009 -10							
SEMESTER : FIFTH										DURATION : 16 WEEKS							
PATTERN : FULL TIME - SEMESTER										SCHEME : E							
SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										
				TH	TU	PR	PAPER HRS	TH (01)		PR (04)		OR (08)		TW (09)		SW (16005)	
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Switchgear and Protection	SAP	12143	04	--	02	03	100	40	--	--	25@	10	--	--	50	
2	A. C. Machines	ACM	12144	04	--	02	03	100	40	50#	20	--	--	25@	10		
3	Utilisation of Electrical Energy	UEE	12145	04	--	--	03	100	40	--	--	--	--	--	--		
4	Elective-I (Any One)																
	Electric Traction-I	ETR	12146	03	--	02	03	100	40	--	--	25#	10	25@	10		
	Computer Hardware Maintenance	CHM	12147	03	--	02	03	100	40	--	--	25#	10	25@	10		
	Illumination Engineering	IEG	12148	03	--	02	03	100	40	--	--	25#	10	25@	10		
5	Elective-II (Any One)																
	Industrial Automation	IAU	12149	03	--	02	03	100	40	--	--	25#	10	25@	10		
	Energy Conservation and Audit	ECA	12150	03	--	02	03	100	40	--	--	25#	10	25@	10		
7	Industrial Project & Entrepreneurship Development *	IPE	12151	01	01	02	--	--	--	--	--	--	--	25@	10		
8	Professional Practices-V	PPR	12152	--	--	05	--	--	--	--	--	--	--	50@	20		
TOTAL				19	01	15	--	500	--	50	--	75	--	150	--	50	
Student Contact Hours Per Week: 35 Hrs. THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH. Total Marks : 825 @ Internal Assessment, # External Assessment, No Theory Examination. * One theory and One Tutorial for EDP and Two practical periods for Industrial Project Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work ➤ Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW). ➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms. ➤ Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.																	

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Switchgear & Protection

Subject Code : 12143

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25@	--	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

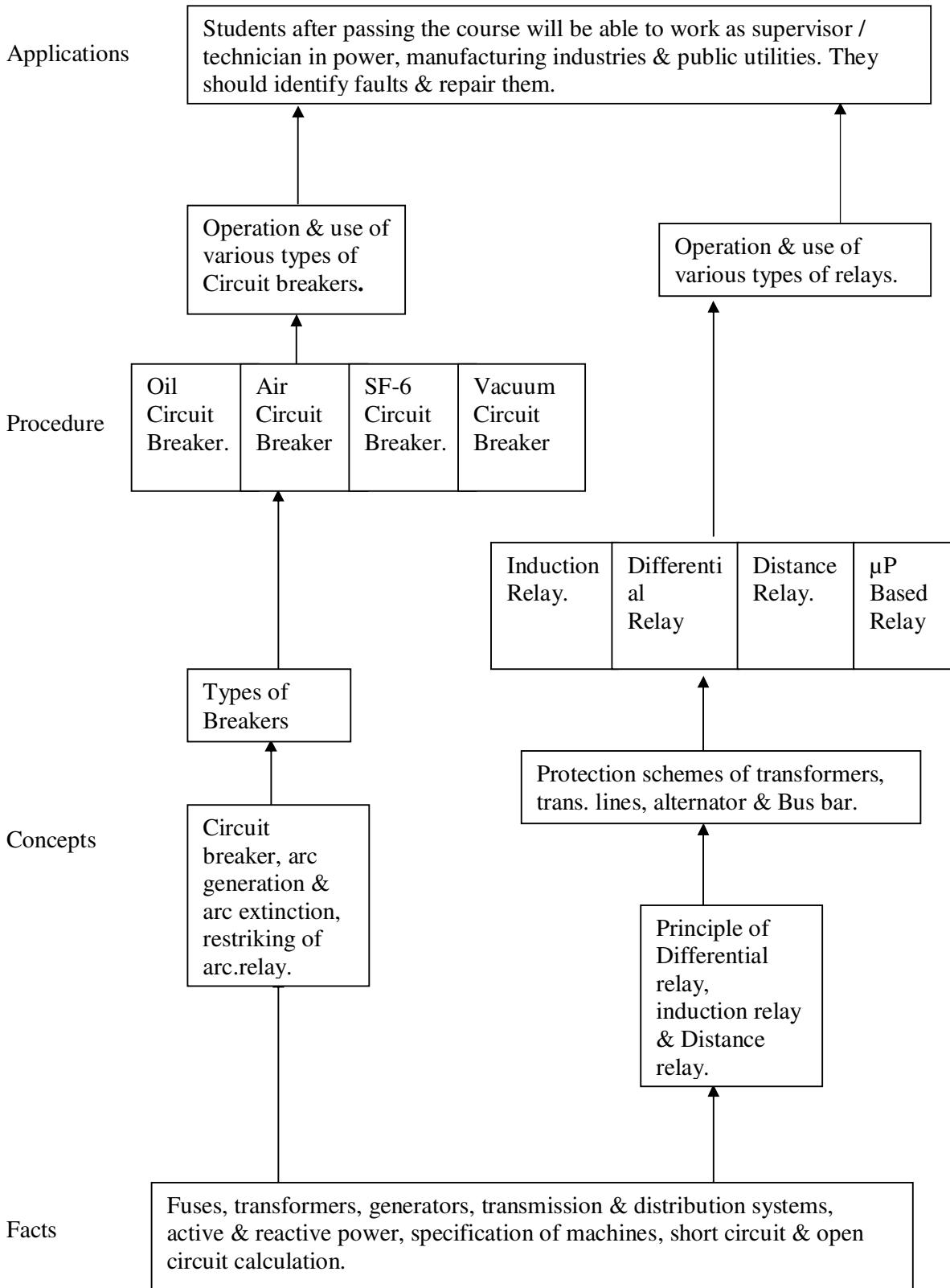
In modern world electrical power system is growing fast due to expanding technical activities. As such the students must know about the switchgear and protection system. It is expected that the knowledge of facts, concepts, principles & procedural aspects of switchgear and protection system must be known by students which ultimately help the students in discharging their duties as a supervisor or a technician in substations, manufacturing industries & public service utilities.

Objectives:

The students will be able to:

- 1) Learn the principles, concepts & procedural aspects of switchgear & protection.
- 2) Identify the various components of switchgear & protection systems.
- 3) know the specifications & select switchgear & protection system
- 4) Identify the faults & repairs.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Fundamental: 1.1 Necessity & functions of protective system. 1.2 Normal & abnormal conditions. 1.3 Types of faults & their causes. 1.4 Short circuit calculations(Symmetrical faults only) 1.5 Use of current limiting reactors & their arrangements.	05	10
02	Circuit interrupting devices 2.1 Fuses -Construction, , Working of Semi enclosed & HRC fuse, characteristics, selection and applications 2.2 Isolators- Vertical break, Horizontal break & Pentograph type 2.3 Arc formation process, methods of arc extinction – High resistance method, Low resistance or current zero method, related terms – Arc voltage, Recovery voltage & Restriking voltage. 2.4 Circuit breakers- Concept, Classification, Working principle, Construction, Specification & Applications of 2.4.1 H.T – Bulk oil circuit breaker, Minimum oil circuit breaker (M.O.C.B.), Sulpher Hexa Fluoride circuit breaker (SF ₆), Vacuum circuit breaker. 2.4.2 L.T.- Air circuit breakers (ACB), Miniature circuit breakers (M C B) , Moulded case circuit breaker (M C C B) , Earth leakage circuit breaker (ELCB) , Comparison of fuse & MCCB 2.5 Selection of MCCB for motor. 2.6 Selection and rating of circuit breakers.	12	20
03	Protective Relaying 3.1 3.1.1. Fundamental Requirements (Qualities)- Selectivity, Speed, Sensitivity, Reliability, Simplicity, Economy 3.1.2. Basic relay terminology- Protective relay, relay time, Pick up current , Reset current, Current setting, Plug setting multiplier , Time setting multiplier 3.2 Classification Electromagnetic attraction – Operation of Attracted armature type, Solenoid type and Balanced beam type relays. Electro magnetic induction type – Operation of Shaded pole type and Watt hour meter type relays. Block diagram , Operation, Advantages & disadvantages of Static and μ P based relays. 3.3 CT and PT as Protective transformers. (Definition of Ratio error, Phase angle error, CT burden) (No numerical on above topic.) 3.4 Over current relay-Time current characteristics. 3.5 Operation of Static over current relay with block diagram 3.6 Operation of μ P based over current relay with block diagram 3.7 Distance relaying- Principle, Operation of – Definite distance relay, Time distance relay and MHO relay 3.8 Directional relay- The need of directional relay, construction, operation of Induction type directional over current relay	12	20

	3.9 Differential Relay- Operation of Current differential relay & Voltage differential relay. (Simple numerical on relay setting)		
04	Protection of Alternator 4.1 Abnormalities & Faults 4.2 Differential protection , % Differential protection 4.3 Over current, earth fault, inter turn fault, negative phase sequence, over heating protection. 4.4 Reverse power protections. (Simple numerical on differential protection)	08	12
05	Protection of Transformer 5.1 Abnormalities & faults. 5.2 Differential, Biased differential, Over current, Earth fault, Inter turn, Restricted earth fault, Over heating protection. 5.3 Buchholz relay (Simple numerical on differential protection)	08	10
06	Protection of Motor 6.1 Abnormalities & faults. 6.2 Short circuit protection, Overload protection, Single phase preventor	04	06
07	Protection of Busbar & transmission line 7.1 Abnormalities & faults. 7.2 Bus bar protection – Operation of Differential Protection and Fault bus protection schemes. 7.3 Transmission line, over current, distance protection. Pilot wire protection.	06	10
	Neutral Earthing 8.1 Introduction & importance. 8.2 Types of earthing 8.3 substation earthing 8.4 Difference between Equipment earthing and Neutral earthing	03	04
09	Over voltage Protection 9.1 Causes of over voltages. 9.2 Lighting phenomena & over voltage due to lightning. 9.3 Protection of transmission line & substation from direct stroke. 9.4 Types of lightning arresters – Rod gap, Horn gap, Expulsion and Thyrite type , their construction & principle of operation. Surge absorber – Definition & working with neat diagram. 9.5 Protection against traveling waves. 9.6 Necessity of Insulation co-ordination.	06	08
	Total	64	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Identify different types of circuit breakers
2. Identify various faults on the system
3. Calculate the fault levels

Motor Skills:

1. Simulate circuit configuration to create various faults
2. Set the relays for various fault levels

List of Practical:

- 1) To study different switchgear equipments used in electrical power system / switchgear and protection lab.
- 2) To identify the components of different types of circuit breakers with their specifications (through visits / video / model).
- 3) To study various types of over current relays and to plot the performance characteristics of an over current relay.
- 4) To understand the protection schemes of alternator and to sketch labeled schematic diagram of various types of protections of alternator.
- 5) To understand the protection schemes of transformer through visit to local high voltage substation and to sketch labeled and to sketch labeled schematic diagram of various types of protections of transformer.
- 6) To understand various types of neutral earthing and specifications of earthing at different substations / different locations and new trends in earthing schemes (Information Search).
- 7) To understand types and specifications of lightning arrestors of different manufacturers through brochures / literature.
- 8) To perform experiments for a given 3 phase induction motor with direct on line (DOL) starter.
 - a) To check the operation of DOL starter under short circuit condition.
 - b) To check the operation of single phasing preventer by creating single phasing fault.
 - c) To check the operation of over current relay for various loads.

