6.1 UTILIZATION OF ELECTRICAL ENERGY

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RATIONALE

This subject assumes importance in view of the fact that an electrical technician has to work in a wide spectrum of activities wherein he has to make selection from alternative schemes making technical and economical considerations; e.g. to plan and design an electrical layout using basic principles and handbooks, to select equipment, processes and components in different situations. The contents have been designed keeping the above objectives in view. Besides giving him basic knowledge in the topics concerned, attempts have been made to ensure that the knowledge acquired is applied in various fields as per his job requirements. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize the students with the new developments in different areas

DETAILED CONTENTS

1. Illumination: (12 hrs)

    1.1 Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light

    1.2 Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux.

    1.3 Laws of illumination – simple numericals

    1.4 Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour sodium lamp, fluorescent lamp, halogen lamp, neon lamp, compact filament lamp(CFL), LED Lamp, comparison of incandescent, fluorescent, CFL & LED

    1.5 Calculation of number of light points for interior illumination, calculation of illumination at different points, considerations involved in simple design problems. Illumination schemes; indoor and outdoor illumination levels

    1.6 Main requirements of proper lighting; absence of glare, contrast and shadow

    1.7 Awareness about time switches, street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.

2. Electric Heating (10 hrs)

    2.1 Advantages of electrical heating

2.2 Heating methods:

2.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances, thermostat control circuit

2.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications

2.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace

2.2.4 Dielectric heating, applications in various industrial fields

2.2.5 Infra-red heating and its applications (construction and working of two appliances)

2.2.6 Microwave heating and its applications (construction and working of two appliances)

2.2.7 Solar Heating

2.3 Calculation of resistance heating elements (simple problems)

3. Electric Welding: (8 hrs)

3.1 Advantages of electric welding

3.2 Welding method

3.2.1 Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment

3.2.2 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method and their applications. Power supply requirement. Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper

4. Electrolytic Processes: (10 hrs)

4.1 Need of electro-deposition

4.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing

4.3 Equipment and accessories for electroplating

4.4 Factors affecting electro-deposition

4.5 Principle of galvanizing and its applications

4.6 Principles of anodizing and its applications

4.7 Electroplating of non-conducting materials

4.8 Manufacture of chemicals by electrolytic process

4.9 Power supplies for electroplating

5. Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers: (10 hrs)

5.1 Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants

5.2 Description of Electrical circuit used in

a) Refrigerator,
b) Air-conditioner, and
c) Water cooler

6. Electric Drives: (20 hrs)

6.1 Advantages of electric drives

6.2 Characteristics of different mechanical loads

6.3 Types of motors used as electric drive

6.4 Electric braking

6.4.1 Plugging
6.4.2 Rheostatic braking
6.4.3 Regenerative braking

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

6.6 Examples of selection of motors for different types of domestic loads

6.7 Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel.

6.8 Specifications of commonly used motors e.g. squirrel cage motors, slip ring induction motors, AC series motors, Fractional kilo Watt(FKW) motors

6.9 Selection of motors for Domestic Appliances

7. Electric Traction: (10 hrs)

7.1 Advantages of electric traction over other types of traction.
7.2 Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub-urban, and main line and their speed-time curves
7.3 Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector-pentagraph
7.4 Factors affecting scheduled speed
7.5 Electrical block diagram of an electric locomotive with description of various equipment and accessories used.
7.6 Types of motors used for electric traction
7.7 Power supply arrangements
7.8 Starting and braking of electric locomotives
7.9 Introduction to EMU and metro railways

7.10 Train Lighting Scheme

Note: Students should be taken for visits to nearest electrified railway track and railway station to study the electric traction system.

INSTRUCTIONAL STRATEGY

It is desired to give ample practical examples in the class while teaching this subject. Teacher must supplement his/her classroom teaching with aids such as models, charts, and video films from time to time. This subject requires demonstrations and exposure to actual workplace/industry/field. For this purpose, the subject teacher should do advance planning for visits/studies related to each topic in consultation with HOD and Principal of the polytechnic/institution.

