SCHEME FOR
SIXTH SEMESTER (ELECTRICAL ENGINEERING)

Sr. No.	Subject	Study Scheme Hrs/Week L	T	P	EVALUATION SCHEME						Total Marks
					INTERNAL ASSESSMENT		EXTERNAL ASSESMENT (EXAMINATION)				
					Theory	Practical	Written Paper		Practical		
					Max. Marks	Max. Marks	Max. Marks	Hrs.	Max. Marks	Hrs.	
6.1**	Employability Skills-II	-	-	2	-	25	-	-	50	3	75
6.2*	Utilization of Electrical Energy	5	-	-	25	-	100	3	-	-	125
6.3	Electrical Power-II	4	-	2	25	25	100	3	50	3	200
6.4*	PLCs and Microcontrollers	4	-	4	25	25	100	3	50	3	200
6.5*	Elective	4	-	-	25	-	100	3	-	-	125
6.6*	Entrepreneurship Development and Management	3	-	-	25	-	100	3	-	-	125
6.7	Major Project Work	-	-	6	-	100	-	-	100	-	200
# Student Centered Activities including Entrepreneurial Awareness Camp		-	-	6	-	25	-	-	-	-	25
Total		**20**	**-**	**20**	**125**	**200**	**500**	**-**	**250**	**-**	**1175**

* Common with other diploma programmes
** Common with diploma programme in Power Station Engineering
+ Includes 25 marks for Viva-voce
# Student Centered Activities will comprise of co-curricular activities like extension lectures, library studies, games, hobby clubs e.g.photography, painting, singing, seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, Civil Defense/Disaster Management activities etc.

SYLLABUS: Polytechnic (EE)

Department: Electrical Engineering – 6th Semester

Subject: Employability Skills– II (Practical) **Subject Code: EMP SKLL**

Detailed Contents

Unit No 1 Oral Practice

Topic No.1: Mock interview
Topic No.2: Preparing for meeting
Topic No.3: Group discussion
Topic No.4: Seminar presentation
Topic no. 5: Making a presentation
- 5.1) Elements of good presentation
- 5.2) Structure and tools of presentation
- 5.3) Paper reading
- 5.4) Power point presentation

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
-	-	2	-	25	-	-	50	3	75

Subject: Utilization of Electrical Energy (Theory) **Subject Code: 120961**

Detailed Contents

Unit No.1 Illumination

Topic No.1 : Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of Light

Topic No.2: Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux

Topic No.3: Laws of illumination – simple numerical

Topic No.4: Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour

Topic No.5 :sodium lamp, fluorescent lamp, halogen lamp, neon lamp, compact filament lamp(CFL), LED Lamp, comparison of incandescent, fluorescent, CFL & LED

Topic No.6 : Calculation of number of light points for interior illumination, calculation of illumination at different points, considerations involved in simple design problems.

Topic No.7: Illumination schemes; indoor and outdoor illumination levels

Topic No.8: Main requirements of proper lighting; absence of glare, contrast and shadow

Topic No.9: Awareness about time switches, street lighting, flood lighting, monument lighting and decorative lighting, light characteristics

Unit No.2 Electric Heating

Topic No.10: Advantages of electrical heating

Topic No.11: Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range

Topic No.12: Properties of resistance heating elements, domestic water heaters and other heating appliances, thermostat control circuit

Topic No.13: Induction heating; principle of core type and coreless induction furnace, their construction and applications

Topic No.14: Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields

Topic No.15: Infra-red heating and its applications (construction and working of two appliances)

Topic No.16: Microwave heating and its applications (construction and working of two appliances)

Topic No.17: Solar Heating, Calculation of resistance heating elements (simple problems)

Unit No.3 Electric Welding

Topic No.18: Advantages of electric welding, Welding method

Topic No.19: Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment, Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc ,Hydrogen arc welding method and their applications.