Learning Resources:**Books:**

Sr No.	Author	Name of Book	Publication
1.	S.Rao.	Switch gear & protection	Khanna Publications, New Delhi
2.	Soni,Gupta & Bhatnagar.	A text book on electrical power system	Dhnapat Rai & Sons, New Delhi
3.	Mason C.R.	The art & science of protective relaying	-----
4.	S.L.Uppal.	A text book of Electrical power	Khanna Publishers, Delhi.
5.	Badriram & Vishwakarma P.N.	Power System Protection & Switchgear	TMH, New Delhi

Course Name : Electrical Engineering Group
Course Code : EE/EP
Semester : Fifth
Subject Title : A. C. Machines
Subject Code : 12144

Teaching & Examination scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	50#	--	25@	175

Rationale:

This subject is classified under core technology group intended to teach students of facts, concepts, principles & procedure for operations and testing of electrical machines such as induction motor alternator and synchronous motor. Student will be able to analyze the characteristics and qualitative parameters of these machines

These machines are widely used in industries and for generation of electricity. The knowledge gained by the student is useful in the study of technological subjects such as Utilization System, Manufacturing Processes and Testing and Maintenance of Electrical Machines

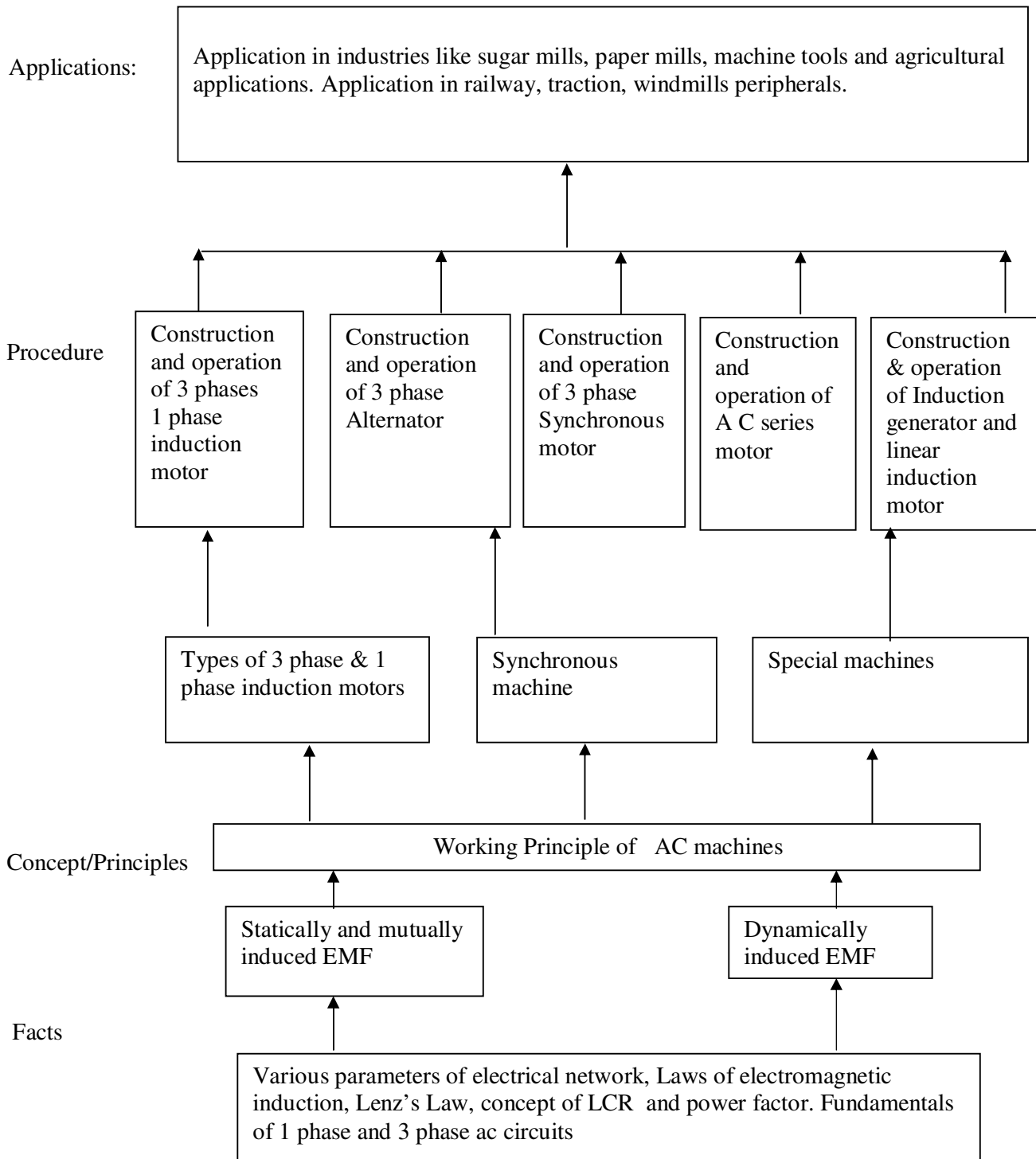
The knowledge and skills obtained will be helpful in discharging technical functions such as supervision, controlling and as R & D technician.

Objectives:

Student will be able to

- 1) Know the constructional details & working principal of various types of ac machines
- 2) Operate given machine properly.
- 3) Use the knowledge for testing of machine.
- 4) Select motors of proper rating for particular use.
- 5) Relate this knowledge to understand the subject of higher semester.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Three phase induction motor 1.1 Construction of three phase induction motor 1.2 Production of rotating magnetic field 1.3 Principle of working/operation 1.4 Concept of slip 1.5 Equation of rotor induced emf, current, frequency, reactance, and impedance under steady and running condition 1.6 Torque equation of three phase induction motor 1.7 Starting and running torque of squirrel cage and slip ring induction motor 1.8 Condition for maximum and starting torque 1.9 Torque slip characteristics of three phase induction motor 1.10 Effect of change in rotor circuit resistance on torque-slip characteristics 1.11 Effect of change in supply voltage on torque-slip characteristics	12	20
	1.12 measurement of slip by a) Tachometer method b) Comparing rotor frequency and stator frequency 1.13 Speed control of three phase induction motor by a) Pole changing method b) Frequency control method c) By stator voltage control d) Rotor resistance control 1.14 Comparison between squirrel-cage and slip-ring induction motor. 1.15 Applications of three phase induction motor. 1.16 Power stages of three phase induction motor. (Numerical on all above) 1.17 Double cage IM a) Construction b) Characteristic of outer, inner cage & combined characteristic c) Industrial Applications 1.18 I.M. as a generalized transformer 1.19 Vector diagram of IM	12	20
	1.20 Equivalent circuit of 3-phase IM (No numerical) 1.21 Starting of 3-phase IM (No numerical) a) Stator resistance starter b) Star-Delta starter c) Auto transformer starter d) Rotor resistance starter	06	08
	Three Phase Alternator 2.1 Definition and construction of three phase Alternator a) Armature b) Rotor- smooth cylindrical & projecting type 2.2 Derivation of e.m.f. equation of Alternator which includes a) Chording factor b) Distribution factor 2.3 Factors affecting the terminal voltage of Alternator	12	20

	a) Armature resistive drop b) Leakage reactance drop c) Armature reaction at various power factors & concept of Synchronous impedance 2.4 Regulation of three phase Alternator by a) Synchronous impedance method b) mmf method (Numerical on all above)		
03	Synchronous Motor 3.1 Principle of working/operation 3.2 Synchronous Motor on load with constant excitation 3.3 Effect of excitation at constant load 3.4 V curve & inverted V curve 3.5 Hunting & phase swinging 3.6 Applications 3.7 Starting of Synchronous Motor 3.8 Comparison between IM & Synchronous Motor (Numerical on all above)	10	12
04	Single phase Motors 4.1 Double field revolving theory 4.2 Types of Single phase IM 4.3 Split phasing principle of starting a) Resistance start induction run b) Capacitor start induction run c) Capacitor start Capacitor run d) Double value Capacitor applications motor 4.4 Shaded pole IM 4.5 Applications	06	12
05	Special machines 5.1 Induction Generator: Principle of operation, Construction and Applications 5.2 Linear Induction Motor Principle of operation, Construction and Applications 5.3 AC series motor Principle of operation, Construction and Applications	06	08
Total		64	100

Practical:

Intellectual Skills: 1. Analytical Skills
 2. Identification Skills

Motor Skills : 1. Measuring Skills
 2. Connecting instruments

List of Practical:

- 1) a) To measure the slip of 3-phase IM by
 - i) Tachometer
 - ii) Comparing rotor & stator frequency
 - iii) Stroboscopic method.

- b) To reverse the direction of rotation of 3-phase IM.
- 2) To measure the performance of 3-phase IM by direct loading
 - 3) To list different types of starters used for 3-phase IM .Identify & use the same to start & run 3-phase IM
 - 4) Using an MG set (DC motor-Alternator) observe the effect of excitation & speed on induced e.m.f. & plot O.C.C. of the given alternator.
 - 5) To find the percentage regulation of 3-phase alternator by synchronous impedance method at various power factors.
 - 6) To find the percentage regulation of 3-phase alternator by direct loading method at various power factors.
 - 7) To list & explain various starting methods of synchronous motor & applying one of them to start the synchronous motor. Plot V & inverted V curve of the same.
 - 8) To list the various types of 1-phase IM, Collect the literature for them from dealers/manufacturers of local places & compare on the following pts.
 - i) Method of starting
 - ii) Cost
 - iii) Performance
 - iv) Starting torque etc.
 Prepare a report

Learning Resources:**Books:**

Sr.No.	Author	Title	Publisher
01	S. K. Bhattacharya	Electrical Machines	TTTI, Chandigarh
02	B. L. Theraja	Electrical Technology Vol. II	S Chand & Co.
03	C. L. Dawes	Electrical Technology	--

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Utilisation of Electrical Energy

Subject Code : 12145

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

Electrical Engineering Diploma holders are appointed in industries in the supervisory cadre. Their main job functions are to supervise the operation & control of various electrical drives, electrical furnaces, electrical welding equipments, and refrigeration and air conditioning systems. The factory illumination scheme is also to be maintained by them. Therefore, the knowledge of operation and control of these machines and equipments is vital for every Diploma holder.

Railway is one of the major employers of Electrical Diploma holders; therefore, Diploma holder should also study the electrical traction.

Now, a days there are power crises and the cost of electrical energy is increasing day by day. Economical utilisation of electrical energy and energy conservation are thus essential aspects. Therefore, economics of utilising electrical energy is essential part of curriculum of Diploma in Electrical Engineering.

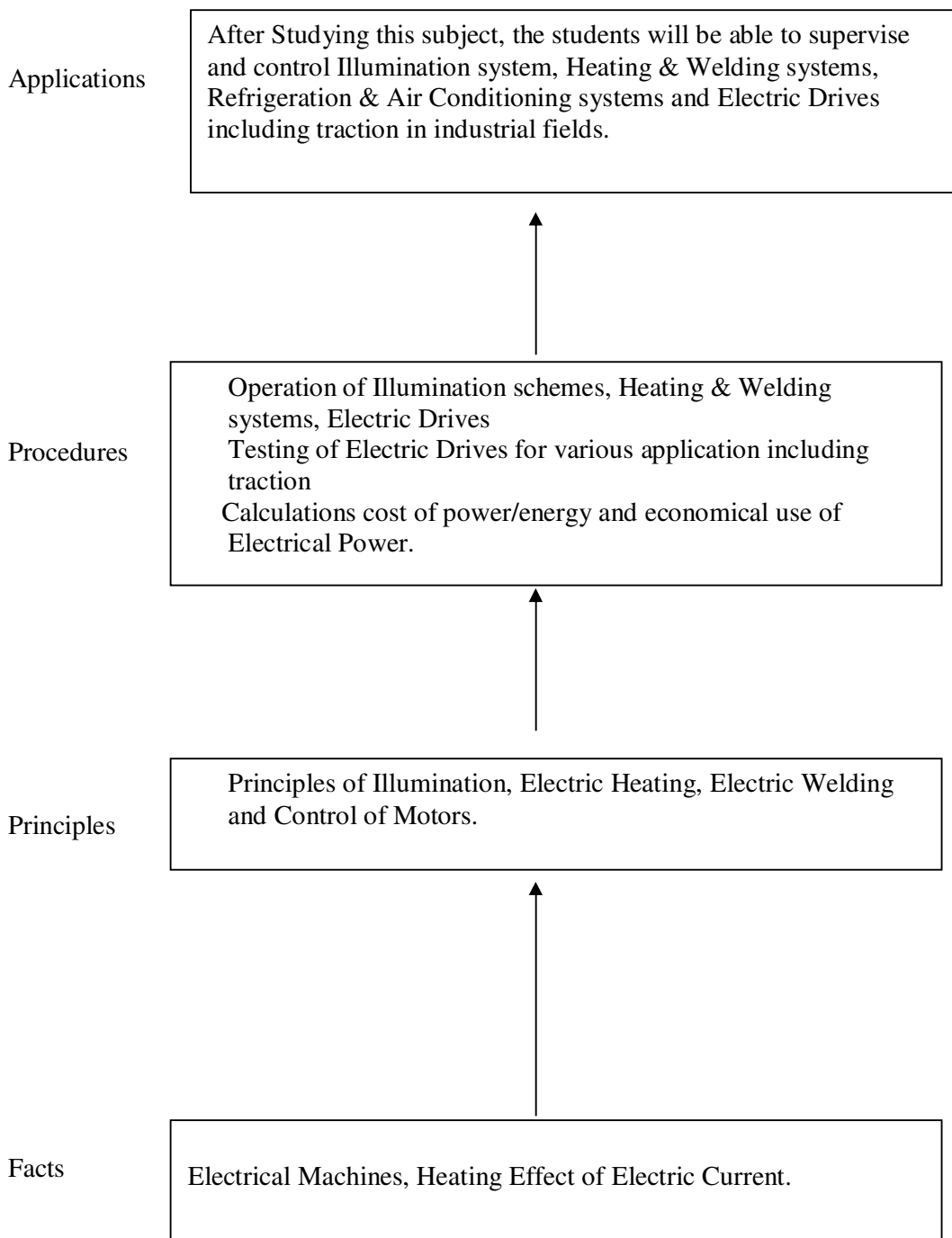
Hence, it is essential for every Diploma students to study the subject of Utilisation of Electrical Energy. This subject belongs to technology area.

