SIXTH SEMESTER (ELECTRONICS ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Microwave Engineering	4	-	4	5	20	30	50	50	2 ½	50	3	100	150
6.2	Microcontrollers and Embedded System	6	-	6	7	20	30	50	50	2 ½	50	3	100	150
6.3	Wireless and Mobile Communication System	4	-	6	6	20	30	50	50	2 ½	50	3	100	150
6.4	*Elective	4	-	2	4	20	30	50	50	2 ½	50	3	100	150
6.5	Project Work	-	-	8	3	-	50	50	-	-	100	4	100	150
#Student Centred Activities (SCA)		-	-	4	1		30	30	-	-	-	-	-	30
Total		18		**30**	26	80	**200**	**280**	**200**	**-**	**300**	**-**	**500**	**780**

*Elective: Any one out of the following:

6.4.1 Control System 6.4.2 Medical Electronics 6.4.3 Computer Networks

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

6.1 MICROWAVE AND RADAR ENGINEERING

L	T	P
4	-	4

RATIONALE

This subject includes an exposure to microwaves engineering, radar systems, fiber optics and satellite communication. In microwaves industry, job opportunities are available in the area of assembly, production, installation, repair and maintenance of microwave transmitters and receivers. The knowledge of radar systems allows opportunities with civil and defense organizations dealing with aircraft and shipping. Fiber optics is the latest thrust area in communication with vast opportunities in the private sector.

LEARNING OUTCOMES

After completion of the course, the students should be able to:

- identify and demonstrate operating principles and typical applications of tubes and diodes.
- understand the various types and propagation modes of wave guides
- describe the various types of antennas and wave propagation techniques
- know the basic principle of radar and interpret the various parameters used in radar equations
- measure VSWR of a given load
- identify the block diagram and explain the operating principles of CW(Doppler), FMCW, MTI radar
- interpret radar display PPI
- describe the working principles of microwave communication link

DETAILED CONTENTS

1. **Introduction to Microwaves** (12 Periods)

Introduction to microwaves and its applications, Classification on the basis of its frequency bands (HF, VHF, UHF, L, S, C, X, Ku, Ka, Sub mm)

Microwave Devices

Characteristics, operating principles and typical applications of the following devices (No mathematical treatment)

- Multi cavity klystron
- Reflex klystron
- Multi-cavity magnetron
- Traveling wave tube
- Gunn diode
- IMPATT diode
- TRAPATT diode
- PIN diode

2. Wave guides (10 Periods)

Rectangular and circular wave guides and their applications. Mode of wave guide; Propagation constant of a rectangular wave guide, cut off wavelength, guide wavelength and their relationship with free space wavelength (no mathematical derivation). Impossibility of TEM mode in a wave guide.

3. Antenna and Wave Propagation (12 Periods)

- Physical concept of radiation electromagnetic energy from an antenna, relationship between the direction of electric and magnetic fields with direction of propagation; concept of polarization of EM waves.
- Electromagnetic spectrum and its various range VLF, LF, HF, VHF, UHF, Micro wave, Optical waves etc.
- Definition and physical concepts of the terms used with antennas like point source, gain, power gain, directivity aperture, effective area, radiation pattern, (field strength power and phase) beam angle, beam width and radiation resistance.
- Types of antennas- Brief description, characteristics and typical applications of medium wave antenna, shortwave antenna, HF antenna, VHF, UHF and Microwave antenna e.g., half wave dipole, ground plane, yagi and ferrit rod antenna in transistor receiver. Brief idea about rhombic antenna, dish antenna, Horn, Parabolic reflector and Lens antenna.
- Antenna arrays-Brief description of broad side and end fire arrays their radiation pattern and application (without analysis)
- Basic idea about different modes of radio wave propagation- ground wave propagation, space wave propagation and sky wave propagation, their characteristics and typical areas of application. (e.g. medium wave, short wave, TC communication.)
- Explanation of the terms-critical frequency, maximum usable frequency (MUF) and skip distance.

4. Radar Systems (10 Periods)

– Introduction to radar, its various applications, radar range equation (no derivation) and its applications.

5. Satellite Communication (12 Periods)

- Basic idea passive and active satellites.
- Meaning of the terms Orbit, Apogee and Perigee
- Geo- stationary satellite and its need.
- Block diagram and explanation of a satellite communication link.
- Differentiate between various types of satellites.