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

3. Utilization of Electrical Energy by Sahdev, Uneek Publication, Jalandhar

4. A Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi

5. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi

6. Utilization of Electrical Energy by OS Taylor, Pitman Publications

7. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

Sr. 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**

6.2 PROGRAMMABLE LOGIC CONTROLLERS & MICROCONTROLLERS

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RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in all industries for efficient control operations. A diploma holder in industry is called upon to design , modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

Microcontrollers have also assumed great significance in the field of electronics and comma goods industry, and thus considered to be an important field of engineering. This subject aims to expose the students to both of these and give them adequate knowledge of these topics.

DETAILED CONTENTS

1. Introduction to PLC (06 hrs)

   What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc.

.

2. Working of PLC (08 hrs)

   - Basic operation and principles of PLC
   - Architectural details processor
   - Memory structures, I/O structure
   - Programming terminal, power supply

3. Instruction Set (08 hrs)

   - Basic instructions like latch, master control self holding relays.
   - Timer instruction like retentive timers, resetting of timers.
   - Counter instructions like up counter, down counter, resetting of counters.
   - Arithmetic Instructions (ADD,SUB,DIV,MUL etc.)
   - MOV instruction
   - RTC(Real Time Clock Function)

- Comparison instructions like equal, not equal, greater, greater than equal, less than, less than equal

4. Ladder Diagram Programming (06 hrs)

Programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.

5. Applications of PLCs (04 hrs)

- Assembly
- Packaging
- Process controls
- Car parking
- Doorbell operation
- Traffic light control
- Microwave Oven
- Washing machine
- Motor in forward and reverse direction
- Star-Delta, DOL Starters
- Paint Industry
- Filling of Bottles
- Room Automation

6. Micro Controller Series (MCS)-51 Over View (10 hrs)

- Pin details
- I/o Port structure
- Memory Organisation
- Special function registers

7. Instruction Set Addressing Modes (06 hrs)

- Timer operation
- Serial Port operation
- Interrupts

8. Assembly language programming (06 hrs)

- Assemblers and Compilers
- Assembler Directives

9. Design and Interface (04 hrs)

Examples like: keypad interface, 7- segment interface, LCD, stepper motor. A/D, D/A, RTC interface.

10. Introduction of PIC Micro controllers (04 hrs)

11. Application of Micro controllers (02 hrs)

LIST OF PRACTICALS

PLCs

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)

Micro Controllers

1. Familiarization with a study of Architecture of 8085 kit, basic sub systems and input output connectors, functions keys on micro controllers kit
2. Familiarization of Micro Controllers (8051) kit
3. Testing of general input/output on Micro controller board
4. Development of Electrical , Instrumentation applications using 8051 micro-controller

INSTRUCTIONAL STRATEGY

Introduce the subject and make the students familiar with applications of PLCs and Microcontrollers. The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, be designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work.

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
5) Module on "Allen Bradlag PIC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
6) Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh
7) The 8051 Micro controller by 1 Scot Mackenzie, Prentice Hall International, London
8) The 8051 Micro controllers Architecture, programming and Applications by Ayala; Penram International
9) Process Control Instrumentation Technology by Johnson, Curits; EE Edition, Prentice Hall of India, New Delhi
10) Microcontrollers by Ayala
11) Microcontrollers by Mazidi
12) Microcontrollers by Neil Makanzie
13) Microcontrollers by Deshmukh

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. 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 PIC Micro controllers	4	5
11	Application of Micro controllers	2	5
	Total	**64**	**100**

6.3 ELECTRICAL POWER-II

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RATIONALE

In view of the complexities associated with the modern interconnected power stations, the responsibilities and the job requirements of a diploma pass out have become more complex than what they used to be earlier. He is required to work with modern electrical equipment and maintain reliability of supply. The course is designed to understand the concepts, principles involved in the construction and working of generating stations and protective switch gear system so that one can handle, install, maintain them and also take decisions at his/her level in different situations. The teaching of this subject requires reinforcement in the form of visits to substations, power stations and well designed laboratory experiences. A practice-oriented approach to the teaching of this subject is suggested.