Topic No.20: Power supply requirement. Advantages of using coated electrodes, comparison between AC and DC arc welding, Welding control circuits, welding of aluminum and copper

Unit No.4 Electrolytic Processes

Topic No.21: Need of electro-deposition, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing

Topic No.22: Equipment and accessories for electroplating, Factors affecting electro-deposition

Topic No.23: Principle of galvanizing and its applications, Principles of anodizing and its applications

Topic No.24: Electroplating of non-conducting materials, Manufacture of chemicals by electrolytic process, Power supplies for electroplating

Unit No.5 Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers

Topic No.25: Principle of air conditioning, vapour pressure, refrigeration cycle, eco –friendly refrigerant

Topic No.26: Description of Electrical circuit used in a) Refrigerator) Air-conditioner, and c) Water cooler

Unit No.6 Electric Drives:

Topic No.27: Advantages of electric drives, Characteristics of different mechanical loads

Topic No.28: Types of motors used as electric drive, electric braking: Plugging, Rheostat braking,

Regenerative braking, General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives

Topic No.29: Examples of selection of motors for different types of domestic loads

Topic No.30: Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift, Application of flywheel

Topic No.31: Specifications of commonly used motors e.g. Squirrel cage motors, slip ring induction motors, AC series motors, Fractional kilo Watt(FKW) motors

Topic No.32: Selection of motors for Domestic Appliances

Unit No.7 Electric Traction

Topic No.33: Advantages of electric traction over other types of traction, Different systems of electric traction, DC and AC systems

Topic No.34: Diesel electric system, Types of services – urban, sub-urban, and main line and their speed-time curves, Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector- pentagraph

Topic No.35: Factors affecting scheduled speed

Topic No.36: Electrical block diagram of an electric locomotive with description of various equipment and accessories used, Types of motors used for electric traction, Power supply arrangements

Topic No.37: Starting and braking of electric locomotives, Introduction to EMU and metro railways

Topic No.38: Train Lighting Scheme

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
5	-	-	25	-	100	3	-	-	125

RECOMMENDED BOOKS

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

S. No.	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Illumination	12	15
2	Electric Heating	10	15
3	Electric Welding	8	10
4	Electrolytic Processes	10	10
5	Electrical Circuits used in Refrigeration, Air conditioning and Water coolers	10	10
6	Electric Drives	20	25
7	Electric Traction	10	15
	Total	**80**	**100**

Subject: Electrical Power–II (Theory) **Subject Code: 120963**

Detailed Contents

Unit No.1 Faults

Topic No.1: Common type of faults in both overhead and underground systems, symmetrical/unsymmetrical faults
Topic No.2: Single line to ground fault, double line to ground fault, 3-phase to ground fault open circuit, simple problems relating to fault finding

Unit No.2 Switch Gears

Topic No.3: Purpose of protective gear. Difference between switch, isolator and circuit breakers
Topic No.4: Function of isolator and circuit breaker. Making capacity and breaking capacity of circuit breaker
Topic No.5: Circuit breakers. Types of circuit breakers, bulk and minimum oil circuit breakers, air SF6 circuit breakers
Topic No.6: Principles of Arc extinction blast circuit breakers in OCB and ACB
Topic No.7: Constructional features of OCB, ACB, and their working, Method of arc extinction
Topic No.8: Miniature circuit breakers MCB, MCCB, ELCB, for distribution and transmission System

Unit No.3 Protection Devices

Topic No.9: Fuses; function of fuse. Types of fuses, HV and LV fuses, rewire-able, cartridge,HRC
Topic No.10: Earthing : purpose of earthing , method of earthing, Equipment earthing, Substation earthing
Topic No.11: System earthing as per Indian Electricity rules. Methods of reducing earth resistance .
Topic No.12: Relays: - types of relays. Electromagnetic and thermal relays, their construction and working
Topic No.13: Induction type over-current, earth fault relays, instantaneous over current relay
Topic No.14: Directional over-current, differential relays, their functions
Topic No.15: Distance relays, their functions
Topic No.16: Idea of static relays and their applications