LIST OF PRACTICALS

1. To measure electronics and mechanical tuning range of a reflex klystron
2. To measure VSWR of a given load.
3. To plot radiation pattern of horn antenna in horizontal and vertical plane.
4. To plot VI characteristics of GUNN-Diode.
5. To determine the frequency and wavelength of a rectangular waveguide working in TE_{10} mode.
6. To study and test various parameters such as gain, noise, bandwidth and voltage at different point of a microwave amplifier.
7. To measure the power gain and beam width of a microwave dish antenna.

NOTE

Visit to the appropriate sites of microwave station/tower and communication stations should be made to understand their working. A comprehensive report must be prepared by all the students on these visits, especially indicating the dates and locations of their visits.

INSTRUCTIONAL STRATEGY

Microwave and radar engineering is very important subject and requires both theoretical as well as practical exposure. The teaching should be supplemented by visits to the microwave stations and using suitable audio visual aids.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

1. Microwave Devices and Components by Sylio; Prentice Hall of India, New Delhi
2. Electronics Communication by Roddy and Coolen; Pearson Publishers.
3. Electronics Communication System by KS Jamwal; Dhanpat Rai and Sons, Delhi
4. Microwave Engineering by Das; Tata McGraw Hill Education Pvt Ltd , New Delh
5. Microwave & Radar Engineering by Navneet Kaur; Ishan Publications, Ambala City
6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	12	22
2.	10	18
3.	12	22
4.	10	18
5.	12	20
Total	**56**	**100**

6.2 MICROCONTROLLERS & EMBEDDED SYSTEM

L	T	P
6	-	6

RATIONALE

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in electronic industries. Microcontroller is the heart of the programmable devices. Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. Students of electronics and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry. The subject aims expose students to the embedded systems besides giving them adequate knowledge of micro controllers.

LEARNING OUTCOMES

After completion of the subject, the learner should be able to:

- understand the working of microcontrollers
- understand the Instruction set and programming related to microcontrollers
- describe embedded system
- explain embedded operating systems
- program PIC microcontroller and AVR microcontroller
- interface sensors with microcontroller

DETAILED CONTENTS

1. Microcontroller series (MCS) (14 Periods)

   1.1 Architecture of 8051Microcontroller
   1.2 Pin details
   1.3 I/O Port structure
   1.4 Memory Organization
   1.5 Special Function Registers (SFRs)
   1.6 External Memory

2. Instruction Set for Microcontroller Programming (16 Periods)

   2.1 Instruction Set of 8051
   2.2 Addressing Modes,
   2.3 Types of Instructions
   2.4 Timer operation
   2.5 Serial Port operation

2.6 Interrupts

3. Introduction to Embedded System (08 Periods)

Embedded system, history of embedded systems, embedded system architecture, Functional structure of embedded system

4. Embedded operating systems (10 Periods)

Real-time operating system, factors affecting embedded systems, applications of embedded systems, embedded systems characteristics and features,

5. Introduction of PIC microcontroller, block diagram, function of each block. Introduction of AVR microcontroller, block diagram, function of each block. (10 Periods)

6. Programming concepts of microcontrollers. Basic introduction of Software used in microcontrollers. How to transfer C or ASM code in microcontrollers. (10 Periods)

7. Input/output interface (08 Periods)
   - Sensors, 7-segemtn display, LCD, LED and relay

8. Internet of Things (08 Periods)
   - Introduction to Internet of things
   - Application, architecture, protocols
   - Functional blocks of IoT, Characteristics of IoT
   - Brief idea of Arduino IDE

LIST OF PRACTICALS

1. Familiarization with Micro-controller Kit and its different sections
2. Programming to interface switches and LEDs
3. Programming and interface of Seven Segment and LCD.
4. Programming for A/D converter, result on LCD.
5. Programming for D/A converter, result on LCD.
6. Programming for serial data transmission from PC to Kit or Vice versa.
7. Programming and interfacing of RELAY and Buzzer
8. Design PIC based Security System
9. Design AVR based Temperature indicator cum controller.

Practical using Arduino-interfacing sensors

1. Interfacing Light Emitting Diode(LED)- Blinking LED
2. Interfacing Button and LED – LED blinking when button is pressed
3. Interfacing Light Dependent Resistor (LDR) and LED, displaying automatic night lamp
4. Interfacing Relay module to demonstrate Bluetooth/wifi based home automation application. (using Bluetooth/wifi and relay).

