

## 6.1 OPTICAL FIBRE COMMUNICATION

L T P  
Periods/ Weeks 3 1 2

### 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 (10 Periods)
  - Historical perspective, basic communication systems, optical frequency range, advantages of optical fibre communication, application of fibre optic communication
  - Electromagnetic spectrum used, Advantages and disadvantages of optical communication.
  - Principle of light penetration, reflection, critical angle.
  
2. Optical Fibers and Cables (10 Periods)
  - Constructional details of various optical fibers, multimode and mono-mode fibers, step index and graded index fibers, acceptance angle, Types of optical fiber cables.
  - Optical Fibers cable connectors and splicing techniques
  
3. Losses in Optical Fiber Cable (08 Periods)
  - Absorption Losses: Scattering Losses, Radiation losses, Connector losses, Bending losses.
  - Dispersion: Types and its effect on data rate.
  
4. Optical Sources (10 Periods)

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 (08Periods)

Characteristics of photo detectors used in optical communication; PIN diode and avalanche photo diode (APD), Noise in detectors
  
6. Optical Amplifiers (10 Periods)

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 Periods)  
 Optical transmitter circuit, optical receiver circuit, optical power budgeting, Multiplexing: WDM (Wavelength Division Multiplexing), Modulation in fibre optics

### LIST OF PRACTICALS

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

### 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

Topic	Time Allotted (Periods)	Marks Allotted (%)
1	10	15
2	10	15
3	8	15
4	10	15
5	8	15
6	10	15
7	8	10

<b>Total</b>	<b>64</b>	<b>100</b>
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## 6.2 MOBILE COMMUNICATION

L - P  
Periods/ Weeks 4 - 4

### RATIONALE

The wireless/mobile communication technology though complex but is spreading at a very fast rate. People use more mobile phones in comparison to land line phones. It is expected that with in very short period almost everybody 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

1. Wireless Communication (10 Periods)
  - 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) Signal Fading
    - e) Doppler Effect
  
2. Cellular Concept (12 Periods)
  - 2.1 Cell area
  - 2.2 Capacity of cell
  - 2.3 Frequency Reuse
  - 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 (18 Periods)
  - 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
  - 3.8 Introduction to Wireless local loop (WLL) technologies.
    - (a) Satellite- Based System

- (b) Cellular-- Based System
  - (c) Micro Cellular-- Based System
  - (d) Fixed Wireless Access Systems
4. Mobile Communication Systems (16 Periods)
    - 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.
  5. Mobile computing (08 Periods)
    - 5.1 Introduction to Blue tooth and Infrared Data Association( IRDA)
    - 5.2 Introduction to Wi-Fi ,Radio Frequency identification (RFID) .

### **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. Visit of a Mobile Switching Centre (MSC) in the nearest M.S. facility provider
4. Demonstration of Base Trans Receiver (BTS) with nearby cellular tower
5. Observing call processing of GSM trainer Kit.
6. Observing call processing of CDMA trainer Kit.
7. Practical study of setting of Wi-Fi
8. Fault finding of a basic (GSM) and a (CDMA) mobile phones Demonstration
9. Study and practice of data transfer using blue tooth

### **INSTRUCTIONAL STRATEGY**

Wireless and Mobile Communication is heaving 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 Publishers
9. Wireless and Mobile Communication VK Sangar, Ishan Publications.

#### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	10	15
2	12	20
3	18	25
4	16	25
5	08	15
<b>Total</b>	<b>64</b>	<b>100</b>

## 6.3 MICRO CONTROLLERS AND EMBEDDED SYSTEM

L T P  
Periods/ Weeks 4 - 4

### RATIONALE

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).

### DETAILED CONTENTS

1. Microcontroller series (MCS) – 51 Overview (16 Periods)
  - Pin details
  - I/O Port structure
  - Memory Organization
  - Special Function Registers (SFRS)
  - External Memory
  
2. Instruction Set; Addressing Modes, Instruction types (12 Periods)
  - Timer operation
  - Serial Port operation
  - Interrupts
  
3. Assembly language programming (10 Periods)
  - Assembler directives
  - Assembler operation
  
4. Design and Interface (10 Periods)
  - keypad interface, 7- segment interface, Switches etc
  
5. Embedded Systems (16 Periods)  
Introduction, Embedded design concept, Brief description and architecture of AVR and PIC, Application of embedded system, case study of embedded system. General Idea of Robotics, Different types of Robots, Their working principles and elements used in robotics.

