

6.1 UTILIZATION OF ELECTRICAL ENERGY

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RATIONALE

This subject assumes importance in view of the fact that a diploma engineer has to work in a wide spectrum of activities wherein he/she 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 fluorescent (Lamp(CFL).
 - 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 General ideas 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:

- a) 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
- b) Induction heating; principle of core type and coreless induction furnace, their construction and applications
- c) Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace
- d) Dielectric heating, applications in various industrial fields
- e) Infrared heating and its applications (construction and working of two appliances)
- f) Microwave heating and its applications (construction and working of two appliances)
- g) 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:

- a) Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment
- b) 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
- 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,
 - 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
 - a) Plugging
 - b) Rheostatic braking
 - c) 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
 - 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, New 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, New Delhi
5. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, New Delhi
6. Utilization of Electrical Energy by OS Taylor, Pitman Publications
7. Generation, Distribution and Utilization of Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

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	10	10
6	Electric Drives	20	25
7	Electric Traction	10	15
	Total	80	100

6.2 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 Principles of Arc extinction in OCB and ACB, Constructional features of OCB, ACB, and their working,
 - 2.3 Circuit breakers. Types of circuit breakers, bulk and minimum oil circuit breakers, air blast circuit breakers, SF₆ circuit breakers
 - 2.4 Miniature circuit breakers ACB, ELCB, MCB, 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

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

6.3 PROGRAMMABLE LOGIC CONTROLLERS AND MICRO CONTROLLERS

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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 Automatio
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 to 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; 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

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

6.4 ELECTIVE

6.4.1 VLSI SYSTEM DESIGN

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RATIONALE

With the advancement in technology thousands of digital ICs can be embedded on one single chip with the help of VLSI technology and power consumption of ICs can be reduced considerably. The size of the overall circuit will also reduce due to embedding of thousand of digital IC on one VLSI chip. The VLSI chips are 100 times faster than microprocessors. As most Industries are using this technology, it becomes imperative that every student should have some knowledge about this technology. Hence this subject.

DETAILED CONTENTS

1. Overview of VLSI (12 hrs)
 Introduction to Computer-aided design tools for digital systems. Hardware - description languages, Introduction to VHDL, data objects, classes and data types, operators, overloading, logical operators. Types of delays, entity and architecture declaration. Introduction to behavioural, dataflow and structural models.
2. VHDL Statements (12 hrs)
 Assignment statements, sequential statements and process, conditional statements, case statements, concept and use of concurrent statements.
3. Combinational Circuit Design: (14 hrs)
 VHDL models and simulation of combinational circuits such as multiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.
4. Sequential Circuit Design: (14 hrs)
 VHDL Models and simulation of sequential circuits, shift registers, counters etc.
5. Introduction to CPLDs and FPGAs: (12 hrs)
 Programmable logic devices : ROM, PLAs, GAL, PEEL, CPLDs and FPGA. FPAA (Field Programmes Analog Array)

LIST OF PRACTICALS

Combinational Design Exercises

1. Design of Gates
 - a. Design of AND gate

- b. Design of OR gate
- c. Design of XOR gate
- 2. Design of XOR gate using other basic gates
- 3. Design of 2:1 Mux using other basic gates
- 4. Design of 2 to 4 Decoder
- 5. Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
- 6. Design of 3:8 Decoder
- 7. Design of 8:3 Priority Encoder
- 8. Design of 4 Bit Binary to Grey code Converter
- 9. Familiarisation of VLSI and Tools with software like Ex-VLSI

Sequential Design Exercises Using VHDC

- 10. Design of Synchronous 8-bit Johnson Counter
- 11. Design of ALU (Addition, subtraction, Multiplication, Division)

RECOMMENDED BOOKS

- 1. VLSI Technologies by SZE, Tata McGraw Hill Education Pvt Ltd , New Delhi
- 2. IEEE Standard VHDL Language Reference Manual(1993)
- 3. "Digital System Design using VHDL":Charles. H. Roth; PWS(1998)
- 4. VHDL-IV Edition: Perry; Tata McGraw Hill Education Pvt Ltd , New Delhi
- 5. VLSI Design for Analog by Geiger, Tata McGraw Hill Education Pvt Ltd , New Delhi

Recommended Software:

- 1. Xilinx Synthesis Software (web pack) freely available on internet. On Xilinx.com
- 2. VLSI System Design is wind software for designing (System Designing).
- 3. VLSI Learning Resource like Ex-VLSI

INSTRUCTIONAL STRATEGY

This subject is very important for designing Digital Systems. For this, the students need to have strong base understanding of fundamental concepts of digital electronics. The teacher is required to lay more emphasis on programming practice in VHDL.