INSTRUCTIONAL STRTEGY

Instruction should be given to students by showing them actual microcontrollers in the class room so that they can develop the concept. Exercise on programming should be done by taking simple examples like interfacing of switch, LED and relay.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual laboratory and practical work
- Model making
- Viva-Voce

RECOMMENDED BOOKS:-

1. Fundamentals of Microprocessor and Microcontroller by B. Ram , Dhanpat Rai Publications.
2. Microcotroller and Embedded Systems using Assembly And C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi: Pearson
3. PIC Microcontroller and Embedded Systems : Using assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Danny Causey; Pearson
4. Microcotroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi, RolinMckinlay, Janice GilispieMazidi, Pearson
5. Embedded Systems - Architecture, Programming, Design, by Kamal, R. Tata McGraw Hill, New Delhi
6. YashavantKanetkar, ShrirangKorde, “21 Internet Of Things (IOT) Experiments”
7. NeerparajRai , “Arduino Projects For Engineers”
8. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	14	16
2	16	18
3	08	10
4	10	12
5	10	12
6.	10	12
7.	08	10
8.	08	10
Total	**84**	**100**

6.3 WIRELESS AND MOBILE COMMUNICATION

L	T	P
4	-	6

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 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.

LEARNING OUTCOMES

After completion of the course, the students will be able to:

- identify and explain the features, specification and working of cellular mobile
- measure and analyze signal strength at various points from a transmitting antenna with mobile phone.
- understand generation of cellular phones.
- describe and analyze different Multiple Access Techniques for Wireless Communication (FDMA, TDMA and CDMA)
- describe different Mobile Communication Systems(GSM and CDMA)
- demonstrate call processing on a GSM and CDMA trainer Kit
- demonstration of SIM, LTE, Vo-LTE and mobile network
- describe the idea of LAN, MAN, WAN

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 Cellular Network Systems.

2. Cellular Concept (10 Periods)

2.1. Introduction to 1G, 2G, 3G, 4G, and 5G
2.2 Cell area
2.3. Cell Site Structure
2.4. Capacity of cell
2.5. Frequency Reuse (Concept)
2.6 Interference (Co-channel, Adjacent channel)
2.7 Power Control for reducing Interference
2.8 Fundamentals of cellular network planning
a) Coverage planning
b) Capacity planning
c) Cell splitting and sectoring

3 Multiple Access Techniques for Wireless Communication (10 Periods)

3.1 Introduction to Multiple Access.
3.2 Frequency Division Multiple Access (FDMA)
3.3 Time Division Multiple Access (TDMA)
3.4 Distinction between TDMA FDD and TDMA TDD
3.5 Code Division Multiple Access (CDMA), WCDMA

4. Introduction to Bluetooth technology and Wifi Technology (02 Periods)

5. Mobile Communication Systems (14 Periods)
5.1 Introduction of Global Systems for Mobile Communication (GSM) and its architecture, Introduction of CDMA System, comparison of CDMA and GSM Systems and frequency bands.
5.2 Introduction to GPRS and EDGE
5.3 Introduction to Architecture and Features of UMTS
5.4 HSPA (High Speed Packet Access)
5.5 Features and Architecture of LTE (Long Term Evolution), Vo-LTE(Voice Over Long Term Evolution)
5.6 Brief description of Y-Max technology and SIM, IMIE
5.7 Introduction to GPS(Global Position System)

6. Digital and Data Communication (10 Periods)

6.1 Data Transmission Basics: Review of digital data anlog modulation and digital formats. Data rates, Baud Rates, Channel capacity, Mediums for communication, Synchronous and ashnchronous data communication.
6.2 ISO-OSI model and TCP/IP model of network, Protocols and services. Connection oriented and connectionless services.

6.3 IEEE 208 standards for computer networks.
6.4 Internet and ISDN services.

LIST OF PRACTICALS

1. Study the features, specification and working of cellular mobile
2. Measurement of signal strength at various points from a transmitting antenna
3. Demonstration of Base Trans Receiver(BTS) with nearby cellular tower
4. Observing call processing of GSM trainer kit.
5. Repair of a GSM mobile phone
6. Troubleshooting GSM Mobile Phone
   - Assembling and dissembling of GSM phone
   - Study parts of Mobile Phone
   - Testing of various parts

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 detailed 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 to mobile companies

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Actual laboratory and practical work
- Assembly and disassembly exercises
- Viva-Voce