### LIST OF PRACTICALS

1. Familiarization of Micro Controllers (8051) kit
2. Assembly Language Programming
3. Testing of general input/output on Micro controller board
4. Development of Electrical , Instrumentation applications using 8051 micro-controller
5. Study of interfacing ADC, Infra red Sensor, RS 232, DAC with 8051.
6. Case study of embedded system

## RECOMMENDED BOOKS

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Liu Gibson: Microcomputer Systems: The 8086/8088 Family- Architecture, Programming And Design , PHI
3. D. V. Hall: Microprocessors and Interfacing, TMH.
4. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
5. Ayala Kenneth:- The 8051 microcontroller, Third Edition, Cengage Learning
6. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
7. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
8. V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
9. Digital Electronics by Malvino Leach, Tata McGraw-Hill Publishing, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	16	25
2	12	20
3	10	15
4	10	15
5	16	25
<b>Total</b>	<b>64</b>	<b>100</b>



## 6.4 COMPUTER NETWORKS

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4 - 3

### RATIONALE

The future of computer technology is in computer networks. Global connectivity can be achieved through computer networks. A diploma holder in computer engineering should therefore understand the function of networks. Knowledge about hardware and software requirements of networks is essential.

### DETAILED CONTENTS

1. Networks Basics (08Periods)
  - Concept of network
  - Models of network computing
  - Networking models
  - Peer-to-peer Network
  - Server Client Network
  - LAN, MAN and WAN
  - Network Services
  - Topologies
  - Switching Techniques
  
2. OSI Model (10 Periods)
  - Standards
  - OSI Reference Model
  - OSI Physical layer concepts
  - OSI Data-link layer concepts
  - OSI Networks layer concepts
  - OSI Transport layer concepts
  - OSI Session layer concepts
  - OSI presentation layer concepts
  - OSI Application layer concepts
  
3. Introduction to TCP/IP (12 Periods)
  - Concept of physical and logical addressing
  - Different classes of IP addressing, special IP address
  - Sub netting and super netting
  - Loop back concept
  - IPV4 and IPV6 packet Format
  - Configuring IPV4 and IPV
  
4. Network Architecture (10 Periods)
  - ARC net specifications
  - Ethernet Specification and Standardization:  
10 Mbps (Traditional Ethernet), 10 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet), Introduction to Media Connectivity (Leased lines, ISDN, PSTN, RF, VSAT, Optical and IPLC)
  
5. Network Connectivity (08 Periods)
  - Network connectivity Devices
  - NICs

- Hubs
  - Repeaters
  - Multiplexers
  - Modems
  - Routers and Protocols,
  - Firewall
  - ATM
  - VOIP and Net-to-Phone Telephony,
  - Laws and Protocols
6. Network Trouble Shooting Techniques (10 Periods)
- Trouble Shooting process
  - Trouble Shooting Tools: PING, IPCONFIG, IFCONFIG, NETSTAT, TRACEROUT, Wiresharp/ Dsniffer/ Pcop
  - Hauffman codes
  - Cryptography
7. Wireless Networking (06 Periods)
- Basics of Wireless: Wireless MAN, Networking, Wireless LAN, Wi-Fi, Wi-Max (Broad-band Wireless) and Blue-Tooth technology.

### **LIST OF PRACTICALS**

1. Recognize the physical topology and cabling (coaxial, OFC, UTP, STP) of a network.
2. Recognition and use of various types of connectors RJ-45, RJ-11, BNC and SCST
3. Recognition of network devices (Switches, Hub, Routers of access points for Wi-Fi)
4. Making of cross cable and straight cable
5. Install and configure a network interface card in a workstation.
6. Identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation
7. Managing user accounts in windows or LINUX
8. Study and Demonstration of sub netting of IP address
9. Connectivity troubleshooting using PING, IPCONFIG, IFCONFIG
10. Installation of Network Operating System(NOS)
11. Visit to nearby industry for latest networking techniques

### **Required Software**

- Windows Server/Linux Server

### **Required Tools and Supplies**

- 1) Crimping tool, crone Tool, Cable tester,
- 2) RJ 45 connectors, RJ-11, BNC, SCST
- 3) Coaxial Cable, UTP, STP, OFC cable
- 4) Screwdriver Kit
- 5) Switch/Hub
- 6) Manageable Switch

### **INSTRUCTIONAL STRATEGY**

This subject deals with both theory and practicals. The students should be made to practically establish LAN with various hardware and software and their integration.