SUGGESTED DISTRIBUTION OF MARKS

Sr No	Topic	Time Allotted (hrs)	Marks Allocation (%)
1	Overview of VLSI	12	20
2	VHDL Statements	12	15
3	Combinational Circuit Design	14	25
4	Sequential Circuit Design	14	25
5	Introduction to CPLDs and FPGAs	12	15
Total		64	100

6.4.2 OPTICAL FIBER COMMUNICATION

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RATIONALE

Progressing from communication over copper wire to today's fibre optic communication, we have increased our ability to transmit more information, more quickly and over longer distances. This has expanded our boundaries and is finding a good slot in communication system. Optical fibers has replaced existing transmission media due to its advantages. As a result the technicians are supposed to have knowledge of optical communication. This subject will provide basic concepts and requisite knowledge and skill required.

DETAILED CONTENTS

1. Introduction (12 hrs)
 - a) Historical perspective, basic communication systems, optical frequency range, advantages of optical fibre communication, application of fibre optic communication
 - b) Electromagnetic spectrum used, Advantages and disadvantages of optical communication.
 - c) Principle of light penetration, reflection, critical angle.

2. Optical Fibers and Cables (08 hrs)
 - a) Constructional details of various optical fibers, multimode and mono-mode fibers, step index and graded index fibers, acceptance angle and types of optical fiber cables.
 - b) Optical Fibers cable connectors and splicing techniques

3. Losses in Optical Fiber Cable: (08 hrs)
 - a) Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending losses.
 - b) Dispersion: Types and its effect on data rate.

4. Optical Sources (10hrs)

Characteristics of light used in optical communication, principle of operation of LED, different types of LED structures used and their brief description, Injection laser diode, principle of operation, different injection laser diodes, comparison of LED and ILD.

5. Optical Detectors (08hrs)

Characteristics of photo detectors used in optical communication; PIN diode and avalanche photo diode (APD), Noise in detectors

6. Optical Amplifiers (10 hrs)
Types of optical amplifiers, semiconductor & fiber optical amplifiers Functional types, principal of operation of SOA, types of SOA. FPA, TWA, SOA applications, advantages, Drawbacks, EDFAS, Raman amplifiers.
7. Optical Fiber System (08 hrs)
Optical transmitter circuit, optical receiver circuit, optical power budgeting, Multiplexing: WDM (Wavelength Division Multiplexing), Modulation in fibre optics

LIST OF PRACTICALS

1. Setting up of fiber analog link
2. Setting up to optic digital link
3. Measurement of bending losses in optical fibers
4. To observe and measure the splice or connector loss
5. To measure and calculate numerical aperture of optical fiber
6. To observe characteristics of optical source
7. To observe characteristics of optical defector
8. To connect a fiber with connector at both ends
9. Introduction to various components and tools used in optical fiber communication

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 in communication system. 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.

RECOMMENDED BOOKS

1. Optical fiber Communication by John M Senior, Prentice Hall of India, New Delhi
2. Optical fiber Communication by J. Gower , Prentice Hall of India, New Delhi
3. Optical fiber Communication by Gerd Keiser, McGraw Hill International Editions
4. Optical Communications – Components and Systems by JH Franz and VK Jain, Narosa Publishing House, New Delhi

5. Optical Fiber Communication by Sangar and Sahdev, Uneek Publications, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Sr. No.	Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	Introduction	12	20
2	Optical Fibers and Cables	8	15
3	Losses in Optical Fiber Cable:	8	15
4	Optical Sources	10	15
5	Optical Detectors	8	10
6	Optical Amplifiers	10	15
7	Optical Fiber System	8	10
	Total	64	100

6.4.3 WIRELESS AND MOBILE COMMUNICATION

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RATIONALE

The wireless/mobile communication technology though complex but is spreading at a very fast rate. People use more of mobile phones in comparison to land line phones. It is expected that within a very short period almost every body will be using mobile communication. Technology is also changing very fast. Therefore, the students should know the functioning of wireless/mobile system/equipment to keep themselves abreast of this latest application of communication.

DETAILED CONTENTS

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| 1. | Wireless Communication | (12 hrs) |
| 1.1 | Basics | |
| 1.2 | Advantages of wireless communication | |
| 1.3 | Electromagnetic waves. | |
| 1.4 | Frequency Spectrum used. | |
| 1.5 | Paging system. | |
| 1.6 | Cordless Telephone System. | |
| 1.7 | Cellular Telephone System | |
| 1.8 | Comparison of above wireless communication systems. | |
| 1.9 | Propagation considerations | |
| | a) Range | |
| | b) Atmospheric Effect | |
| | c) Geographic Effect | |
| | d) Fading | |
| | e) Doppler Effect | |
| 2. | Cellular Concept | (12 hrs) |
| 2.1 | Cell area | |
| 2.2 | Capacity of cell | |
| 2.3 | Frequency Response | |

- 2.4 Co-channel Interference
- 2.5 Adjacent channel Interference
- 2.6 Power Control for reducing Interference
- 2.7 Improving coverage and capacity in cellular system
 - a) Cell Splitting.
 - b) Sectoring
 - c) Repeater for Range Extension.
- 3. Multiple Access Techniques for Wireless Communication (16 hrs)
 - 3.1 Introduction to Multiple Access.
 - 3.2 Frequency Division Multiple Access (FDMA)
 - 3.3 Time Division Multiple Access (TDMA)
 - 3.4 Code Division Multiple Access (CDMA)
 - 3.5 Spread Spectrum Multiple Access (SSMA)
 - 3.6 Frequency Hopping spread Spectrum (FHSS).
 - 3.7 Comparison of FDMA/TDMA/CDMA
- 4. Mobile Communication Systems (24 hrs)
 - 4.1 Advanced Mobile Phone System (AMPS)
 - a) Operation of AMPS
 - b) Working of AMPS Phone System
 - 4.2 Introduction of Global Systems for Mobile Communication (GSM) and its architecture, Introduction of CDMA System, comparison of CDMA and GSM Systems
 - 4.3 Introduction of GPRS and GPS System.
 - 4.4 Introduction to DTH, Blue tooth, Wi-Fi and RDFI.