Objectives:

The students will be able to:

1. Explain the importance of good illumination in factory and flood lighting.
2. Compare different methods of electric heating and electric welding.
3. Select Electric Drive for specific applications.
4. Explain the working of various components in Electric Traction system and list the advantages.
5. Analyse the electric circuits of refrigerator, water cooler and room air conditioner for troubleshooting.
6. Apply various measures for economic aspects of utilising electrical energy.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Illumination:</p> <p>1.1 Definitions of Terms Used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilisation Factor, Maintenance Factor, Depreciation Factor, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle.</p> <p>1.2 Laws of Illumination: - Law of Inverse Squares - Lambert's Cosine Law. (No Numerical)</p> <p>1.3 Sources of Light: Construction, Working and Applications of Following Lamps: - Incandescent Lamps. - Halogen Lamps. - Low Pressure Mercury Vapour Lamps (Fluorescent Tube). - High Pressure Mercury Vapour Lamps. - Sodium Vapour Lamps. - Compact Fluorescent Lamps (C.F.L.) - Metal Halide Lamps - LED Lamps - Neon Signs.</p> <p>1.4 – Basic Principles of Light Control.</p> <p>1.5 – Types of Lighting Schemes. Direct, Semi-direct, Semi-indirect, Indirect, General Lighting.</p> <p>1.6 – Design of Lighting Scheme: Objectives of Lighting Scheme. Factors to be considered While Designing the Lighting Scheme. (Simple Numericals)</p> <p>1.7 - Factory Lighting: - General Requirements - Types of Installations: General Lighting, Local Lighting, Emergency Lighting.</p> <p>1.8 – Lumen or Light Flux Method of Lighting Calculations. (Simple Numericals)</p> <p>1.9 – Flood Lighting - Flood Lighting Purposes. - Classification of Projectors. - Location and Mounting of Projectors. (Simple Numericals) [no numerical]</p>	10	16

02	<p>Electric Heating and Welding: Electric Heating: 2.1.1– Advantages of Electric Heating. 2.1.2 – Modes of Transfer of Heat: - Conduction, Convection and Radiation. 2.1.3 – Classification of Electric Heating Methods: 2.1.4 – Resistance Heating:(Construction & Operation) - Direct Resistance Heating: Salt Bath Furnace. - Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Causes of Failure of Heating Elements, Methods of Temperature Control. - Applications of Resistance Heating. 2.1.5 – Arc Heating: (Construction & Operation) - Direct Arc Furnace: - Indirect Arc Furnace. - Applications of Arc Heating. 2.1.6 –Induction Heating: (Construction & Operation) - Core Type Induction Furnaces: Ajax Wyatt Furnace. - Coreless Induction Furnace. - Applications of Induction Heating. (Simple Numericals on Melting Furnaces) 2.1.7 – Dielectric Heating: - Principle of Dielectric Heating. - Advantages of Dielectric Heating - Limitations of Dielectric Heating. - Applications of Dielectric Heating. (Simple Numericals on Dielectric Heating) 2.1.8 Eddy current heating Principle, advantages and applications</p>	06	10
	<p>Electric Welding: 2.2.1– Methods of Electric Welding: Electric Arc Welding, Resistance Welding. 2.2.2 – Resistance Welding: - Principle of Resistance Welding. - Advantages of Resistance Welding. - Types of Resistance Welding - (Only List) 2.2.3 – Spot Welding Machine. 2.2.4 – Electric Arc Welding: - Formation and Characteristics of Electric Arc. - Effect of Arc Length. - Arc Blow. 2.2.5 – Polarity in DC Welding: 2.2.6 – Electrodes for Metal Arc Welding: 2.2.7 – V-I Characteristics of Arc Welding DC Machines. 2.2.8 – Arc Welding Machines:[only list] - DC Welding Machines – MG Set, AC Rectified Welding Unit. - AC Welding Machines – Welding Transformer.</p>	06	10

03	<p>Elevators:</p> <p>3.1 Types of electric elevators 3.2 Size and shape of elevator car 3.3 Speed of elevators 3.4 Location of elevator machine 3.5 Types of elevator machines, elevator motors 3.6 Power transmission gears braking 3.7 Safety in elevators 3.8 Bombay lift act.</p>	06	08
04	<p>Electric Drives:</p> <p>4.1 – Introduction: <ul style="list-style-type: none"> - What is drive? - Drives – Mechanical Drive and Electric Drive. </p> <p>4.2 – Advantages and Disadvantages of Electric Drive. 4.3 – Factors Governing Selection of Electric Motors. 4.4 - Nature of Electric Supply: 3 ϕ & 1ϕ AC and DC. 4.5 - Type of Drive: Group Drive & Individual Drive. 4.6 - Nature of Load: Nature of the Mechanical Load, Matching of the Speed Torque Characteristics of the Motor with that of the Load, and Starting Conditions of the Load. 4.7 - Electrical Characteristics: (Only DC Series, Three Phase and Single Phase Induction Motors are to be dealt) <ul style="list-style-type: none"> - Running Characteristics: Three Typical Speed Torque Characteristics – Inverse, Constant Speed and Drooping. - Starting Characteristics: Starting Torque only. (No Starters). - Speed Control: Suitability to Economic and Efficient Speed Control Methods (Above and Below Normal Speed). - Braking Characteristics: Plugging, Rheostatic Braking and Regenerative Braking, as Applied to DC Series and Three Phase Induction Motor. Only characteristics and applications of following motors D.C. Series, 1phase A.C. Series, 1phase I.M., 3phase I.M., Universal motor, Stepper motor. Requirements of Motors used in following applications, stone crushing, textile industry, paper manufacturing industry, rolling mill, chemical industry. </p> <p>4.8 - Mechanical Features: <ul style="list-style-type: none"> - Type of Enclosure as per IS - Type of Bearings - Type of Transmission for Drive - Noise Level. </p> <p>4.9 - Size and Rating of Motor: <ul style="list-style-type: none"> - Load Cycles for – Continuous Loads, Short Time Loads, Intermittent Loads, Continuous Operation with Short Time Loads and Continuous Operation with Intermittent Loads. - Duty Cycles. - Standard Ratings for Motors as per ISS. </p>	12	16

	<ul style="list-style-type: none"> - Estimation of Rating of a Motor. (Simple Numericals on Estimating Size of Continuously Rated Motor) - Load Equalisation. (No Calculations) <p>4.10 - Cost:</p> <ul style="list-style-type: none"> - Capital Cost - Running Cost (Losses, p.f., Maintenance). 		
05	<p>Electric Traction:</p> <p>5.1 – Requirements of an Ideal Traction System.</p> <p>5.2 – Traction Systems:</p> <ul style="list-style-type: none"> - Non-electric Traction Systems. - Electric Traction Systems: Straight Electric Traction, Its advantages and Disadvantages. Diesel Electric Traction, Its advantages and Disadvantages. <p>5.3 - Systems of Track Electrification: DC System, Composite System – Single Phase to Three Phase System and Single Phase AC to DC System (Kando System). Advantages and Disadvantages of Single Phase 25 KV AC System Over DC System.</p> <p>5.4 – Traction Mechanics:</p> <ul style="list-style-type: none"> - Units Used in Traction Mechanics. - Types of Services. - Speed Time Curve. - Simplified Speed Time Curve (No Derivation) - Average Speed and Schedule Speed. - Factors Affecting The Schedule Speed. - Tractive Effort [No Derivation] - Specific Energy Consumption [No Derivation] - Factors Affecting Specific Energy Consumption. - Coefficient of Adhesion. <p>(Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption)</p> <p>5.5 – Traction Motors:</p> <ul style="list-style-type: none"> - Desirable Characteristics of Traction Motors, Special features of traction motor. only advantages ,disadvantages and applications of following motors - Suitability of DC Series Motor for Traction. - Suitability of Three Phase Induction Motor for Traction. , LIM, 1phase ac series motor. <p>5.6 - Traction Motor Control:</p> <ul style="list-style-type: none"> - Requirements. - Traction Control of DC Locomotives and EMUs: Series Parallel Control Combined with Rheostatic Control, Transition from Series to Parallel Combination (Open Circuit Transition, Shunt Transition and Bridge Transition), Energy Efficiency and Limitations of Series Parallel cum Rheostatic Control, Chopper Control of Motors in DC Traction Systems. - Traction Control System of AC Locomotives: Tap Changer, Step less Voltage Control through Use of Thyristors, PWM Control of Induction Motors. 	16	26

	<p>5.7 – Braking:</p> <ul style="list-style-type: none"> - Requirements of a Braking System. - Mechanical Braking: Vacuum Braking, Compressed Air Braking, Hand Brake for Parking. - Electric Braking: Rheostatic Braking and Regenerative Braking. (No Derivation and No Numericals). - Sequence of Braking - Dead Man's Handle 		
06	<p>Economic Aspects of Utilising Electrical Energy:</p> <p>6.1 – Economic Aspects of Utilising Electrical Energy.</p> <p>6.2 – Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges and Running Charges.</p> <p>6.3 – Formulation of Electrical Tariffs.</p> <p>6.4 – Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consumers. Simple, Block rate, Two part, Three part, KVA, MD, P.F. Tariffs.</p> <p>6.5 – Power Factor Improvement: Causes of Low Power Factor, Disadvantages of Low Power Factor, Power Factor Improvement by using Static Capacitors, Location of Capacitors for Power Factor Improvement, Most Economical Power Factor. Automatic Power Factor Controller (Derivation and Simple Numericals)</p> <p>6.6 – Energy Conservation: Importance and need of Energy Conservation, Measures for Energy Conservation in (i) Electric Drives (ii) Electric Traction (iii) Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination.</p>	08	14
Total		64	100

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	H. Partab	Art & Science of Utilisation of Electrical Energy	Dhanpat Rai & Sons
02	J. B. Gupta	Utilisation of Electric Power & Electric Traction.	S. K. Kataria & Sons
03	G. C. Garg	Utilisation of Electric Power & Electric Traction.	Khanna Publishers
04	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publisher Ltd.
05	G. K. Dubey	Fundamentals of Electrical Drives	Narosa Publishing House.

Course Name : Electrical Engineering Group
Course Code : EE/EP
Semester : Fifth
Subject Title : Electric Traction - I (Elective-I)
Subject Code : 12146

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

Note: 1) This subject is prerequisite for Electric Traction – II of Sixth Semester.

Rationale:

Electric traction means a locomotion in which the driving force is obtained from electric motors. One of the practical applications of electricity, which enters into the everyday life of many of us, is its use in service of mass transport – the electric propulsions of vehicles – electric trains, trolley buses, tram cars and in the latest developments such as metro and sky bus.