### RECOMMENDED BOOKS

1. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi
2. Data Communications and Networking by Forouzan, (Edition 2<sup>nd</sup> and 4<sup>th</sup>), Tata McGraw Hill Education Pvt Ltd , New Delhi
3. Data and Computer Communication by William Stallings, Pearson Education, New Delhi
4. Local Area Networks by Peter Hudson
5. Understanding Local Area Network by Neil Jenkins
6. Area Networks by Stan Schatt, Prentice Hall of India, New Delhi
7. Network+ Lab manual,- BPB Publications -by Tami Evanson
8. Networking Essentials – BPB Publications New Delhi
9. Computer Network and Communications By V.K. Jain and Narija Bajaj, Cyber Tech Publications, New Delhi.
10. Linux – Install and Configuration Black Book by Dee Annleblanc and Issac Yates, IDG Books India Private Limited, Delhi.
11. Unleashed Linux by TechMedia Publishers, New Delhi
12. Computer Network by J.S. Katre, Tech-Max Publication, Pune

### SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	08	12
2.	10	16
3.	12	20
4.	10	15
5.	08	12
6.	10	15
7.	06	10
<b>Total</b>	<b>64</b>	<b>100</b>

## 6.5 Satellite Communication

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4 - 3

### UNIT-1

#### **PRINCIPLES OF SATELLITE COMMUNICATION: (08 Periods)**

Evolution & growth of communication satellite, Synchronous satellite, Satellite frequency allocation & Band spectrum, Advantages of satellite communication, Active & Passive satellite.

#### **COMMUNICATION SATELLITE LINK DESIGN: (08 Periods)**

Introduction, General link design equations, System noise temperature, C/N & G/T ratio, Atmospheric & Ionospheric effects on link design, Complete link design, Earth station parameters.

### UNIT 2

#### **ANALOG SATELLITE COMMUNICATION : (12Periods)**

Introduction, Baseband analog(Voice) signal, FDM techniques, S/N & C/N ratio in frequency modulation in satellite link, S/N ratio in FM with multiplexed telephone signal in satellite link, Single channel per carrier(SCPC) systems, Companded single sideband (CSSB) systems, Analog FM/FDM TV satellite link, Inter modulation products & their effects in FM/FDM systems, Energy disposal in FM/FDM systems.

**DIGITAL SATELLITE COMMUNICATION:** Introduction, Base band signal, Digital modulation technique-ASK, PSK, QPSK, BFSK.

### UNIT 3

#### **MULTIPLE ACCESS TECHNIQUES: (10 Periods)**

Introduction, TDMA, TDMA-Frame structure, TDMA-Burst structure, TDMA-Frame efficiency, TDMA-super frame, TDMA Frame acquisition & Synchronization, TDMA compared to FDMA, TDMA Burst Time Plan, CDMA .

#### **SATELLITE ORBITS: (10 Periods)**

Introduction, Synchronous orbit, Orbital parameters, Satellite location with respect to earth, Look angles, Earth coverage & slant range, Eclipse effect, Satellite placement in geostationary orbit, station keeping, Satellite stabilization.

### UNIT 4

#### **Communication Satellite Subsystem- (10 Periods)**

Electric Power Supply, Attitude and Orbit Control, Propulsion Sub System, Repeaters / satellite. Transponder, Telemetry, Tracking and command Subsystem, thermal control system. Satellite Earth Station-

**Earth station Subsystem,****(08 Periods)**

Small earth station, Large Earth Station, Very small Aperture Terminal. TVRO, MSAT (Mobile Satellite Communication technique)

**Satellite communication List of Practical**

1. Establishing a direct communication link between
2. Uplink Transmitter and Downlink Receiver using tone signal.
3. Establish an AUDIO-VIDEO satellite link between Transmitter and Receiver.
4. Transmit and receive three separate signals (Audio, Video, Tone) simultaneously through satellite Link.
5. Communication Voice Signals through Satellite Link.
6. To study the Path Loss (effect of distance) between Transponder and Downlink Receiver.
7. To measure the Link Carrier to Noise Ratio (C/N)

**TEXT BOOK:**

1. Satellite Communication : D.C. Aggarwal ; Khanna.

**REFERENCE BOOK :**

1. Satellite Communication : D.C. Aggarwal ; Khanna.
2. Satellite Communication : Gagliardi ; CBS
3. Dennis Roddy, 'Satellite Communication', McGraw Hill International, 4th Edition, 2006.
4. Wilbur L. Pritchard, Hendri G. Snyderhoud, Robert A. Nelson, 'Satellite Communication Systems Engineering', Prentice Hall/Pearson, 2007.

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allocation%</b>
1	16	24
2	10	20
3	24	36
4	14	20
Total	<b>64</b>	<b>100</b>

## 6.6 EMPLOYABLE SKILLS

L T P  
Periods per week - - 4

### RATIONALE

Diploma holders are required to not only possess subject related knowledge but also soft skills to get good jobs and to rise steadily at their workplace. This subject is included to develop employability skills amongst the students.

### DETAILED CONTENTS

1. Industrial Scenario Engineering Education and expectations of competences from an engineer by employer (04 periods)
2. Personality types, characteristic and features for a successful engineer (04 periods)
3. Professional Engineer desirable values and ethics and their development. Relation between engineering profession, society and environment (04 periods)
4. Managing project (16 periods)
  - Leadership
  - Motivation
  - Time management
  - Resource management
  - Computer Software
  - Interpersonal relationship
  - Engineer economics and fundamentals
5. Effective Communication (08 periods)
  - Listening
  - Speaking
  - Writing
  - Presentation Technique/Seminar
  - Group discussion
6. Preparing for Employment (08 periods)
  - Searching for job/job hunting
  - Resume Writing
  - Interview technique in personal interview telephonic interview, panel interview, group interview, video conference

7. Managing Self (06 periods)
  - Managers body, mind, emotion and spirit
  - Stress Management
  - Conflict resolution
  
8. Continuing professional development (04 periods)
  - Organising learning and knowledge
  - Use of computer for organising knowledge resource
  
9. Creativity, Innovation and Intellectual property right (06 periods)
  - Concept and need in present time for an engineer
  
10. Basic rules, laws and norms to be adhered by engineers during their working (04 periods)

## 6.7 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:

- 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:

- a) Projects related to designing small electronic equipment / instruments.
- b) Projects related to increasing productivity in electronic manufacturing areas.
- c) Projects related to quality assurance.
- d) Projects connected with repair and maintenance of plant and equipment.
- e) Projects related to design of PCBs.
- f) Projects related to suggesting substitutes of electronics components being used.
- g) Projects related to design of small oscillators and amplifier circuits.



- h) Projects related to design, fabrication, testing and application of simple digital circuits and components.
- i) Projects related to microprocessor/microcontroller based circuits/ instruments.

**A. SOME OF THE PROJECTS BASED ON ABOVE AREAS ARE LISTED BELOW FOR THE BENEFIT OF STUDENTS**

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. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of PCB circuits using ORCAD/ EAGLE Software.
8. Fabrication of ON line/OFF line UPS of different ratings and inverters
9. Design, fabrication and testing of different types of experimental boards
10. Repair of oscilloscope, function generator
11. Design and developing web sites of organizations
12. Installation of computer network (LANS).
13. Microprocessor/Microcontroller based solar tracking system
14. GSM based car or home security system
15. Bank token display using microcontroller
16. Printer sharing unit
17. Microprocessor/Microcontroller Based A/D converter
18. Microprocessor/Microcontroller Based D/A converter
19. Simulation of half wave and full wave rectifiers using Simulation Software
20. Simulation of class A, Class B, Class AB and Class C amplifiers
21. Simulation of different wave forms like sine, square, triangular waves etc.
22. GPS based vehicle tracking system
23. Calculate Bit Error Rate (BER) of various modulation techniques
24. Design ALU using CPLD/FPGA
25. Design Display System using CPLD/FPGA
26. Electronic Weighing Machines

**B. FABRICATION AND TESTING (AT LEAST TWO OF THE FOLLOWING):**

- 1 Voltage Stabilizer for Refrigerator, Air-Conditioner
- 2 Emergency Light using SCR
- 3 Power amplifier
- 4 Low cost intercom for home
- 5 Analog computer
- 6 Regulated power supply (+ 12V and + 6V) using 7812, 7912 and 7806, 7906
- 7 Automatic battery charger using SCR
- 8 Burglar Alarm
- 9 Automatic street light/dressing table light
- 10 Inverter circuit 500 watt.
- 11 Microprocessor/Microcontroller Based A/D converter
- 12 Microprocessor/Microcontroller Based D/A converter
- 13 Simulation of half wave and full wave rectifiers using Simulation Software
- 14 Simulation of class A, Class B, Class AB and Class C amplifiers
- 15 Inverter/Emergency light circuit using power transistors
- 16 SCR based automatic battery charger

- 17 SCR operated illumination controller
- 18 SCR operated automatic water level controller
- 19 SCR based speed controller for DC shunt motor
- 20 Three phase full wave rectifier using power diodes
- 21 Timer circuit using 555-IC
- 22 SCR controlled rectifier circuit
- 23 Speed control circuit of DC shunt motor using SCR
- 24 Inverting and non-inverting amplifiers using OP AMP(741)
- 25 Comparator circuits using OP AMP (741)

**NOTE:**

**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				
			Excel lent	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
<b>Total marks</b>		<b>100</b>	<b>100</b>	<b>80</b>	<b>60</b>	<b>40</b>	<b>20</b>

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 organisations in such an exhibition.