DETAILED CONTENTS

1. Faults: (6 hrs)

   Common type of faults in both overhead and underground systems, symmetrical/ unsymmetrical faults. Single line to ground fault, double line to ground fault, 3-phase to ground fault open circuit, simple problems relating to fault finding.

2. Switch Gears (16 hrs)

   2.1 Purpose of protective gear. Difference between switch, isolator and circuit breakers. Function of isolator and circuit breaker. Making capacity and breaking capacity of circuit breaker (only definition)

   2.2 Circuit breakers. Types of circuit breakers, bulk and minimum oil circuit breakers, air SF_6 circuit breakers

   2.3 Principles of Arc extinction blast circuit breakers in OCB and ACB, Constructional features of OCB, ACB, and their working, Method of arc extinction

   2.4 Miniature circuit breakers MCB, MCCB, ELCB, for distribution and transmission system (Descriptive)

3. Protection Devices (16 hrs)

   3.1 Fuses; function of fuse. Types of fuses, HV and LV fuses, rewire-able, cartridge, HRC

   3.2 Earthing: purpose of earthing, method of earthing, Equipment earthing, Substation earthing, system earthing as per Indian Electricity rules. Methods of reducing earth resistance.

3.3 Relays:

a) Introduction - types of relays. Electromagnetic and thermal relays, their construction and working
b) Induction type over-current, earth fault relays, instantaneous over current relay
c) Directional over-current, differential relays, their functions
d) Distance relays, their functions
e) Idea of static relays and their applications

4. Protection Scheme (10 hrs)

4.1 Relays for generator protection
4.2 Relays for transformer, protection including Buchholtz relay protection
4.3 Protection of feeders and bus bars, Over current and earth fault protection.
4.4 Distance protection for transmission system
4.5 Relays for motor protection

5. Over-voltage Protection (10 hrs)

5.1 Protection of system against over voltages, causes of over voltages, utility of ground wire
5.2 Lightning arrestors, rod gap, horn gap, metal oxide type.
5.3 Transmission Line and substation protection against over-voltages and lightning

6. Various Types of Tariffs: (6 hrs)

6.1 Concept of Tariffs
6.2 Block rate, flat rate, maximum demand and two part tariffs
6.3 Simple problems

Note: Students may be taken to various Sub-stations/ Grid Stations. Students must be familiarized with present tariff system employed by State Electricity Boards.

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

INSTRUCTIONAL STRATEGY

Since this is a descriptive and practice oriented subject, it is suggested that visits to different types of generating stations and substations be arranged and various equipment, accessories and components explained to the students. The protection schemes should be shown at the site and engineers from field may be invited for delivering expert lectures on these topics. Help of Video Films may be taken to explain the layout; construction and working of different power equipment.

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

6. A Course in Electrical Power by ML Soni, PV Gupta and Bhatnagar, Dhanpat Rai & Sons, New Delhi

7. Principles of Power Systems by VK Mehta, S Chand and Co., New Delhi

8. Preventive Maintenance of Electrical Apparatus by SK Sharotri, Katson Publishing House, Ludhiana

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPERSETTER

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

Elective – II
6.4(a) MODERN ELECTRIC TRACTION

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RATIONALE

Now a days electrical energy finds one of its major application is in electric traction besides diesel electric locomotives. An electrical engineering diploma holder is required to have elementary knowledge of electric drives and systems used in traction and their accelerating and braking arrangements. This subject deals with the modern electric traction systems and practices.