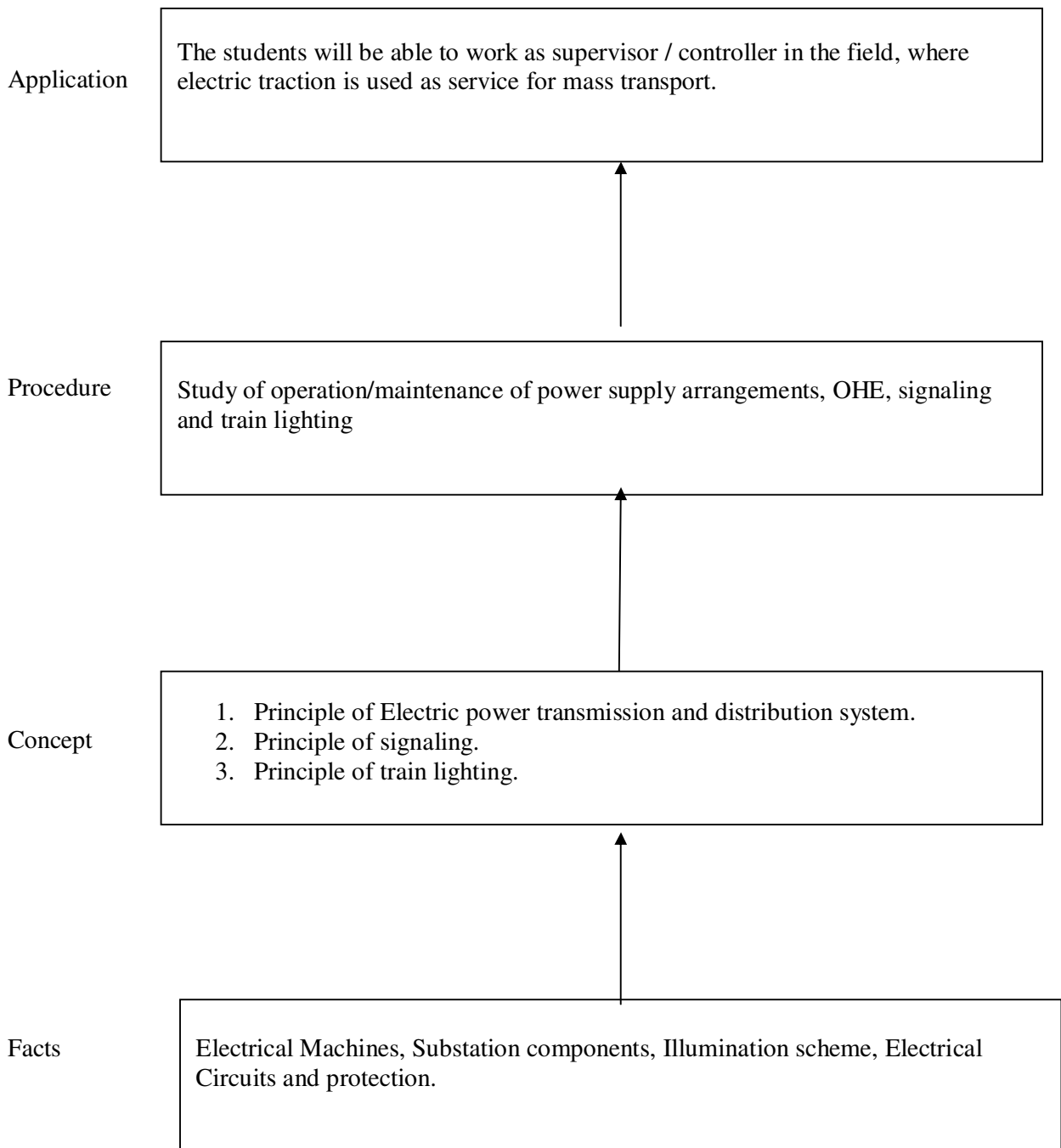
In view of the growing importance and technological developments, which have come about in this area in the recent past, for Electrical Engineering students it is desirable to study the course dealing with electric traction. This subject belongs to technology area.

Objectives:

The students will be able to:

1. Identify and explain use of components of the power supply arrangements for electric traction.
2. Maintain different overhead equipments.
3. Differentiate the various types of current collecting systems and current collecting gears based on utility.
4. Explain the different types of signals and track circuits.
5. Explain supervisory control used in electric traction.
6. Explain special requirements of train lighting and various systems of train lighting.

Learning Structure:



Contents: Theory:

Chapter	Topics	Hours	Marks
01	Power Supply Arrangements: 1.1 – Introduction 1.2 – High Voltage Supply. 1.3 – Constituents of Supply System. Substations. Feeding Posts. Feeding and Sectioning Arrangements. Sectioning and Paralleling Post. Sub sectioning and Paralleling Post. Sub sectioning Post. Elementary Section. Miscellaneous Equipments at Control Post or Switching Stations. 1.4 – Major Equipments at Substation. Transformer. Circuit Breaker. Interrupter. Protective System for AC Traction – Transformer Protection and 25 KV Catenary Protection 1.5 – Location and Spacing of Substations.	12	22
02	Overhead Equipments: 2.1 – Overhead Equipments (OHE). 2.2 – Principles of Design of OHE: Composition of OHE. Height of Contact Wire. Contact Wire Gradient. Encumbrances. Span Length. 2.3 – Automatic Weight Tension and Temp. Compensation. 2.4 – Uninsulated Overlaps. 2.5 – Insulated Overlaps. 2.6 – Neutral Section. 2.7 – Section Insulator. 2.8 – Isolator. 2.9 – Polygonal OHE: Single Catenary Construction. Compound Catenary Construction. Stitched Catenary Construction. Modified Y Compound Catenary. 2.10 – Effect of Speed on OHE. 2.11 – OHE Supporting Structure. 2.12 – Different types of signal boards of OHE. 2.13 – Maintenance of OHE: - OHE Maintenance Schedule. (No Derivation and No Numerical)	12	20
03	Current Collecting Equipments: 3.1 – Introduction. 3.2 – Systems of Supplying Power in Electric Traction:	08	20

	<p>Third Rail or Conductor Rail System. Overhead System.</p> <p>3.3 – Current Collectors for Overhead System: - Trolley Collector or Pole Collector, Bow Collector, Pentograph Collector.</p> <p>3.4 – Types of Pantographs: Diamond Pantograph and Faiveley Type.</p> <p>3.5 – Construction of Faiveley Type Pantograph.</p> <p>3.6 – Methods of Raising and Lowering of Pantograph.</p> <p>3.7 – Maintenance of Pantograph.</p>		
04	<p>Signalling and Supervisory Control:</p> <p>4.1 – Requirements of Signalling System</p> <p>4.2 – Types of Signals.</p> <p>4.3 – Colour Light Signals.</p> <p>4.4 – Three and Four Aspects of Colour Light Signals.</p> <p>4.5 – Track Circuits.</p> <p>4.6 – DC Track Circuit.</p> <p>4.7 – AC Track Circuit.</p> <p>4.8 – Supervisory Control: Introduction. Advantages of Remote Control. Systems of Remote Control: DC versus Voice Frequency (VF) Signalling. Remote Control System Equipment and Network. Mimic Diagram. Control Desk for TPC. Remote Control Switching Equipments. The F.M.V.F.T. Power Supply. Controlled Station Equipments.</p>	08	20
05	<p>Train Lighting:</p> <p>5.1 – Systems of Train Lighting.</p> <p>5.2 – Special Requirements of Train Lighting.</p> <p>5.3 – Method of obtaining Unidirectional Polarity.</p> <p>5.4 – Method of obtaining Constant Output.</p> <p>5.5 – Single Battery System.</p> <p>5.6 – Double Battery Parallel Block System.</p> <p>5.7 – Failure of Under frame Generating Equipments.</p> <p>5.8 – End on Generation.</p> <p>5.9 – Railway Coach Air Conditioning: - Requirements. - Types of Installations. - Air Conditioned Rolling Stock.</p> <p>5.10 – Air Conditioning Equipments on Coaches.</p>	08	18
Total		48	100

Assignments:**Drawing Sheets:**

- (i) Drawing on half Imperial sheet for Traction Substation Layout or Feeding Post.

- (ii) Drawing of half Imperial sheet for Pentagonal OHE Catenary, Different Catenary. according to speed limit, Cantilever assembly OHE Supporting structure, Pentograph, Cross section of Contact Wire.

Note: Students should be able to identify, explain the functions of various components of substation and OHE.

Visits:

Visit to Traction Substation (for substation layout and OHE) **or** Railway Station (for signaling and train lighting) and writing a report.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons
02	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publishers Ltd.
03	Om Prakash Kesari	Viddut Engine Parichay (In Hindi)	S. P. Graphics, Nashik.

Course Name : Diploma in Electrical Engineering

Course Code : EE

Semester : Fifth

Subject Title : Computer Hardware Maintenance (Elective-I)

Subject Code : 12147

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

Rationale:

This is an elective subject for third year diploma in Electrical Engineering. Now a day's computers have become an inevitable part of our life. Ability to work on computer has become an essential life skill. Focus of industries has been shifted mostly from production base to service oriented. Hence industries need persons suitable for service sector. Therefore there is a growing need of engineers / technicians in this field. Hence, it is necessary to study computer hardware, peripheral devices, network equipment, assembly, installation and trouble shooting the computer system.

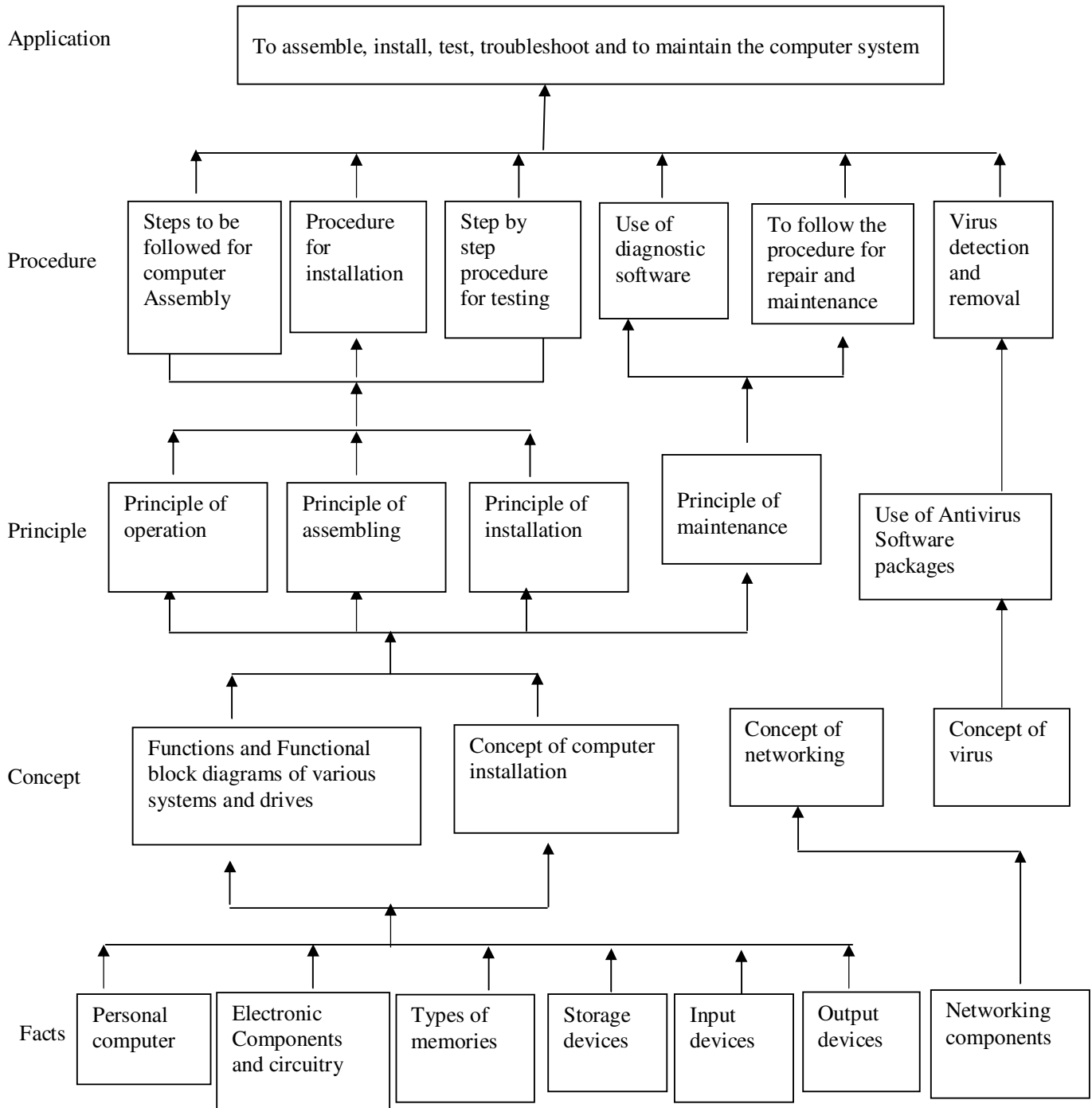
This subject covers personal computer assembly, installation, troubleshooting, servicing and maintenance. It also covers basics of networking. After completing this subject the student can carry out assembly, installation, testing and troubleshooting of personal computers. He can work as service engineer or get self employed.