Unit No.4 Protection Scheme

Topic No.17: Relays for generator protection
Topic No.18: Relays for transformer, protection including Buchholtz relay protection
Topic No.19: Protection of feeders and bus bars, over current and earth fault protection
Topic No.20: Distance protection for transmission system
Topic No.21: Relays for motor protection

Unit No.5 Over-voltage Protection

Topic No.22: Protection of system against over voltages, causes of over voltages, utility of ground wire
Topic No.23: Lightning arrestors, rod gap, horn gap, metal oxide type
Topic No.24: Transmission Line and substation protection against over-voltages and lightning

Unit No.6 Various Types of Tariffs

Topic No.25: Concept of Tariffs
Topic No.26: Block rate, flat rate, maximum demand and two part tariffs
Topic No.27: Simple problems

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4	-	-	25	-	100	3	-	-	125

RECOMMENDED BOOKS

1. Testing, Commissioning , Operation and Maintenance of Electrical Equipment by S Rao, Khanna Technical Publication, New Delhi
2. Electrical Power – II by SK Sahdev, Uneek Publications, Jalandhar (Pb)
3. Electrical Power Systems by CL Wadhwa, Wiley Eastern Ltd., New Delhi

4. Textbook of Electrical Technology by BL Theraja, S Chand and Co., New Delhi
5. Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

S.No.	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Faults	6	10
2	Switch Gears	16	25
3	Protection Devices	16	25
4	Protection Schemes	10	15
5	Over Voltage Protection	10	15
6	Various Types Of Tariffs	06	10
	Total	**64**	**100**

Subject: Electrical Power–II (Practical) **Subject Code: 120963(P)**

LIST OF PRACTICALS

Visit to power station/sub-station for the conduct of following practical work:

1. Testing of the dielectric strength of transformer oil and air
2. Study of different types of circuit breakers and isolators
3. Plot the time current characteristics of over current relay
4. Power measurement by using CTs and PTs
5. Earthing of different equipment/Main Distribution Board and Energy Meter Box
6. Perform the overload and short circuit test of MCB as per IS specifications
7. Plot the time-current characteristics of Kit-Kat fuse wire
8. Taking reading of current on any LT line with clip on meter

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
-	-	2	-	25	-	-	50	-	75

Subject: Programmable Logic Controllers and Micro-Controllers (Theory) **Subject Code: 120962**

Detailed Contents

Unit No.1 Introduction to PLC

Topic No.1: What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays.
Topic No.2: Advantages of PLCs over electromagnetic relays
Topic No.3**: Different** programming languages, PLC manufacturer

Unit No. 2 Working of PLC

Topic No.4: Basic operation and principles of PLC, Architectural details processor
Topic No.5: Memory structures, I/O structure, Programming terminal, power supply

Unit No.3 Instruction Set

Topic No.6: Basic instructions like latch, master control self holding relays, Timer instruction like retentive timers, resetting of timers.
Topic No.7: Counter instructions like up counter, down counter, resetting of counters.
Topic No.8: Arithmetic Instructions (ADD, SUB, DIV, MUL etc.)
Topic No.9: MOV instruction, RTC (Real Time Clock Function)
Topic No.10: Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal

Unit No.4 Ladder Diagram Programming

Topic No.11: Programming based on basic instructions, Force on a conductor placed in the magnetic field
Topic No.12: timer, counter, sequencer, comparison instructions using ladder program.

Unit No.5 Applications of PLCs

Topic No.13: Assembly, Packaging, Process controls, Car parking, Doorbell operation, Traffic light control, Microwave Oven
Topic No.14: Washing machine, Motor in forward and reverse direction, Star-Delta, DOL Starters, Paint Industry, Filling of Bottles, Room

Unit No.6 Micro Controller Series (MCS)-51 Over View

Topic No.15: Pin details, I/O Port structure, Memory Organization, Special function registers

Unit No.7 Instruction Set Addressing Modes

Topic No.16: Timer operation, Serial Port operation, interrupts

Unit No.8 Assembly language programming

Topic No.17: Assemblers and Compilers, Assembler Directives

Unit No.9 Design and Interface

Topic No.18: Examples like: keypad interface, 7- segment interface
Topic No.19: LCD, stepper motor. A/D, D/A, RTC interface