DETAILED CONTENTS

1. Introduction (4 hrs)

   1.1. Electric Traction System.

   1.2. Historical background of track electrification in India.

   1.3. Advantages over other system

   1.4. Types of electric traction systems

   1.5. Choice of traction system in India

2. System of Track Electrification (6 hrs)

   2.1 Single phase low frequency system.

   2.2 Three phase low frequency system

   2.3 Composite System

   2.4 Disadvantages of Single phase to D.C. System

   2.5 Comparison between pure A.C. and D.C system.

3. Track Mechanics (8 hrs)

   3.1 Types of services (Urban, Suburban and Mainline)

   3.2 Speed time curve

   3.3 Tractive effort and traction effort speed characteristics

   3.4 Power of traction motor

   3.5 Specific energy consumption

   3.6 Mechanics of train movement, co-efficient

3.7 Factors affecting slip.

3.8 Simple numerical problems.

4. Power Supply arrangement (8 hrs)

4.1 Constituents of Power supply system i.e. substation

4.2 Sectioning and paralleling post.

4.3 Subsection and post

4.4 Sub-sectioning post and elementary sections

4.5 Major control posts or switching substations

4.6 Major equipment of substations.

5. Equipment used in and outside the Locomotive (8 hrs)

5.1 Block diagram of a Locomotive
5.2 Overhead equipment
5.3 Section Insulator
5.4 Polygon OHE
5.5 Supporting structure
5.6 Current collector
5.7 Circuit breaker
5.8 Tap changer
5.9 Transformer
5.10 Rectifier connections
5.11 Smoothing reactors

6. Traction Motors and Traction Motor Control (8 hrs)

6.1 Desirable characteristic of traction motors.

6.2 Comparative study of characteristic of Induction motors and d.c. series motors

6.3 Linear induction motors and their suitability for traction applications.

6.4 Series parallel control of traction motors.

6.5 Advantages of series parallel control

6.6 Simple numerical problems

7. Braking (8 hrs)

7.1 Requirements of braking system.

7.2 Types of brakes (Mechanical, hydraulic, magnetic and eddy current)

7.3 Electrical braking – plugging, rheostatic and regenerative braking.

8. Train Lighting (8 hrs)

8.1 Systems of train lighting

8.2 Special requirements of train lighting

8.3 Single Battery system

8.4 Double Battery parallel block systems

8.5 Principal equipment of Double Battery system

8.6 Modified Train Lighting System

8.7 Silicon Blocker Rectifier

8.8 End on generation.

9. Railway Coach Air-conditioning (6 hrs)

9.1 Electrical equipment for power generation and accessories for control of air conditioning equipment.

- Motor generator set
- Star-delta starter and pre-cooling plug socket
- Compressor – condenser and air conditioning unit motors
- Main control panel.
- Batteries

9.2 Circuit explanation of schematic diagram for air conditioning equipment.

9.3 Starting of plant when coach is stationary and no ac supply is available.

9.4 Starting the plant when coach is running and the generator is generating.

INSTRUCTIONAL STRATEGY

Since the subject is field oriented and there is no laboratory arrangement in polytechnics, the students should be taken to locomotive yard, railway workshops and shown the actual working of the system.

RECOMMENDED BOOKS

1. Art and Science of utilization of electrical energy by H. Partab, Dhanpat Rai and Sons, Delhi

2. Modern Electric Traction by Partab, Dhanpat Rai and Sons, Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	4	5
2.	System of Track Electrification	6	10
3.	Track Mechanics	8	10
4.	Power Supply Arrangement	8	10
5.	Equipment used in and outside the Locomotive	8	15
6.	Traction Motors and Traction Motor Control	8	15
7.	Braking	8	10
8.	Train Lighting	8	15
9.	Railway Coach Air-Conditioning	6	10
Total		**64**	**100**

Elective-II
6.4(b) OPTICAL FIBER COMMUNICATION

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RATIONALE

Progressing from communication over copper wire to today's fiber optic communication, we have increased our ability to transmit larger information, more quickly covering even longer distances. This has expanded our boundaries and it finding a good slot in communication system. It has gradually replaced the old technology of electrical communication. Operational fiber optical systems are now in common and new installations and applications appear continually. The growth is expected to continue for many years. Basic concepts and techniques of optical fiber communication have been dealt with in this subject.