RECOMMENDED BOOKS

1. Wireless Communications, Principles and Practice, by ThedoreS.Rappaport.
2. Wireless Communications and Networking, by William Stallings.
3. Mobile and Personal Communication Systems and Services, by Raj Pandya, Prentice Hall of India, New Delhi
4. Wireless and Mobile Communication VK Sangar, Ishan Publication, Ambala.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	18
2.	10	18
3.	10	18
4.	02	03
5.	14	25
6.	10	18
Total	**56**	**100**

6.4.1 CONTROL SYSTEM

L	T	P
4	-	2

RATIONALE

A diploma holder when employed in automation industry such as automated power stations will be required to know the basics of control system and process variables. Early automation systems were mechanical in design, the timing and sequencing being affected by gears and cams. Now these design concepts were replaced by electrical drives and are controlled by PI of PID controllers. Diploma holders in industry are responsible to design, modify and troubleshoot such control circuits. Looking at the industrial application of control system in the modern industry, this subject finds its usefulness in the present curriculum.

LEARNING OUTCOMES

After completion of courses the learner should be able to:

- understand the concept of open loop and close loop system
- understand various types of signals in control system
- determine Transfer function of a Control System
- explain various parameter of first order and second order Control System
- determine the stability of a Control System
- understand use of various controller in a Control System
- apply controllers in various industrial applications

DETAIL CONTENT

1. Introduction to Control System (12 Periods)

    1.1 Open loop Control System, block diagram and its elements, properties and application
    1.2 Close app Control System, block diagram and its elements, properties and application (with example)
    1.3 Block diagram of feedback Control System and its elements
    1.4 Comparison between open and close loop Control System
    1.5 Definition and Explanation of the following Control System
        a) Linear and Non linear System
        b) Continuous and Discrete System
        c) Static and dynamic System

2. Basic Signals (04 Periods)

2.1 Basic idea of impulse signal, unit step, ramp, and its Laplace transform

3. Transfer Function (08 Periods)

3.1 Definition of Transfer function and its use in Control System
3.2 Transfer function of the following:
3.3 Open loop and Close loop System
3.4 Simple RC low pass and High pass filter
3.5 Characteristic Equation
3.6 Pole-Zero Concept of Transfer Function
3.7 Initial value and final value theorem.

4. Time Domain Analysis (12 Periods)

4.1 Time response of first order system with unit step input
4.2 Time response of second order system with unit step input
4.3 Basic idea of delay time, rise time, setting time, steady state error, max overshoot, Damping ratio (No Derivation)
4.4 Over damped, under damped, critically damped, un damped system (basic idea only) and Pole-zero representation, Nature of transit response, Damping ration (No Derivation)

5. Stability Theory (10 Periods)

5.1 Basic concept of stability analysis by Routh-Hurwitz Criterion

6. Basic Controller (10 Periods)
6.1 Introduction,
6.2 Need of controller
6.3 Type of controller (Basic idea and Mathematical expression only)
a) On-off controller
b) Proportional controller
c) PD controller
d) PI controller
e) PID controller

LIST OF PRACTICALS

1. To obtain a transient response of first order system with unit step input
2. To obtain a transient response of second order system with unit step input

3. To observe the output waveform of a under damped system with unit step input
4. To observe the output waveform of a over damped system with unit step input
5. To observe the output waveform of a critically damped system with unit step input
6. To observe the output waveform of a undamped system with unit step input
7. To observe the output waveform of a plant controlled by P, PI and PID controllers.

INSTRUCTIONAL STRATEGY

The subject requires more emphasis on closed loop controlled system. Visit to instrumentation and communication industries most be carried out, so as to make students understand where and how various instruments are used in the industry.

MEANS OF ASSESMENT

- **Class test/Quiz**
- **Home Assignments**
- **Attendance**
- **Sessional and end semester examination**

RECOMMENDED BOOKS

1. **Modern Control Engineering by K. Ogata; PHI Publications.**
2. **Control System Engineering by I. J Nagrath and M.Gopal; New Age International Publishers.**
3. **Linerar Control System by B.S Manke; Knanna Publishers**
4. **E-book/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.**

Websites for Reference:
http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1.	12	22
2.	04	06
3.	08	14
4.	12	22
5.	10	18
6.	10	18
Total	**56**	**100**

6.4.2. MEDICAL ELECTRONICS

L	T	P
4	-	2

RATIONALE

A large number of electronic equipment s are being used in hospitals for patient care and diagnosis or carry out advanced surgeries. This subject will enable the students to learn the basic principles of different instruments used in medical science.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- describe various medical electronics equipment and their uses
- use electrodes for various purposes
- identify different types of bio-medical transducers
- understand the working of biomedical recorders
- measure various parameters required for patient monitoring system
- use modern imaging system
- identify the various patient safety standards.