Objectives:

After studying this subject, the student will be able to

- Identify various components of PC.
- Describe the construction, working and function of different peripheral devices.
- Read and interpret documentation (use manuals).
- Assemble the PC and connect the modules.
- Install system software, application software and drivers.
- Check the components for proper function, correct faults.
- Install and handle the diagnostic and test software.
- Detect and remove virus infections.
- State different types of networks and components used in networking.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	1.1 Evolution – IBM PC to Pentium, Laptops, Palmtops. 1.2 Personal computer system – functional block diagram, recognize major components of PC 1.3 Technical specifications. 1.4 Comparison chart – processor and memory IBM PC to Pentium IV, AMD athlon, Sempron etc. 1.5 System unit – brief description of motherboard, interface cards, expansion slots, front panel control, rear side connectors, cables and connectors, SMPS, floppy disc drive, hard disc drive, CD- ROM drive, display unit, keyboard.	03	08
02	Inside PC 2.1 Inside PC – functional blocks of mother board – CPU, RAM, BIOS, Cache RAM, BUS extension slots, on-board I/O and IDE connectors, ISA, PCI, AGP & PCI express. 2.2 BIOS, services, organization and interaction. 2.3 CMOS, CMOS setup utilities, 2.4 Motherboard types. 2.5 Processors – CISC and RISC. 2.6 Features of Pentium 4 processor, Pentium Celeron processor, , AMD series processors. 2.7 Chipsets – features of Intel, 915 series chipset motherboards 2.8 Power supplies – Linear power supplies, SMPS, block diagram of SMPS, Linear vs SMPS power supply, SMPS for computers, Power requirements in PCs.	08	16
03	On board memory and I/O interface 3.1 PC's memory organization 3.2 ROM, RAM, distinguish between static and dynamic RAM 3.3 DRAM, Synchronous DRAM, Extended Data Out DRAM, Double Data Rate SDRAM, Direct Rambus DRAM, Cache Memory, Extended/Expanded/Virtual memory. 3.4 I/O port – Serial port, Parallel port, Game port, USB port	03	06
04	Storage devices 4.1 Magnetic storage fundamentals – read/write head, writing, reading. 4.2 Hard disk drives – drive sub assemblies, hard disk controller – functions and functional block diagram, interfacing of HDC, SATA technology. 4.3 Installation and configuration of HHD – configuring, formatting, partitioning. 4.4 CD-ROM disks – types, reading and writing of CD 4.5 CD-ROM drive – principle of operation, block diagram, installation and setup. 4.6 DVD technology – DVD disks, DVD drive, block diagram, DVD formats. 4.7 Pen drives. 4.8 Installing CD and DVD media drives.	08	16
05	Input Devices 5.1 Keyboard – types, operation, and keyboard signals, interface logic, keyboard functions.	04	06

	5.2 Mouse – principle of operation, mouse signals, optical mouse, mouse installation. 5.3 Scanner – principle of operation, types, installation.		
06	Video and Sound 6.1 Display 6.2 Video basics – CRT, scanning methods, colour CRT 6.3 VGA monitor – Functional block diagram 6.4 Digital display technology (thin displays) – Liquid crystal displays, LCD panel display, displays, TFT monitors. 6.5 CRT controller - functions 6.6 Graphic card – Accelerated Video Cards, components of graphic cards, 3- D video. 6.7 Troubleshooting Video and sound	05	08
07	Computer Installation 7.1 Room preparation – location, computer room pollution, air conditioning, false flooring and ceiling, fire protection system. 7.2 Power supply – power supply problems-transients, spikes and surges, blackouts, power conditioning, surge protector, voltage regulator, isolation transformer, line conditioners, servo stabilizer, CVT, problems with CVT, Off-line and on-line UPS, UPS batteries, Inverters. 7.3 PC assembly- Installation steps, configuring motherboard, identifying the connectors and cables, adding memory modules, bios-CMOS setup, HD formatting and partitioning, installation of system and application software and necessary drivers.	05	08
08	Troubleshooting, servicing and maintenance 8.1 Power-On Self Test (POST) –functions, IPL hardware, test sequence, error messages, audio codes and their fault domains, error codes on display screen. 8.2 Troubleshooting the motherboard-possible problems, diagnosis and troubleshooting. 8.3 Troubleshooting the keyboard-possible problems, diagnosis and troubleshooting. 8.4 Trouble shooting the Hard disk drive – possible problems, diagnosis and troubleshooting. 8.5 Introduction to diagnostic softwares – Microsoft diagnostics, Norton Utilities, CHECKIT, QA Plus, ATDIAGS, Sissoft Sandra. 8.7 Data Security – computer virus, types of computer viruses, virus prevention techniques, Anti-virus software packages.	05	12
09	Printers and Plotters 9.1 Dot matrix printer – principle of operation, sub assemblies, printer mechanism, unpacking the printer, installation, testing the printer, connecting the printer to the computer, ribbon refilling. 9.2 LASER printer – principle of operation, functional block diagram, toner cartridges, printer installation, self test. 9.3 Ink-jet printer- principle of operation, installation, installing ink cartridges, printer operation check. 9.4 Preventive maintenance and cleaning of printers.	05	12
10	Introduction to networking 10.1 Local Area Network (LAN) and Wide Area Network (WAN) 10.2 Network components – File server, workstations, network interface cards, network cabling, bridge, router, gateways, repeater (brief description only)	02	08

	10.3 Wireless networks, network security 10.3 MODEM – principle of operation, functional block diagram, installation. 10.4 Internet – typical uses of internet		
	Total	48	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Identify various components of Computer.
2. Able to prepare a block diagram to correlate all the components based on their functions.
3. Know the procedure for starting and checking the computer function for satisfactory working.

Motor Skills:

1. Able to use the various tools efficiently.
2. Identify Motor proper tools for repair work.
3. Start and operate the computer as per procedure.

List of Practical:

1. Identify the components of Pentium4 motherboard & demonstrate the connections
2. Understand the CMOS setup of Pentium processor
3. Install partition & format a hard disk.
4. Identify the various components of hard disk drive & understand their functions
5. Install display cards-SVGA
6. Understand the working of scanner, install, scan a image & take a print of image
7. Understand the working & installation of Modem
8. Understand the working & installation of
 - i. Inkjet printer
 - ii. Dot matrix printer
 - iii. Laser printer
9. i) Connect a SMPS & identify the parts of SMPS
ii) Understand the working of uninterrupted power supply
10. Find faults related to CPU, monitor, printer & other peripherals
11. Assemble the various parts of PC & build a PC & install an operating system
12. Understand the use of diagnostic software
13. Install system as Windows 2003 server.

Note: For the lab manual required for conducting above practicals, refer the lab manual of sub 9069, Computer architecture & maintenance of Course CO4C

Learning Resources:

Books:

Sr. No	Name of Book	Author	Publisher & Address
1	Computer Installation and Servicing	Bala Subramanian	TMH, New Delhi
2	Managing and Troubleshooting PCs	Mike Meyers, scott Jernigan	TMH, New Delhi

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Illumination Engineering (Elective-I)

Subject Code : 12148

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

Rationale:

This subject is intended to teach the students various aspects of Illumination scheme. Student will be in a position to apply principles and laws of Illumination & Illumination schemes. Students also have the knowledge of various types of lamps lighting accessories & control circuits. This will also enable them to use knowledge for preparing an Illumination scheme, requirement of the circuits, develop the skill of designing illumination scheme for specific applications. He/She will become aware of his role in adapting new changes in Illumination scheme necessitated due to technical innovations brought out by R & D in Illumination technology. This is a Technology subject.

Objectives:

The student will be able to:

1. Measure the level of Illumination.
2. Differentiate between the various types of lamps.
3. List of various lighting accessories of components.
4. Design a control circuit for Illumination.
5. Design Illumination schemes for various applications in residential, commercial & industrial Locations.
6. Execute Illumination scheme for residential, commercial & industrial locations.

Learning Structure:

Application

Apply principles and laws of Illumination & Illumination schemes. Use different types of accessories as per the need. Design illumination scheme.

Procedure

Calculate the number of lamps/accessories required to provide appropriate lighting as per the need. Select proper equipment to fulfill the needs of providing proper lighting. Decide Illumination levels as per the requirements.

Concept/
Principal

Direct Lighting, Indirect or diffused Lighting, Flood Lighting, Factory Lighting, Sign Board/Advertisement Lighting, Luminous Intensity, Lumen.

Facts

Illumination levels, Light Intensity, Lighting Accessories, Cables, Wires.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	Fundamentals of Illumination 1.1 Illumination Terminology 1.2 Laws of Illumination 1.3 Featuring of good Illumination scheme 1.4 Advantages of good Illumination scheme 1.5 Measurement of level of Illumination (simple illumination)	06	08
2	Lamps & Lighting Accessories 2.1 Types of lamps: ARC lamps, HPMV lamps, Sodium Lamps, CFL Lamps, Metal halides, LED lamps 2.2 Neon Sign Tubes. 2.3 Neon Lamps. 2.4 Halogen Lamps. 2.5 Construction, working principle, advantages, disadvantages & Application of incandescent & Fluorocent 2.6 Lighting accessories. (All fittings, switches, enclosers)	10	20
3	Illumination Control & Control Circuits 3.1 Purpose of lighting control 3.2 Dimmer & Dimmer Transformer & their types 3.3 Electronic Dimmer 3.4 Enhancing Lighting control. 3.5 Control circuits for lamps (refer) : ON/OFF control & Illumination control.	06	16
4	Illumination for Interior Applications 4.1 Standard for various situations of Interior Illumination 4.2 Design Techniques 4.3 Design considerations for Interior location of Residential, Commercial, Industrial premises 4.4 Design Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit.	10	20
5	Illumination for Outdoor Applications 5.1 Factory Lighting 5.2 Street Lighting (Latest Technology) 5.3 Flood Lighting 5.4 Railway Lighting 5.5 Lighting for Advertisement/Hoardings 5.6 Sports Lighting	10	20
6	Lighting for Special Applications 6.1 Agriculture & Horticulture 6.2 Health Care Centers / Hospitals 6.3 Decorating Purposes 6.4 Stage Lighting 6.5 Aquariums & Shipyards 6.6 Special purpose lamps used in photography video films.	06	16
Total		48	100

Practical:

Skill to be developed:

Intellectual Skills:

1. Apply different Designing Skills.
2. Select proper equipment.

Motor Skills:

1. Measurement of Illumination.
2. Drawing skills.

List of Practicals:

1. To Measure Illumination by luxmeter.
2. Visit to nearby lamp manufacturing industry.
3. Prepare a report of different luminaries available in the market & collect the technical data (Visit local market / Use internet for data collection).
4. Study the different lighting accessories required for varies types of lamps.
5. Design an Illumination scheme for a garden of medium size.
6. Design an Illumination scheme for a conference room of medium size.
7. Design an Illumination scheme for a workshop for fine work of medium size.
8. Design an Illumination scheme for a medium size Hotel / Hospital /Shopping complex.

Learning Resources:**1. Books:**

Sr. No.	Author	Name of Book	Publisher & Address
1.	Jack L. Lindsey	Applied Illumination Engineering	The Fairmont Press Inc.
2.	R. H. Simons, Robert Bean	Lighting Engineering: Applied Calculations	Architectural Press (ISBN 0750650516)
3.	Casimer M Decusatis	Handbook of Applied Photometry	Springer (ISBN 1563964163)

2. Video Cassettes/ CDs

3. IS/International Codes : IS 2418, 9974, 9900, 2218, 5077, 4012, 4013, 1885, 1947, 4347, 6665, 3287, 1777, 3646, 2672, 10894, 1944, 10322, 2140

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Industrial Automation (Elective-I For EP And Elective-II For EE)

Subject Code : 12149

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject is classified as under Technology group intended to develop the technician to carry out the responsibilities in the industries related to industrial automation. The pass outs from the course needs to operate, test & maintain various industrial activities which are automated.

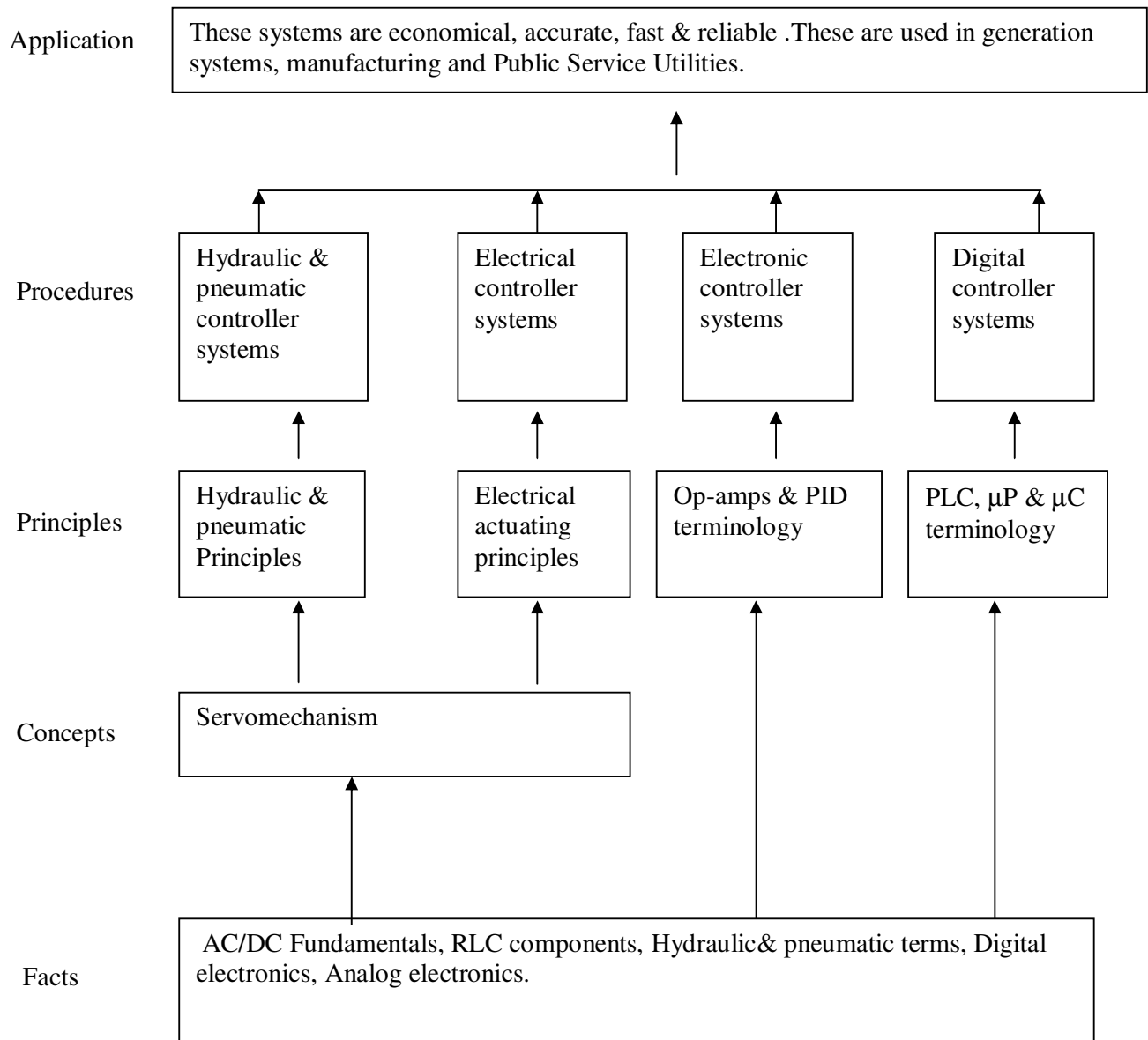
Student can analyze different types of control systems used in industries. The knowledge gained by students is used in the operation of various control systems like PLC, SCADA, DCS. His knowledge is used in supervising, controlling & maintaining the control systems.

Objective:

Student will be able to

1. Explain applications of control systems / Automation.
2. Read & design data for control systems.
3. Explain the hydraulic/ pneumatic systems.
4. Describe & program PLC using Ladder logic.
5. Describe working of control components.
6. Draw power & control circuit.

Learning structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	Automation 1.1 Need of automation 1.2 Advantages of automation 1.3 Requirements of automation	02	04
2	Control System 2.1 Concept of control system 2.2 Basic block diagram of control system 2.3 Transfer function 2.4 Different terms in control system 2.5 Types of control system 2.6 Applications of control system 2.7 Development of block diagram for simple applications like level, temperature, flow control	04	08
3	Control System Components 3.1 Contacts-types, current capacity & load utilization categories 3.2 Solenoids-dc, ac 3.3 I/P devices- switches-push buttons, foot switch, selector switch, pilot switch, proximity, photoelectric, temperature actuated, level control, pressure sensing, overload sensing 3.4 Relays- electromechanical, reed 3.5 O/P devices- contactors, valves, pilot lamps 3.6 Symbols in power & control circuits 3.7 Developing control circuit-basic & thumb rule 3.8 Power & control circuit for different applications like hoist, crane, conveyer belt, induction motors	08	16
4	Electrical Actuators 4.1 Potentiometers-working & use as error detector 4.2 Servomotors-ac & dc –working principle 4.3 Synchros - transmitter, control transformer, use of as error detector 4.4 Stepper motor-PM & variable reluctance- working principle 4.5 Tacho - generator 4.6 Applications of above components as AC/DC control system.	08	12
5	Controllers 5.1 Hydraulic-advantages & disadvantages, hydraulic servomotor, types of pumps used, control valves, components like accumulator, filter, seals 5.2 Pneumatic-resistance & capacitance of pressure system, pneumatic flapper-nozzle system, pneumatic relays, actuating valves, cylinders, comparison between pneumatic & hydraulic systems 5.3 Electrical & electronic controller-brief overview of op-amps, inverting, non-inverting, lead-lag networks 5.4 Digital controllers-brief overview of microprocessor & micro-controller to be worked as controller	08	16

6	Control actions 6.1 On-Off, P, I, P+I, P+D,P+I+D, actions 6.2 P+I+D action using hydraulic, pneumatic electronic controller 6.3 Tuning of P+I+D controller	06	12
7	Programmable Logic Controller 7.1 Introduction 7.2 Advantages & disadvantages 7.3 PLC Vs PC 7.4 Block diagram of PLC 7.5 Basic blocks like CPU, I/O modules, bus system, power supplies & remote I/Os 7.6 Different PLC's available in market	08	16
8	Programming of PLC 8.1 development of Ladder logic 8.2 some simple programs such as I/O connections, starting of IM, stepper motor control (treatment to topic no.8.2 should be given at the time of practical / pp hours.)	02	12
9	Introduction to special control systems 9.1 Distributed Control System(DCS)-brief introduction to hardware & software used 9.2 SCADA- brief introduction to hardware & software used	02	04
Total		48	100

Practical:

Intellectual Skills: a. Logical development
b. Programming skills

Motor Skills : a. Interpretation skills
b. Connecting properly

List of Practicals:**Preparatory Study of control system components, different types of switches and relays**

- 1) a) To plot the characteristics of potentiometer
b) Use of potentiometer as error detector
- 2) To plot V-I characteristics of DC & AC servomotors. compare them with DC & AC motor characteristics
- 3) a) To plot the characteristics of synchro transmitter
b) Use of synchro transmitter- control transformer pair as error detector.
- 4) Measure step angle for a stepper motor in forward & reverse direction.
- 5) Draw a power circuit & control circuit using control symbols for a 3-phase IM using DOL starter.
- 6) Observe various components /parts/symbols/connections of a PLC demonstration kit in your laboratory.

- 7) Draw a ladder logic diagram for two different examples.
- 8) By using above ladder logic diagram observe the status of I/Os using PLC.
- 9) Perform stepper motor/ temperature control using PLC.
- 10) Identify the parts of hydraulic/ pneumatic servomotor from cut-section/model.

B) Mini Project: (one in a group of eight students)

- 11) Collect the data of various PLC brands market & list.
- 12) Collect the data from internet about hardware & software of new control systems like SCADA, DCS.
- 13) Use the various control components in your laboratory to built a AC/DC position control system.
- 14) Built P, I, PI, PD & PID controller using op-amps & R-C circuits. Plot V-I characteristics
- 15) PLC Application: Vist to near by industry to study applications and prepare a report.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher & Address
1	Nagrath Gopal	Control System Engg.	Wiley Eastern
2	K.Ogata	Modern Control Engg.	Prentice Hall
3.	Jacob	Industrial Control Engg	Prentice Hall
4.	Andrew Parr	Hydraulics & Pneumatics	Jaico Publication
5.	Webb & Reis	Programmable Logic Controller: Principle applications	Wiley Eastern
6.	S.K. Bhattachrya Brijinder Singh	Control of Electrical Machines	New Age International Publishers

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Energy Conservation and Audit

Subject Code : 12150 (Elective I for EP and Elective II for EE)

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

Rationale:

This subject is categorized under technology subjects, Rapid Developments in the standard of living of countrymen results into increased energy consumption. But due to limited availability of conventional sources and difficulties in their tapping and uneconomical and insufficient R and D aspect of non conventional sources, energy conservation is the most important tool to some extent, to face the problem of the increased demand.

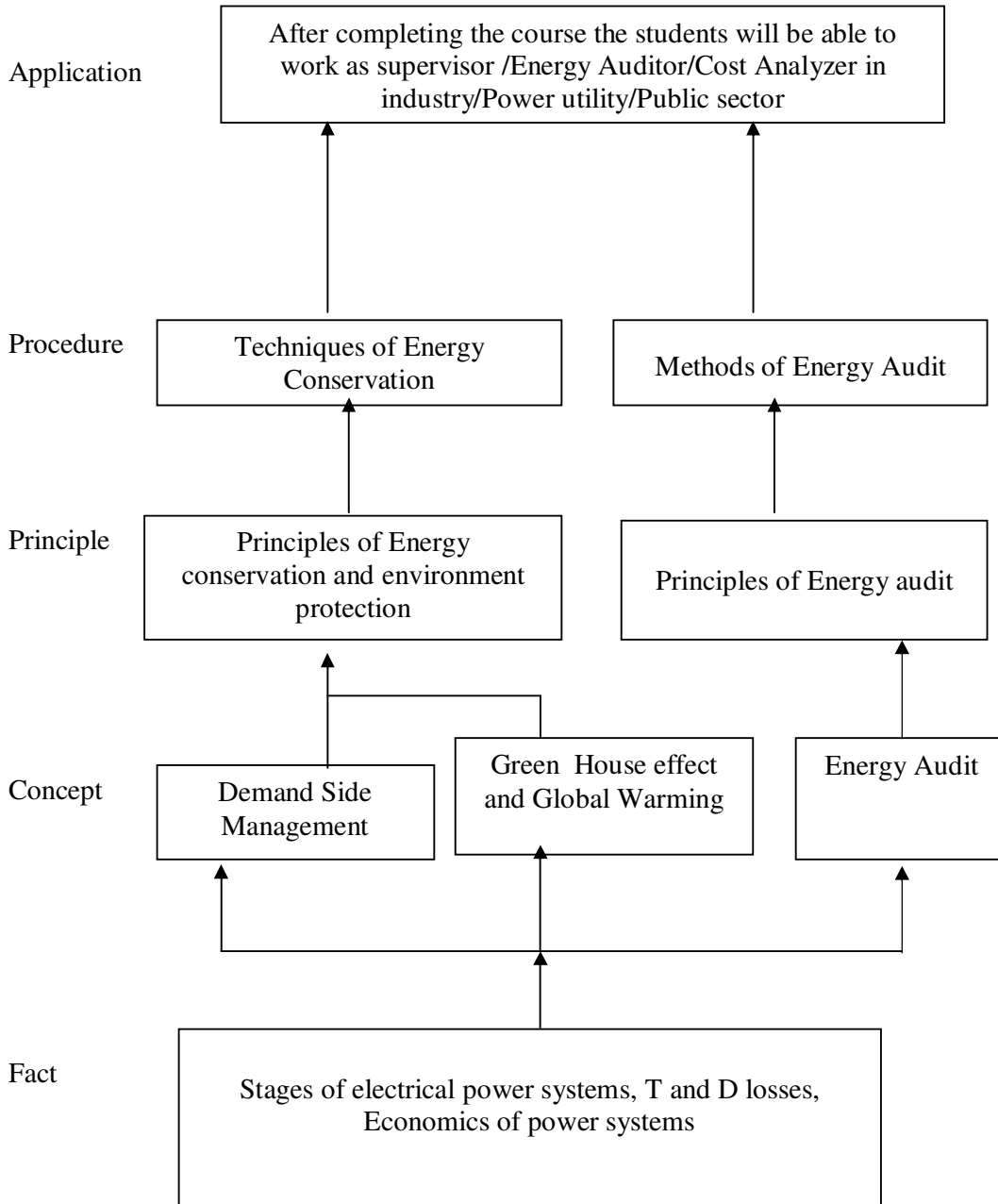
For monitoring effectiveness of the energy conservation methods and proper use of electrical energy, energy audit is must. To maintain the growth of development, electricity generation will be required to be increased by proper mix of conventional and non-conventional sources of energy but at the same time its conservation and audit should be done to increase the efficiency of electrical power system. Hence electrical engineers must have knowledge of various methods of energy conservation and concept of energy audit and its implementation.

Objectives:

The students will be able to:

1. List causes for limited growth of conventional energy sources and limitations of non-conventional sources of energy.
2. Suggest methods of energy conservation for different load conditions.
3. Select appropriate tariff system and methods for reducing electricity consumption and energy saving.
4. Apply Tools for energy audit and recommend measures for energy conservation.

Learning Structure:



Detail : Contents

Chapter	Name of the Topic	Hours	Marks
01	Energy 1.1. Review of various energy sources 1.2. Energy Scenario 1.3. Need of energy conservation and energy audit.	04	08
02	Energy Conservation Lighting energy: 2.1 - Basic terms used in Lighting System (Illumination) 2.2 - Recommended Luminance Levels 2.3 - Procedure for assessing existing lighting System in a facility. 2.4 - Energy conservation techniques / methods in lighting system by. 2.4.1 - Replacing lamp sources 2.4.2 - Using Energy efficient luminaries 2.4.3 – Using light control gears/ circuits 2.4.4 - Installation of exclusive transformer / servo stabilizer for lighting 2.4.5 - Periodic survey and adequate maintenance program	04	10
03	Energy Conservation Methods/Techniques of Electrical motor 3.1 - Types of Electrical motors. 3.2 - Revision of Construction, working and performance of Electric motors. 3.2.1 – Power flow, speed control of Induction motor. 3.3 - Selection of Electric motors. 3.4- Energy Conservation Methods/Techniques of Electrical motor by 3.4.1- Improving power quality 3.4.2- Motor survey 3.4.3-Matching motor rating with required load 3.4.4-Minimising idle and redundant running of motor. 3.4.5 - Operating in star mode 3.4.6 - Rewinding of motors 3.4.7 - Improving mechanical power & transmission efficiency 3.4.8- Use of high efficiency or Energy efficient motors 3.4.9--Using energy conservation equipments like Soft starters, Power factor controller, Automatic star-delta converter, Variable Frequency Drives. 3.4.10- Periodical maintenance	06	14
04	Energy Conservation Methods/Techniques of Transformers 4.1 - Overview of performance of Transformer 4.2 - Opportunities for Energy conservation in Transformer 4.3 - Energy Conservation Methods/Techniques of Transformers.... 4.3.1 - Using Energy efficient transformer 4.3.2 - Using Amorphous Transformers 4.3.3 - Epoxy Resin cast / Encapsulated Dry type Transformer - Periodic maintenance	04	08
05	Energy Conservation by Cogeneration..... 5.1 - What is Co-generation? 5.2 - Need for cogeneration	06	12

	<p>5.3 - Classification of Cogeneration Systems On the basis of the sequence of energy use</p> <p>5.3.1 - Topping cycle.</p> <p>5.3.2- Bottoming Cycle</p> <p>5.4 - Classification of Cogeneration Systems On the basis of the technologies</p> <p>5.4.1 - Steam turbine cogeneration.</p> <p>5.4.2 - Gas turbine cogeneration.</p> <p>5.4.3 - Reciprocating Engine cogeneration.</p> <p>5.5 - Advantages of cogeneration.</p> <p>5.6 - Factor governing selection of cogeneration Systems</p>		
06	<p>Tariff and Energy Conservation in Industries:</p> <p>6.1 - Objectives of Tariff.</p> <p>6.2 - Desirable characteristics of Tariff.</p> <p>6.3 - Types of Tariff</p> <p>6.4 - Classification of Consumers. (LT & HT)</p> <p>6.5 - Terms involved in Tariffs.</p> <p>6.6 - Electricity duty.</p> <p>6.7 - Energy cost and Recent MSEDCL tariffs</p> <p>6.8 - Application of Tariff System to reduce Energy bill.</p> <p>6.9 - Energy Conservation by improving load factor and power factor.</p> <p>6.10 – Simple numerical.(Based on 6.9)</p>	04	12
07	<p>Energy Conservation In Transmission and Distribution Systems:</p> <p>7.1- Overview of Transmission and Distribution system</p> <p>7.2 - Parameters affecting performance of Transmission and Distribution system.</p> <p>7.3 - Losses affecting efficiency of Transmission and Distribution system—(Technical losses and Commercial Losses)</p> <p>7.4 - Energy Conservation opportunities In Transmission and Distribution Systems:</p> <p>7.4.1 – By overcoming technical losses</p> <p>7.4.2 – By compensating Reactive power flow.</p> <p>7.4.3 - By demand side management.</p> <p>7.4.4- By using efficient transformers</p> <p>7.4.5 – By minimizing of line Losses / cable losses.</p> <p>7.4.6 - By optimization of system voltage</p> <p>7.4.7 – By balancing of phase currents.</p> <p>7.4.8 – By reducing commercial losses.</p>	06	10
08	<p>Energy and the Environment:</p> <p>8.1- Relation between Energy and Environment.</p> <p>8.2 - Environment and social concerns related to energy utilization in Industry.</p> <p>8.3 - Global Environmental issues</p> <p>8.3.1- Causes and effects of Ozone layer depletion.</p> <p>8.3.2 - Causes, effect and remedy for Global warming. (The Green House Gas effect).</p> <p>8.3.3 - Causes, effect and remedy for Air Pollution.</p> <p>8.3.4 - Causes, effect and remedy for Acid Rains.</p>	04	12
09	<p>Energy Audit:</p>	10	14

9.1 - Electricity act 2003 (statement) 9.2 - IE rules and regulations for energy audit. 9.3 - Energy Flow Diagram and its significance. 9.4 - Energy audit instruments and their use. 9.5 - Questionnaires for the energy audit. 9.6 - ABC analysis. 9.6 - Internal energy audit checklist. 9.7 - Procedure of Energy audit (walk through audit & detailed audit.) 9.8 - Simple payback period and Return on Investment Examples on small Energy Conservation Projects. (Numerical).		
Total	48	100

Practical:

Skill to be developed:

Intellectual Skills:

1. Identify different methods used for energy conservation.
2. Understand the importance of energy conservation.
3. Select proper tariff for given industry/institute.
4. Collect technical information regarding electricity act.

Motor Skills:

4. Prepare energy audit report.
5. Write visit report.
6. Use different methods of energy conservation.
7. Use of energy saving devices.

List of Practical:

1. Energy saving by using electronic ballast as compared to conventional choke.
2. Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment.
3. Make a survey of 01 establishment to identify different methods used for energy conservation.
4. Prepare Energy audit report for Industry/workshop/ Institute or its on section.
5. Ask to search on the website of power ministry and MERC for Electricity act 2003 and collect the information regarding role of energy manager, energy auditor and prepare power point presentation/report.

Learning Resources:**Books:**

Sr. No.	Name Of Author	Name Of Book	Publication
01	V.K.Mehta	Principles of Power System	S. Chand & Company Pvt. Ltd.
02	Siemens	Power Factor Correction	New Age Vol.38 2005
03	B.G.Desai, J.S.Rana, R.Paraman, A.V.Dinesh	Efficient use and Management of Electricity in Industry	Devki Energy Consultancy Pvt. Ltd.
04	T.Gonen	Electric Power Distribution System Engg.	Tata McGraw Hill
05	O.P.Khanna	Industrial organization and Management	Dhanpat Rai & Sons.
06	M.J. Steinburg and T.H. Smith	Economy Loading of Power plant and Electric system	John Willey and sons
07	C.L. Wadhawa	Generation Distribution and Utilization of Electrical Energy	New Age 2004
08	E. Gordon , K. Natrajan	Entrepreneurship Development	Himalaya Publishing, Mumbai

Energy Efficiency Websites:

www.altenergy.com

www.bee-india.nic.in

www.boiler.com

www.boiler.com

www.greenbusiness.com

www.worldenergy.org

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Industrial Project and Entrepreneurship Development

Subject Code : 12151

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	01	02	--	--	--	--	25@	25

Notes:

1. One theory and one tutorial hour are for Entrepreneurship Development (EDP).
2. Twenty-five marks for term work are for report prepared under EDP.
3. Two clock hours for industrial project

Contents:

PART A) Industrial Project

Following activities related to project are required to be dealt with, during this semester

1. Form project batches & allot project guide to each batch. (Max. 4 students per batch)
2. Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department.
3. Each project batch should prepare action plan of project activities & submit the same to respective guide.
4. At the end of semester, each project batch should submit the action plan and abstract of the project along with list of materials required if project involves fabrication or other facilities required in other kinds of project.
5. Action Plan should be part of the project report.
6. Actual work of project should be done in sixth semester.

Group	Projects
01	(1) Design of Illumination Scheme (Up to 20 KW) for Hospital / Shopping Mall / Cinema Theatre / Commercial Complex / Educational Institute / Industrial Complex. (2) Design of Rural Electrification Scheme for small Village, Colony. (3) Case Studies Related to Industries – Operation / Maintenance / Repair and Fault Finding. (Refer Guideline Document). (4) Energy Conservation and Audit. (5) Substation Model (Scaled) (6) Wind Turbine Model (Scaled) (7) Pole Mounted Substation Model (Scaled)
02	(1) Rewinding of Three Phase/Single Phase Induction Motor. (2) Rewinding of Single Phase Transformer. (3) Fabrication of Inverter up to 1000 VA. (4) Fabrication of Battery Charger. (5) Fabrication of Small Wind Energy System for Battery Charging. (6) Fabrication of Solar Panel System for Battery Charging. (7) Microprocessor/ Micro controller Based Projects. (8) PC Based Projects. (9) Simulation Projects.
03	Seminar on any relevant latest technical topic based on latest research, recent trends, new methods and developments in the field of Electrical Engineering / Power Electronics.

Part B: Entrepreneurship Development

Rationale:

Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. The educational institutions should also demonstrate their uniqueness in the creation of enterprising personalities in

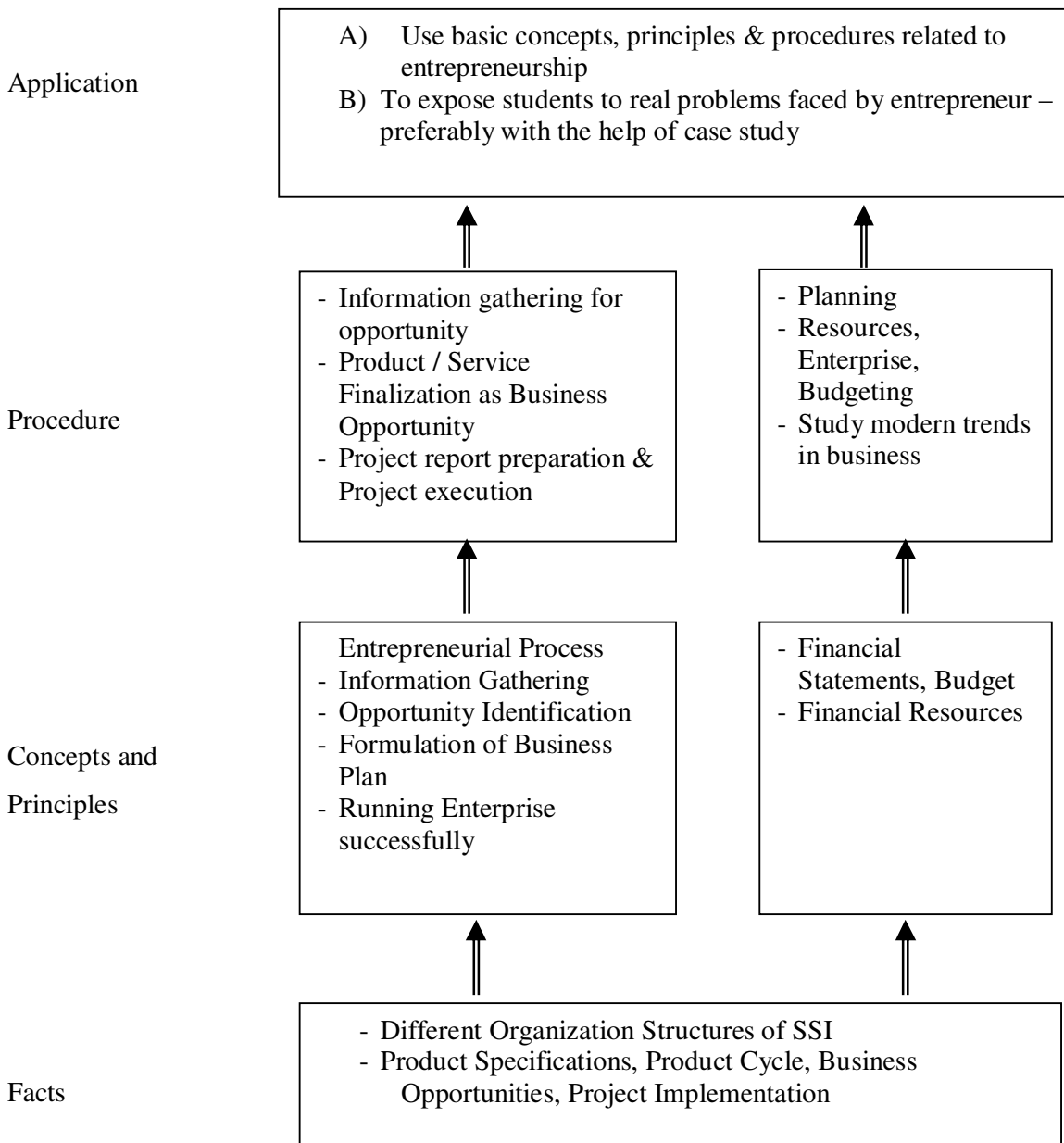
their colleges. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