DETAILED CONTENTS

1. Introduction (8 hrs)

   Historical perspective, basic communication systems, optical frequency range, advantages optical fiber communication, application of fiber optic communication

2. Light Wave Fundamentals (10 hrs)

   Nature of light, acceptance angle and numerical aperture, electromagnetic waves, dielectric wave guide, modes in planar guide, dispersion and distortion in wave guide.

3. Optical Fiber Waveguides (10 hrs)

   Fiber structure, step-index fiber, graded – index fiber, attention, modes in step, index and graded index fibers, pulse dispersion and information rate in optical fibers, construction of optical fibers, optical fiber cables.

4. Light Sources (10 hrs)

   Light emitting diodes (LEDs), Operating characteristics of LEDs, Laser principles, different types of lasers, laser diodes, operating characteristics of laser-diodes, distributed feedback laser diode, optical amplifier, fiber laser.

5. Light Detectors (8 hrs)

   Principles of photodetection, photomultiplier semiconductor photodiode, PIN diode and Avalanche Photo Diode (APD), Comparison between PIN diode and APD.

6. Optical Fiber Joints (8 hrs)

Fiber, alignment and joint loss, fiber end preparation, splices, connectors, source coupling.

7. Distribution Networks and Fiber Components (10 hrs)

Distribution network, directional couplers, star couplers, switches, fiber optical isolators, attenuators, wave length division multiplexing.

INSTRUCTIONAL STRATEGY

This subject gives the complete knowledge of optical fibre communication techniques. The teacher should make the students aware about the historical development, optical sources and optical fibre system in addition to applications of optical fibre. Since this subject deals with theory and practical. The theory should be re-enforced by visit to sites and industries like HFCL having optical fiber installations in addition to practical work in the laboratory.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	8	10
2.	Light Wave Fundamentals	10	15
3.	Optical Fiber Wave guides	10	15
4.	Light Sources	10	15
5.	Light Detectors	8	15
6.	Optical Fiber Joints	8	15
7.	Distribution Networks and Fiber Components	10	15
Total		**64**	**100**

RECOMMENDED BOOKS

1. Optical Fiber Communication by Joseph. C. Palais, Pearson Education Publications, Published by Addison Wesley hangman (Singapore) Pte. Ltd., Delhi.
2. Optical Fiber Communication and its Applications by S.C.Gupta, Prentice Hall India – New Delhi.
3. Optical Fibers Communication by SK Sahdev and VK Sangar, Uneek Publications, Jalandhar

4. Fiber-Optic Communication Systems by G.P. Agrawal; John Wiley and Sons, New Delhi

5. Optical Fibers Communication by John M. Senior, Prentice Hall India, New Delhi.

6. Optical Communication Systems by J. Gower; Prentice Hall India, New Delhi.

7. Optical Fiber Communication by Gerd Keiser; Mc Graw Hill, International Editions.

8. Optical Communication: Components and Systems by Franz, J.H, Narosa Publishing House Pvt. Ltd. Darya Ganj New Delhi

9. Technician Guide to Fiber-Optics by Donald J Sterling, Vikas Publishing House Pvt Ltd, Jangpura, New Delhi

6.5 BASICS OF MANAGEMENT

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RATIONALE

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

DETAILED CONTENTS

1. Principles of Management (06 hrs)

   1.1. Introduction, definition and importance of management.

   1.2. Functions of Management

   Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling

   1.3. Concept and Structure of an organization

   Types of industrial organization
   a) Line organization
   b) Functional organization
   c) Line and Functional organization

   1.4. Hierarchical Management Structure

   Top, middle and lower level management

   1.5. Departmentalization

   Introduction and its advantages.