LIST OF PRACTICALS

1. Study the features, specification and working of cellular mobile
2. Signal strength measurement of various points from a transmitting antenna/cordless phone
3. Measurement of range for a cordless phone
4. Visit of a Mobile Switching Centre(MSC) in the nearest M.S. facility provider
5. Demonstration of Base Trans Receiver(BTS) with nearby cellular tower
6. Observing call processing of GSM trainer Kit.

7. Observing call processing of CDMA trainer Kit.
8. Practice of setting GPRS on Mobile phone
9. Repair of a GSM and a CDMA mobile phones
10. Measurement of cell boundary (time consuming project)
11. Data transfer using blue tooth

Demonstration
only

INSTRUCTIONAL STRATEGY

Wireless and Mobile Communication is having significant impact in Electronics Market. For the proper awareness of this subject it is must to provide the students the detail functioning of wireless/mobile system/equipment. For this visits must be arranged to BTS/MSC (Mobile Switching Centre) providers. The theory classes need to be application based in addition to industrial visits in the BSNL, Vodafone, Airtel, SPICE, TATA indicom etc

RECOMMENDED BOOKS

1. Wireless Communications, Principles and Practice, by Theodore S.Rappaport.
2. Wireless Communications by Singal, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Wireless Communications by Misra, Tata McGraw Hill Education Pvt Ltd, New Delhi
4. Introduction to Wireless and Mobile Systems, by Dharma Prakash Agarwal, Qing-An zeng.
5. Wireless Communications and Networking, by William Stallings.
6. Mobile and Personal Communication Systems and Services, by Raj Pandya, Prentice Hall of India, New Delhi
7. Mobile Communication by John Schiller, Prentice Hall of India, New Delhi
8. Wireless Communications by Pahalwan, Pearson Education, Noida
9. Wireless and Mobile Communication VK Sangar, Ishan Publications, Ambala.

SUGGESTED DISTRIBUTION OF MARKS

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	Wireless Communication	12	22
2	Cellular Concept	12	23
3	Multiple Access Techniques for Wireless Communication	16	25
4	Mobile Communication Systems	24	30
Total		64	100

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

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

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RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to:

Each teachers is expected to guide the project work of 5-6 students at time:

- i) Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study.
- ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- iv) Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

The individual 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. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. 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 project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the project activities are given below:

- Projects related to designing small electronic /Electrical equipment / instruments.
- Projects related to increasing productivity in electronic/Electrical manufacturing areas.
- Projects related to quality assurance.

- Projects connected with repair and maintenance of plant and equipment.
- Projects related to design of PCBs.
- Projects related to suggesting substitutes of electronics components being used.
- Projects related to design of small oscillators and amplifier circuits.
- Projects related to design, fabrication, testing and application of simple digital circuits and components and electrical circuits and products.
- Projects related to microprocessor/microcontroller based circuits/ instruments.

Some of the projects based on above areas are listed below for the benefit of students:

Section-A

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Microprocessor/Microcontroller based liquid level indicator and control
5. Fabrication and assembling of digital clock.
6. Fabrication of PCB circuits using ORCAD/ EAGLE Software.
7. Fabrication of ON line/OFF line UPS of different ratings and inverters
8. Design and developing web sites of organizations
9. Installation of computer network (LANS).
10. Microprocessor/Microcontroller Based A/D converter
11. Microprocessor/Microcontroller Based D/A converter
12. Fabrication and Testing of inverter
13. Fabrication and Testing of Energy light

Section-B

1. Design and construction of small transformer 100VA to 1KVA
2. Construction of hot air blower
3. Fabrication of Automatic Star delta Starter
4. Design and Construct of choke

5. Design and Construction of desert cooler
6. Rewinding of motors (1 to 5 HP)
7. Design and Construction of Geyser
8. Rewinding of Fans
9. Design and assembly of contractor control Circuits for various applications
10. Design and fabrication of automatic curtain operator
11. Design and construction of fan regulator (resistance/inductance type)
13. To survey the load of a villages colony and find the size of the cable for providing a service connection to a consumer

NOTE: At least one project from each section

The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher

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

Sr. No.	Performance Criteria	Max.** Marks	Rating Scale				
			Exce-llent	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 elations	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	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-evaluate 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. This criteria must be followed by the internal and external examiner 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 200 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 students 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.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations in such an exhibition.