Unit No.10 Introduction of PIC Micro controllers

Unit No.11 Application of Micro controllers

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4	-	-	25	-	100	3	-	-	125

RECOMMENDED BOOKS

1) Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA
2) Introduction to PLCs by Gary Dunning. McGraw Hill
3) Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh
4) Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and SK Sahdev by Uneek Publications, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

S.No.	Topic	Time Allotted (Hrs)	Marks Allocation (%)
1	Introduction to PLC	6	10
2	Working of PLC	8	15
3	Instruction set	8	10
4	Ladder Diagram Programming	6	10
5	Applications of PLCs	4	5
6	Micro controller sense (MCS)-51 Over View	10	15
7	Instruction Set Addressing Modes	6	10
8	Assembly Language Programming	6	10
9	Design and Interface	4	5
10	Introduction of PLC Micro Controllers	4	5
11	Application of Micro Controllers	2	5
	Total	**64**	**100**

Subject: Programmable Logic Controllers and Micro-Controllers (Practical) **Subject Code: 120962(P)**

LIST OF PRACTICALS

1. Components/sub-components of a PLC, Learning functions of different modules of a PLC system
2. Practical steps in programming a PLC (a) using a Hand held programmer (b) using computer interface
3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax
4. Basic logic operations, AND, OR, NOT functions
5. Logic control systems with time response as applied to clamping operation
6. Sequence control system e.g. in lifting a device for packaging and counting
7. Use of PLC for an application (teacher may decide)

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
-	-	2	-	25	-	-	50	3	75

Subject: Energy Management (Theory) **Subject Code: 030965A**

Detailed Contents

Unit No.1 Energy Management

Topic No.1: Overview of energy management, Need for energy conservation, Environmental Aspects
TopicNo.2: Need for energy conservation with brief description of oil and coal Crisis, Alternative sources of energy
Topic No.3: Energy efficiency- its significance

Unit No.2 Energy Conservation

Topic No.4: Energy conservation in Domestic sector- Lighting, Home appliances
Topic No.5: Energy conservation in Industrial sector-Industrial lighting, Distribution system, Motor Pumps, Fans, Blowers etc.
Topic No.6: Energy conservation in Agriculture sector Tube well pumps, Diesel-Generating sets.
Topic No.7: Macro Level approach for energy conservation at design stage.

Unit No.3 Energy Efficient Devices

Topic No.8: Energy efficient technology an overview - merits, Demerits, construction of LCD, LED, CFL etc.
Topic No.9: Need for energy efficient devices, Initial cost versus life cycle, cost analysis on life cycle basis
Topic No.10: Energy efficient motors as compared to standard motors.
Topic No.11: BIS standards for energy efficient motors, BIS salient design Features,
Topic No.12: Efficiency as a function of load, safety margins
Topic No.13: Energy efficient lighting system different sources, lumens/watt, LEDs, role of voltage on efficiency
Topic No.14: Distribution system- Optimum cable size, amorphous core transformer, role of Power factor, use of compensating capacitors manual and automatic, location of Capacitors
Topic No.15: Calculation of size of capacitor, shunt capacitors, series capacitors
Topic No.16: Construction and design characteristics of energy efficient motors. Losses in energy efficient motors

Unit No.4 Energy Audit

Topic No.17: Energy audit methodology, Efficiency of energy conversion processes, monitoring system
Topic No.18: Specific energy consumption –three pronged approach, fine tuning, Technical up gradation, avoidable losses.
Topic No.19: Case studies of energy audit of distribution system, AC motors, Industries, audit activities.

Unit No.5 Environmental Impact Assessment

Topic No.20: Need for environmental impact assessment – definition of EIA, history of EIA
Topic No.21: Standard format for assessment and its completion, Evaluation of the assessment.