Objectives:

Students will be able to

- 1) Identify entrepreneurship opportunity.
- 2) Acquire entrepreneurial values and attitude.
- 3) Use the information to prepare project report for business venture.
- 4) Develop awareness about enterprise management.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours
01	<p>Entrepreneurship, Creativity & Opportunities</p> <p>1.1) Concept, Classification & Characteristics of Entrepreneur</p> <p>1.2) Creativity and Risk taking. 1.2.1) Concept of Creativity & Qualities of Creative person. 1.2.2) Risk Situation, Types of risk & risk takers.</p> <p>1.3) Business Reforms, 1.3.1) Process of Liberalization. 1.3.2) Reform Policies. 1.3.3) Impact of Liberalization. 1.3.4) Emerging high growth areas.</p> <p>1.4) Business Idea Methods and techniques to generate business idea.</p> <p>1.5) Transforming Ideas in to opportunities transformation involves Assessment of idea & Feasibility of opportunity</p> <p>1.6) SWOT Analysis</p>	03
02	<p>Information And Support Systems</p> <p>2.1) Information Needed and Their Sources: Information related to project, Information related to support system, Information related to procedures and formalities</p> <p>2.2) Support Systems</p> <p>1) Small Scale Business Planning, Requirements.</p> <p>2) Govt. & Institutional Agencies, Formalities</p> <p>3) Statutory Requirements and Agencies.</p>	02
03	<p>Market Assessment</p> <p>3.1) Marketing -Concept and Importance</p> <p>3.2) Market Identification, Survey Key components</p> <p>3.3) Market Assessment</p>	02

04	<p>Business Finance & Accounts</p> <p>Business Finance 4.1) Cost of Project 1) Sources of Finance 2) Assessment of working capital 3) Product costing 4) Profitability 5) Break Even Analysis 6) Financial Ratios and Significance</p> <p>Business Account 4.2) Accounting Principles, Methodology 1) Book Keeping 2) Financial Statements 3) Concept of Audit</p>	03
05	<p>Business Plan & Project Report 5.1) Business plan steps involved from concept to commissioning Activity Recourses, Time, Cost</p> <p>5.2) Project Report 1) Meaning and Importance 2) Components of project report/profile (Give list)</p> <p>5.3) Project Appraisal 1) Meaning and definition 2) Technical, Economic feasibility 3) Cost benefit Analysis</p>	03
06	<p>Enterprise Management And Modern Trends 6.1) Enterprise Management: 1) Essential roles of Entrepreneur in managing enterprise 2) Product Cycle: Concept and importance 3) Probable Causes Of Sickness 4) Quality Assurance: Importance of Quality, Importance of testing</p> <p>6.2) E-Commerce: Concept and Process 6.3) Global Entrepreneur 6.3.1 Assess yourself-are you an entrepreneur? 6.3.2 Prepare project report and study its feasibility.</p>	03
TOTAL		16

Learning Resources:**1) Books:**

Sr.No	Author	Title	Publisher
1	J.S. Saini B.S.Rathore	Entrepreneurship Theory and Practice	Wheeler Publisher New Delhi
2	--	TTTI, Bhopal / Chandigadh	--
1	E. Gorden K.Natrajan	Entrepreneurship Development	Himalaya Publishing. Mumbai
2	Prepared by Colombo plan staff college for Technician Education.	Entrepreneurship Development	Tata Mc Graw Hill Publishing co. ltd. New Delhi.
3	J.B.Patel D.G.Allampally	A Manual on How to Prepare a Project Report	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
4	J.B.Patel S.S.Modi	A Manual on Business Opportunity Identification & Selection	
5	S.B.Sareen H. Anil Kumar	National Derectory of Entrepreneur Motivator & Resource Persons.	
6	Gautam Jain Debmuni Gupta	New Initiatives in Entrepreneurship Education & Training	
7	P.C.Jain	A Handbook of New Enterpreneurs	
8	D.N.Awasthi , Jose Sebastian	Evaluation of Entrepreneurship Development Programmes	
9	V.G.Patel	The Seven Business Crisis & How to Beat Them.	

2) Video Cassettes:

No	Subject	Source
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmadabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail : ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
2	Assessing Entrepreneurial Competencies	
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur skill	

Glossary:

Industrial Terms

Terms related to finance, materials, purchase, sales and taxes.

Components of Project Report:

1. Project Summary (One page summary of entire project)
2. Introduction (Promoters, Market Scope/ requirement)
3. Project Concept & Product (Details of product)
4. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength)
5. Manufacturing Process & Technology
6. Plant & Machinery Required
7. Location & Infrastructure required
8. Manpower (Skilled, unskilled)
9. Raw materials, Consumables & Utilities
10. Working Capital Requirement (Assumptions, requirements)
11. Market (Survey, Demand & Supply)
12. Cost of Project, Source of Finance
13. Projected Profitability & Break Even Analysis
14. Conclusion.

Course Name : Electrical Engineering Group

Course Code : EE/EP

Semester : Fifth

Subject Title : Professional Practices - V

Subject Code : 12152

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	05	--	--	--	--	50@	50

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 attitude, in addition to basic technological concepts.

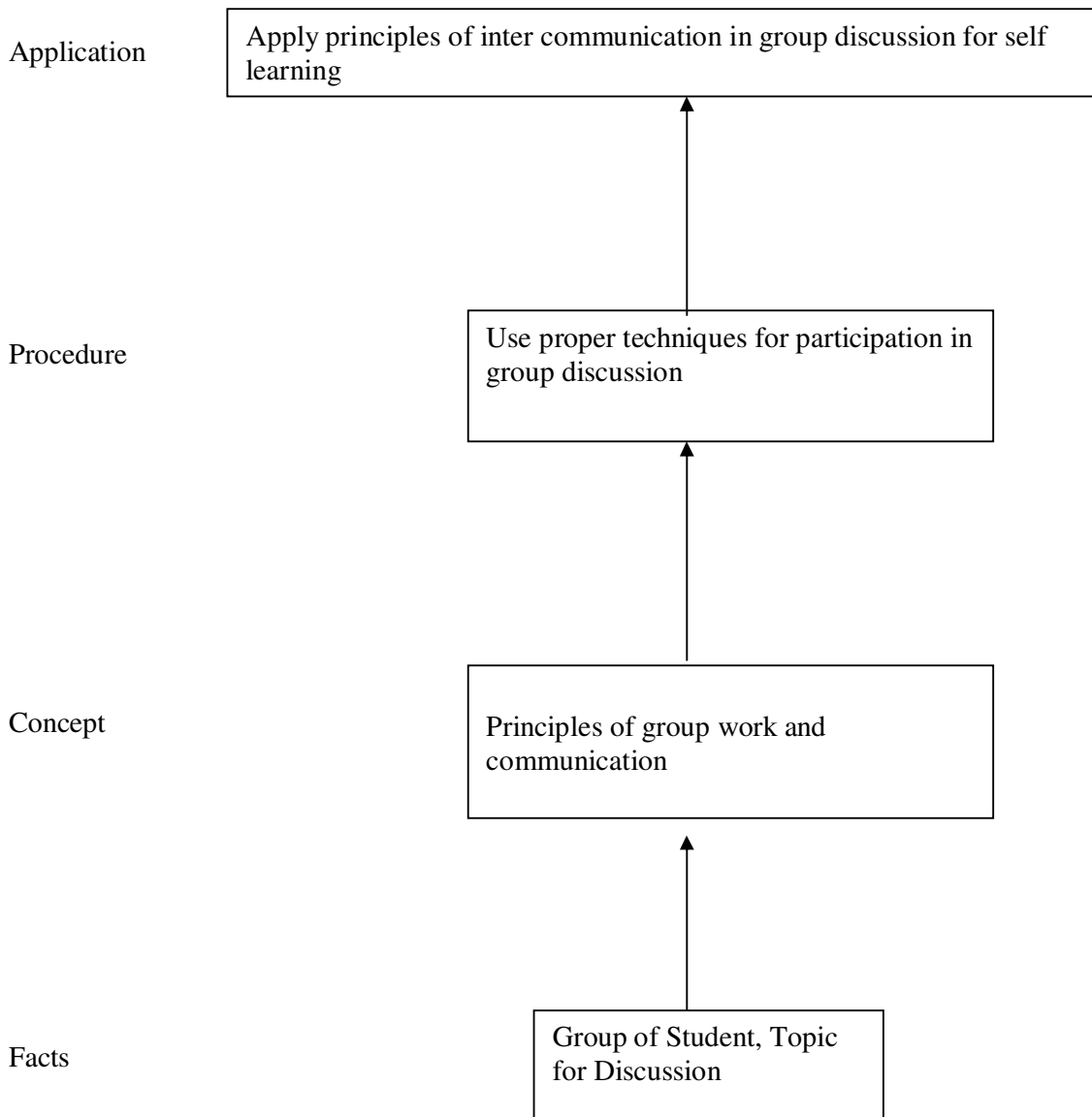
The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation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

Learning Structure:



Activity	Content
1	<p>Industrial Visits Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. Following are the suggested type of Industries/ Fields -</p> <ol style="list-style-type: none"> i) Visit to Electrical Machine Manufacturing Industry. ii) Visit to a Foundry to see Furnaces and Ovens. iii) Visit to L & T LT Switchgear Laboratory at Pune. iv) Visit to Railway Station to study operation of Signaling system. v) Visit to Loco shed or EMW at Nashik. vi) Visit to Large Industry to study Protection Schemes. vii) Any Industry having Automation for manufacturing Processes.
2	<p>The Guest Lecture/s from field/industry experts, professionals to be arranged minimum 3 Lectures each of two hours from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of Term work</p> <ol style="list-style-type: none"> a) Modern trends in A. C. Machines b) Bio Medical Instruments: Working, Calibration etc c) Testing of Switchgears d) Computer aided drafting. e) Automotive wiring & lighting. f) Environmental pollution & control. g) Interview Techniques. h) Automobile pollution, norms of pollution control.
3	<p>Information Search (Student seminars based on information search & guest lecture topics.)</p> <ol style="list-style-type: none"> a) Magnetic Levitation Systems b) Recent developments in use of Electrically operated vehicles for mass transport c) Metro Railway in Kolkata and Delhi comparative study d) Electrically operated Motor Cars and Scooters/Motorbikes e) Alternative fuels & energy options. f) Any other topic
4	<p>Group Discussion : The students should discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are -</p> <ol style="list-style-type: none"> i) CNG versus LPG as a fuel. ii) Load shading and remedial measures. iii) Rain water harvesting. iv) Trends in energy conservation v) Disaster management. vi) Use of Plastic Carry Bags vii) Safety in day to day life. viii) Energy Saving in Institute.
5	<p>Seminar : Seminar topic should be related to the subjects of fifth semester / topics from information search & guest lectures. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)</p>