2. Work Culture (06 hrs)

   2.1. Introduction and importance of Healthy Work Culture in organization

   2.2. Components of Culture

   2.3. Importance of attitude, values and behaviour

   Behavioural Science – Individual and group behaviour

2.4. Professional ethics – Concept and need of Professional Ethics

3. Leadership and Motivation (06 hrs)

3.1. Leadership

a) Definition and Need of Leadership
b) Qualities of a good leader
c) Manager vs. leader

3.2. Motivation

a) Definition and characteristics of motivation
b) Factors affecting motivation
c) Maslow's Need Hierarchy Theory of Motivation

3.3. Job Satisfaction

4. Legal Aspects of Business: Introduction and need (06 hrs)

4.1. Labour Welfare Schemes

a) Wage payment : Definition and types
b) Incentives: Definition, need and types

4.2. Factory Act 1948

4.3. Minimum Wages Act 1948

5. Management Scope in different Areas (12 hrs)

5.1. Human Resource Development

a) Introduction and objective
b) Manpower Planning, recruitment and selection
c) Performance appraisal methods

5.2. Material and Store Management

a) Introduction, functions and objectives of material management
b) Purchasing: definition and procedure
c) Just in time (JIT)

5.3. Marketing and Sales

a) Introduction, importance and its functions
b) Difference between marketing and selling
c) Advertisement- print media and electronic media

d) Market-Survey and Sales promotion.

5.4. Financial Management – Introduction

a) Concept of NPV, IRR, Cost-benefit analysis

b) Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund

5.5 Maintenance Management

a) Concept
b) Preventive Maintenance

6. Miscellaneous topics (12 hrs)

6.1. Customer Relationship Management (CRM)

a) Definition and Need
b) Types of CRM
c) Customer satisfaction

6.2. Total Quality Management (TQM)

a) Inspection and Quality Control
b) Concept of Quality Assurance
c) TQM

6.3. Intellectual Property Rights (IPR)

a) Introduction, definition and its importance
b) Infringements related to patents, copyright, trade mark

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different functions related to management. Some of the topics may be taught using question answer, assignment or seminar method. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organizations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. Principles of Management by Philip Kotler TEE Publication

2. Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.
3. Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co., 7, West Patel Nagar , New Delhi.
4. Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.
5. Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.
6. Essentials of Management by H Koontz, C O' Daniel , McGraw Hill Book Company, New Delhi.
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by DD Sharma, Sultan Chand and Sons, New Delhi.
9. Intellectual Property Rights and the Law by Dr. GB Reddy.
10. Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.
11. Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi
12. Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr No	Topic	Time Allotted (hrs)	Marks Allotted (%)
1.	Principles of Management	06	15
2.	Work Culture	06	10
3.	Leadership and Motivation	06	15
4.	Legal Aspects of Business: Introduction and Need	06	10
5.	Management Scope in different Areas	12	25
6.	Miscellaneous Topics	12	25
Total		**48**	**100**

6.6 MAJOR PROJECT WORK

L	P
-	10

Project work aims at developing skills in the students whereby they apply in totality the knowledge and skills gained through the course in the solution of a practical problem undertaken as a project work. The students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or be given project assignment at least two to three months in advance. The project work identified in collaboration with industry/field organization should be preferred.

Each teacher is expected to guide the project work of 5-6 students at a time. The project assignments may consist of:

a) Projects related with repair and maintenance of machine parts
b) Estimating and costing projects
c) Design of components/ parts/ jigs / fixtures
d) Projects related to quality control
e) Project work related to increasing productivity
f) Project connected with work study
g) Projects relating to erection, installation, calibration and testing
h) Projects related to wastage reduction
i) Projects related to energy audit

For Students of Electrical Engineering Diploma Programme the project work can be grouped under the following four groups. A number of projects have been mentioned under each section. A student should take at least two projects both of which should not be from the same group. If more than two projects are taken to make up a total of 256 hours, then more than 1 may be taken from the same group as long as at least two groups are covered. A student is read to choose one project from each section.

Report for all the four project should be prepared and will give a seminar. The same will be assessed for internal and external assessment.