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4	-	-	25	-	100	3	-	-	125

RECOMMENDED BOOKS:

1. Manual on Energy Efficiency at Design Stage, CII Energy Management Cell.
2. Manual on Energy Efficiency in Pumping System, CII Energy Management Cell.
3. Manual on Variable Speed Drives for Energy Efficiency CII Energy Management Cell.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

S.No.	Topic	Time Alloted(Hrs)	Marks Allocation (%)
1	Energy Management	08	15
2	Energy Conservation	14	25
3	Energy Efficient Devices	20	30
4	Energy Audit	16	25
5	Environmental Impact Assessment	06	5
	Total	**64**	**100**

Subject: ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT (Theory) **Subject Code: 121065**

Detailed Contents

Unit No.1 Introduction

Topic No.1: Concept /Meaning & its need, Qualities and functions of entrepreneur and barriers in Entrepreneurship
Topic No.2: Sole proprietorship and partnership forms of business organizations
Topic No.3: Schemes of assistance by entrepreneurial support agencies at National, State, District level: NRDC, DC, MSME, SIDBI, NABARD, Commercial Banks, SFC's, TCO, KVIB, DIC

Unit No.2 Market Survey and Opportunity Identification

Topic No. 4: Scanning of business environment
Topic No. 5: Salient features of National and State industrial policies and resultant business opportunities
Topic No. 6: Types and conduct of market surve , Assessment of demand and supply in potential areas of growth.
Topic No. 7: Identifying business opportunity, Considerations in product selection

Unit No.3 Project report Preparation

Topic No. 8: Preliminary project report, Detailed project report including technical, economic and market feasibility
Topic No.9: Common errors in project report preparations
Topic No.10: Exercises on preparation of project report

Unit No.4 Introduction to Management

Topic No.11: Definitions and importance of management, Functions of management: Importance and organizing, staffing, directing and controlling
Topic No.12: Principles of management (Henri Fayol, Concept and structure of an organization, Types of industrial organizations

Unit No.5 Leadership and Motivation

Topic No.13: Definition and Need of leadership, Qualities and functions of a leader
Topic No. 14: Manager Vs leader, Types of leadership, Definitions and characteristics of motivation
Topic No.15: Factors affecting motivation, Theories of motivation (Maslow, Herzberg)

Unit No.6 Management Scope in Different Areas

Topic No.16: Human Resource Management, Material and Store Management, Marketing and sales
Topic No.17: Financial Management

Unit No.7 Miscellaneous Topics

Topic No.18: Customer Relation Management (CRM), total Quality Management (TQM)
Topic No.19: Intellectual Property Right (IPR)

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
4	-	-	25	-	100	3	-	-	125

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd.,New Delhi
3. Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

S.No.	Topic	Time Alloted (Hrs)	Marks Allocation (%)
1	Introduction	14	28
2	Market Survey and Opportunity Identification	10	20
3	Project report Preparation	08	16
4	Introduction to Management	04	10
5	Leadership and Motivation	03	06
6	Management Scope in Different Areas	06	14
7	Miscellaneous Topics	03	06
	Total	**48**	**100**

Subject: Major Project Work (Practical) **Subject Code: MPW**

Suggestive criteria for assessing student performance

S.No.	Topic	MAX. MARKS	RATING SCALE				
1	Selection of project assignment	10	10	8	6	4	2
2	Planning and execution of considerations	10	10	8	6	4	2
3	Quality of performance	20	20	16	12	8	4
4	Providing solution of the problems or production of final product	20	20	16	12	8	4
5	Sense of responsibility	10	10	8	6	4	2
6	Self expression/Communication skills	5	5	4	3	2	1
7	Inter personal skills/human relations	5	5	4	3	2	1
8	Report with skills	10	10	8	6	4	2
9	Viva Voce	10	10	8	6	4	2
	Total	**100**	**100**	**80**	**60**	**40**	**20**

STUDY SCHEME			EVALUATION SCHEME						Total Marks
			Internal Assessment		External Assessment (Examination)				
Hrs/week			Theory	Practical	Written Paper		Practical		
L	T	P	Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
-	-	2	-	100	-	-	100	-	200