DETAILED CONTENTS

1. Overview of Medical Electronics, classification of medical Equipments, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments, typical waveforms & signal characteristics (06 Periods)

2. Electrodes (08 Periods)

   Origin of Bioelectric signals, Bio electrodes, Electrode tissue interface, contact impedance, Types of Electrodes, Biological Amplifiers, Gelies, Electrodes used for ECG , EEG, EMG.

3. Bio Transducers & Biosensors (08 Periods)

   Typical signals from physiological parameters, Classification of Bio transducers, pressure transducer, Photoelectric transducer, Transducer for body temperature measurement, pulse sensor, respiration sensor.

4. Bio Medical Recorders (12 Periods)

   Block diagram description and application of following instruments
   4.1 Electrocardiograph (ECG) Machine

4.2 Electroencephalograph (EEG) Machine
4.3 Electromyography (EMG) Machine
4.4 Phonocardiogram (PCG)
4.5 Vector cardiogram (VCG)
4.6 Digital Stethoscope

5. Patient Monitoring Systems (10 Periods)

5.1 Heart rate measurement
5.2 Pulse rate measurement
5.3 Respiration rate measurement
a. Blood pressure measurement
b. Need of defibrillator and Cardiac Pace maker
c. Bedside patient monitoring System

6. Modern Imaging System (08 Periods)

6.1 X-Ray Machine
6.2 Magnetic Resonance Imaging System
6.3 Ultrasonic Imaging System

7. Patient Safety (04 Periods)

7.1 Electric shock hazards
7.2 Leakage currents
7.3 Electrical safety analyser
7.4 Safety standards.
7.5 CT-Scan

Note: Students must be taken for a visit to hospital for exposure of various medical electronics related equipments like ventilator, boyles apparatus, pulse ox meters, defibrillators, bedside monitor and x-ray equipment etc.

INSTRUCTIONAL STRATEGY

The teacher has to play a proactive role in arranging visits to hospitals and well equipped laboratories to reinforce theory. The apparatus and equipment available should be shown to students so that they can understand where and how the various biomedical instruments are used. Various charts and models be used for demonstration. Exposure to Spectrometer and UV Spectrometer must be given to students in addition to arranging visits to biomedical industries.

LIST OF PRACTICALS

1 . To operate and familiarization with:

   a) B.P. Apparatus
   b) ECG Machine
2. To operate and familiarization with:
   a) Ventilator
   b) Incubator
3. To measure the concentration of blood sugar with Glucometer (fasting, P.P., Random)
4. To measure
   a) Respiration rate and interface to PC
   b) Pulse rate
5. To Measure The EMG Signals and interface with PC
6. Body Temperature measurement and recording in excel form in pc.
7. Installation of medical equipment in laboratories of Hospital precautions to be taken.
8. Operation and use of Electro-physiotherapy

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Actual laboratory and practical work
- Assembly and disassembly exercises Viva-Voce

RECOMMENDED BOOKS

1. Handbook of Biomedical Instrumentation by RS Khandpur;Tata McGraw Hill Education Pvt Ltd, New Delhi
2. Biomedical Instrumentation by Cromwell PHL
3. Modern Electronics Equipment by RS Khandpur; TMH, New Delhi
4. Introduction to Biomedical Electronics by Edward J. Perkstein; Howard Bj, USA
5. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allocation (%)
1	06	12
2	08	16
3	08	16
4	12	20
5	10	16
6	08	12
7	04	8
Total	**56**	**100**

6.4.3 COMPUTER NETWORKS

L	T	P
4	-	2

RATIONALE

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

LEARNING OUTCOMES

After completion of the course, the learner should be able to

- recognize physical topology and cabling (coaxial, OFC, UTP, STP) of a network.
- recognize various types of connectors RJ-45, RJ-11,BNC and SCST.
- demonstrate various types of networking models and protocol suites.
- install and configure a network interface card in a workstation.
- identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation.
- configure routers.
- demonstrate sub netting of IP address.
- identify connectivity troubleshooting using PING, IPCONFIG, IFCONFIG.
- explain concept of wireless networking.
- configure different Network devices.
- understand network security management and configuration.

DETAILED CONTENTS

1. Networks Basics (08 Periods)

   1.1 What is network
   1.2 Peer-to –peer Network
   1.3 Server Client Network
   1.4 LAN, MAN and WAN
   1.5 Network Services
   1.6 Network Topologies
   1.7 Switching Techniques

2. OSI Model (08 Periods)

   2.1 Standards
   2.2 OSI Reference Model

2.3 OSI Physical layer concepts and application
2.4 OSI Data-link layer concepts and application
2.5 OSI Networks layer concepts and application
2.6 OSI Transport layer concepts and application
2.7 OSI Session layer concepts and application
2.8 OSI presentation layer concepts and application
2.9 OSI Application layer concepts and application

3. Introduction to TCP/IP (08 Periods)

3.1 Concept of physical and logical addressing
3.2 Different classes of IP addressing, special IP address
3.3 Sub netting and super netting
3.4 Loop back concept
3.5 IPV4 and IPV6 packet Format
3.6 Configuring IPV4 and IPV6

4. Cables and Connectors (08 Periods)

4.1 Types of Cables(Coaxial, Twisted Pair), Shielded and Unshielded Pair of Cables, fiber optic cable.
(Straight through Cable, Cross Over Cables) with colour coding.
4.2 Ethernet Specification and Standardization:
10 Mbps (Traditional Ethernet), 100 Mbps (Fast Ethernet) and 1000 Mbps (Gigabit Ethernet),Leased lines.
4.3 Use of RJ45, RJ11, BNC,SCST.

5. Network Connectivity (09 Periods)

5.1 Network connectivity Devices
5.2 NICs
5.3 Hubs
5.4 Bridges
5.5 Repeaters
5.6 Switches
5.7 Routers and Routing Protocols, Routing Algorithm
5.8 Configuring of Routers.
5.9 VOIP and Internet Telephony

6. Network Administration / Security (09 Periods)

6.1 Client/Server Technology
6.2 Server Management

6.3 RAID management and mirroring
6.4 Cryptography
6.5 Ethical Hacking

7. Wireless Networking (06 Periods)

Basics of Wireless: Wireless MAN, Networking, Wireless LAN, Wi-Fi, WiMax (Broad-band Wireless) and Li-Fi.

LIST OF PRACTICALS

1. Configure local area network using topologies.
2. Configure different network devices used in LAN- hub/switch/routers/bridges.
3. Create different types of cables for straight through and cross over cable
4. Configure Ethernet network
5. Install NIC and locate MAC address
6. Configure TCP/IP addressing
7. Install Network printer and sharing content

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.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model/prototype making
- Actual laboratory and practical work, model/prototype making, assembly and disassembly exercises and viva-voce

RECOMMENDED BOOKS

5. Computer Networks by Tanenbaum, Prentice Hall of India, New Delhi
6. Data Communications and Networking by Forouzan, (Edition 2nd and 4th),Tata McGraw Hill Education Pvt Ltd , New Delhi
7. Data and Computer Communication by William Stallings, Pearson Education, New Delhi
8. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR.

Websites for Reference:

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

6.5

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	08	15
2.	08	15
3.	08	14
4.	08	14
5.	09	15
6.	09	15
7.	06	12
Total	**56**	**100**

PROJECT WORK

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RATIONALE

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.

LEARNING OUTCOMES

After undergoing the project work, the students will be able to:

- Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project.
- 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
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand 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.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.
- Assemble/fabricate and test an electronics gadget.

General Guidelines

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 equipment / instruments.
- Projects related to increasing productivity in electronic 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.
- Projects related to microprocessor/microcontroller based circuits/ instruments.

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 ON line/OFF line UPS of different ratings and inverters
8. Design, fabrication and testing of different types of experimental boards
9. Repair of oscilloscope, function generator
10. Microprocessor/Microcontroller based solar tracking system
11. GSM based car or home security system
12. Bank token display using microcontroller
13. Microprocessor/Microcontroller Based A/D converter
14. Microprocessor/Microcontroller Based D/A converter
15. Simulation of half wave and full wave rectifiers using Simulation Software

16. Simulation of class A, Class B, Class AB and Class C amplifiers
17. Simulation of different wave forms like sine, square, triangular waves etc.
18. GPS based vehicle tracking system
19. Calculate BER(Bit Error Rate) of various modulation techniques
20. Electronic Weighing Machines
21. Setting up home security system using biometrics and video recording
22. Making an overhead tank water level controller using a pump and control system

23. PLC based water level controller/sequential motor starter/bottling plant/traffic light control.

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
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-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.