NOTE: Any one from each section:

SECTION A

1.1 **Electrical Machines and Equipment:**

1.1.1 Design and Construction of a small transformer (100 VA to 1 kVA)

1.1.2 Construction of hot air blower

1.1.3 Design and Fabrication of Automatic curtain operator

1.1.4 Fabrication of Automatic Star-Delta starter

1.1.5 Construction of Automatic Water level controller

1.1.6 Construction of Choke for fluorescent tubes

1.1.7 Design and construction of fan regulators (inductance type)

1.1.8 Design and construction of fan regulators (Resistance type)

1.1.9 Design and construction of loading rheostats

1.1.10 Design and construction of Desert coolers/room coolers

1.1.11 Rewinding of single phase Electric Motor up to 1 HP

1.1.12 Rewinding of motors of 3 phase upto 5 HP

1.1.13 Design and construction of Geyser

1.1.14 Rewinding of motors of small domestic appliances(exhaust fan/ceiling fan)

1.1.15 Erection/installation and commissioning of rotating electrical machine

1.1.16 Fault detection and repair of electrical/electronic instruments

1.1.17 Design and assembly of contactor control circuit for various applications

SECTION B

1.2 **Electrical Power:**

1.2.1 Drawing, estimating and costing of electrical installation of the institution from supplier's pole to the institution distribution board.

1.2.2 Drawing, estimating and costing of electrical installation of a workshop having a given number of electrically operated appliances/machines.

1.2.3 To study the laying of underground distribution cable for a small colony starting from main distribution pole

1.2.4 To study the erection erect a 5 pole span overhead line for a small distance for distribution of electrical energy. To energize it and prepare list of material and cost estimates.

1.2.5 Energy audit for the workshop of your institution and to suggest remedies to have low Electricity Bill

1.2.6 To provide a service connection to a consumer’s premises for domestic purposes

1.2.7 To survey the load of given area in a village, small colony, calculate the effective load and find out the sizes of the cables/conductors for the proposed distribution system

1.2.8 Designing of light and fan scheme for a institutional or commercial building

1.2.9 To study the augmentation of a nearby pole mounted sub station

1.2.10 To prepare a proposal for substation of your institution, calculating the total load (estimating and costing)

SECTION C

1.3 Electronics Based Projects:

Fabrication of:

1.3.1 Voltage Stabilizer for refrigerator, air-conditioner

1.3.2 Emergency light using SCR

1.3.3 Power amplifier

1.3.4 Low cost intercom for home

1.3.5 Analog computer

1.3.6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906

1.3.7 Automatic battery charger using SCR

1.3.8 Digital Clock

1.3.9 FM Radio Receiver

1.3.10 Burglar Alarm

1.3.11 Fabrication of UPS

1.3.12 Automatic street light/dressing table light

1.3.13 Mosquito Repeller

1.3.14 Inverter circuit 500 watt/1 KVA.

1.3.15 Solid State Control of Traffic Lights

SECTION D

1.4 **Fabrication and Testing of:**

1.4.1 Inverter/Emergency light circuit using power transistors

1.4.2 SCR based automatic battery charger

1.4.3 SCR operated illumination controller

1.4.4 SCR operated automatic water level controller

1.4.5 SCR based speed controller for DC shunt motor

1.4.6 Three phase full wave rectifier using power diodes

1.4.7 Timer circuit using 555-IC

1.4.8 SCR controlled rectifier circuit

1.4.9 Speed control circuit of DC shunt motor using SCR

1.4.10 Inverting and non-inverting amplifiers using OP AMP(741)

1.4.11 Comparator circuits using OP AMP (741)

1.4.12 Project using PLC

1.4.13 Project relating to Microprocessor

1.4.14 Project relating to Microcontroller

Note: The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance criteria	Max. marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
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.	Interpersonal skills/human relations	5	5	4	3	2	1
8.	Report writing skills	10	10	8	6	4	2
9.	Viva voce	10	10	8	6	4	2
Total marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluated before being disqualified and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	**Overall grade**
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes

1. **The internal and external examiner must follow these criteria and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**

2. **The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**

3. **The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the student's performance as per the above criteria.**

4. **It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

The students must submit Project Report

It is proposed that the institute may organize an annual exhibition of the project items prepared by the students and invite leading Industrial organisations in such an exhibition. It is also proposed that two students or two projects, which are rated best, be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards.