

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

***ELECTRONICS TECHNOLOGY (68)***  
**5<sup>th</sup> & 6<sup>th</sup>**

SYLLABUS  
(COURSE STRUCTURE-2010)

FIFTH SEMESTER

## AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of monochrome television engineering with special emphasis on:

- features of television communication
- composite video signal
- television camera tube
- television transmitter and receiver.
- black & white picture tube.
- receiver circuit
- test equipment
- television studio

## SHORT DESCRIPTION

Television communication; Factors of television system; Composite video signal; Television camera tube; Television transmitter and receivers; Black and white picture tube; Circuit diagram of a black and white TV; TV antenna; Booster; Feeder cables; Test equipment and TV studio.

## DETAIL DESCRIPTION

### Theory :

#### 1 Understand the features of television communication.

- 1.1 Describe the elementary idea of the role of TV camera, TV transmitter, propagation of signal, reception through antenna, TV receiver for TV communication.
- 1.2 Explain the TV communication with a basic block diagram.
- 1.3 Describe the CCTV, MATV and satellite TV communication with applications.
- 1.4 Describe the factors affecting range of TV coverage such as line of sight propagation, earth's curvature, antenna heights and power of transmitter.

#### 2 Understand the factors of television system.

- 2.1 Describe the terms: gross structure, Image continuity, fine structure and tonal gradation.
- 2.2 Describe number of scanning lines and scanning methods.
- 2.3 Define the terms: field, frame, persistence of vision, flicker, picture element, aspect ratio, interlace error.
- 2.4 Mention the Specification of CCIR, FCC standard used in Television.
- 2.5 List the specification of CCIR standard used in Bangladesh for monochrome television.
- 2.6 Mention the frequency range, sound and picture carrier of various bands and channels in the VHF range used in Bangladesh.
- 2.7 Calculate the required channel bandwidth for transmission of television signal.

#### 3 Understand the features of composite video signal.

- 3.1 List the different signals in the composite video signal.
- 3.2 Describe the video signal dimensions and dc component of the video signal with diagram.
- 3.3 Explain the need for sync, blanking and equalizing pulses.
- 3.4 Describe the need for VSB transmission in television broadcasting.
- 3.5 Describe the reason for employing AM for vision.
- 3.6 Describe the reason for employing FM for sound.
- 3.7 Mention the reason for using negative modulation for TV transmission.

#### 4 Understand the features of television camera tube.

- 4.1 Describe the basis of photoelectric conversion from screen to electrical signal through camera tube.
- 4.2 Describe the construction of vidicon, silicon diode and saticon camera tubes.

- 4.3 Explain the principle of operation of vidicon, silicon diode, solid state Image scanner and saticon camera tubes.
- 4.4 Describe the construction and operation of Solid state Image Scanner.
- 4.5 Explain the term gamma and need for gamma correction.
- 4.6 Define the terms image lag, sensitivity and dark current of a camera tube.
- 5 Understand the features of black and white television transmitter.**
  - 5.1 Draw the block diagram of a standard black and white TV transmitter.
  - 5.2 Level the signals at input and output of each block.
  - 5.3 Describe the functions of each block.
  - 5.4 Describe the basic principle of operation of typical TV transmitter.
- 6 Understand the features of a TV receiver.**
  - 6.1 Draw the block diagram of a black and white (B&W) TV receiver (Transistor and IC models).
  - 6.2 Level the signals at input and output of each block.
  - 6.3 Describe the functions of each block.
  - 6.4 Describe the possible effect of malfunction of each block on the receiver performance.
  - 6.5 Identify the faulty block/blocks when simple fault symptoms are given.
- 7 Understand the features of B & W picture tube.**
  - 7.1 Describe the construction of a B & W picture tube.
  - 7.2 Explain the operating principle of a black & white picture tube.
  - 7.3 Describe the electromagnetic deflection system.
  - 7.4 Describe the transfer characteristics of a B & W picture tube.
  - 7.5 Describe the function of picture tube circuit controls.
  - 7.6 Differentiate between camera tube and picture tube.
- 8 Understand the circuit diagram of a B & W TV (IC/ Transistor/Hybrid Models).**
  - 8.1 Draw the tripical circuit diagram of each block of a B & W TV receiver.
  - 8.2 Explain the working principle of each block including typical DC voltages, signal level and wave forms expected at critical points.
  - 8.3 Explain the procedure of test and alignment of each block.
  - 8.4 Describe the response characteristics of RF, IF, detector and video stages.
  - 8.5 Describe typical faults caused by miss adjustment and common component failure in each stage.
- 9 Understand the features of TV antenna, Booster and Feeder cables.**
  - 9.1 Mention the different types of TV antenna and dimensions of elements.
  - 9.2 Mention the procedure of installation of TV antenna.
  - 9.3 List the use of 300 ohm wire cable and 75 ohm co-axial cable for TV signal distribution and attenuation.
  - 9.4 Different between 75 ohm and 300 ohm cables.
- 10 Understand the concept of test equipment and test charts.**
  - 10.1 Mention the alignment and servicing equipment of television.
  - 10.2 Describe the standard test charts and their interpretation & use.
  - 10.3 Describe the use of B & W test pattern generators for receiver test and alignment.
  - 10.4 Describe signal injectors and their uses for fault finding.
  - 10.5 Describe typical fault charts.
  - 10.6 Describe trouble shooting procedure of B & W TV.
  - 10.7 Mention the safety precautions in television servicing.
- 11 Understand the organization of television studio.**
  - 11.1 Mention the basic audio, video sources and controls in the studio.
  - 11.2 Draw the diagram of a typical broadcast studio system.
  - 11.3 Describe the function of each stages of a television studio.
  - 11.4 Describe tele scene, slide, background superimposition, taylor etc.
  - 11.5 Describe audio dubbing and video editing.

**Practical :**

- 1 Identify with physical layout, location of stages and major components of a Black and White (B & W) TV receiver.**
  - 1.1 Select a B & W TV receiver with circuit diagram and required tools & materials.
  - 1.2 Observe the physical layout.
  - 1.3 Identify the location of stages and components number.
  - 1.4 Identify the location of major components in the physical circuit.
- 2 Locate all controls and effect of adjustments of controls on the performance of B & W TV receiver.**
  - 2.1 Select a B & W TV receiver with circuit diagram and required tools & materials.
  - 2.2 Observe the location of different control knobs.
  - 2.3 Switch on the power supply.
  - 2.4 Adjust each control knob.
  - 2.5 Observe the effect on the TV receiver.
  - 2.6 Adjust the controls for best performance.
- 3 Reassemble CRT and allied parts of a B & W TV receiver.**
  - 3.1 Select a B & W TV receiver with required materials tools and equipment.
  - 3.2 Observe the mechanism of mounting CRT.
  - 3.3 Dismount magnet, coil and earth straps.
  - 3.4 Re-assemble the parts again.
  - 3.5 Adjust the controls for best performance.
- 4 Test the B & W TV CRT and associated circuits for defective operation.**
  - 4.1 Select the B & W TV receiver with required tools and materials.
  - 4.2 Switch on the power supply.
  - 4.3 Observe the defects.
  - 4.4 Check the pin connections.
  - 4.5 Check the typical operating voltage.
  - 4.6 Check the resistance of coils.
  - 4.7 Observe the fault and make remedy.
- 5 Test the E H T and other high voltage section of a B & W TV receiver.**
  - 5.1 Select a B & W TV receiver with required materials and equipment.
  - 5.2 Switch on the power supply.
  - 5.3 Observe the presence of high voltage.
  - 5.4 Observe the associated circuits for high voltage.
  - 5.5 Identify the typical fault conditions.
- 6 Test the horizontal sweep circuit with typical fault conditions.**
  - 6.1 Select a B & W TV receiver with required tools and materials.
  - 6.2 Switch on the power supply.
  - 6.3 Observe the picture.
  - 6.4 Make some typical faults.
  - 6.5 Observe the performances of horizontal sweep circuit.
  - 6.6 Remove the fault and observe the operations.
- 7 Test the vertical sweep with typical fault conditions.**
  - 7.1 Select a B & W TV receiver with required tools and materials.
  - 7.2 Switch on the power supply.
  - 7.3 Observe the performance of vertical sweep circuit.
  - 7.4 Create some faults in vertical section and observe the effect.
  - 7.5 Remove the faults for normal operation.
- 8 Test the tuner stage with typical fault conditions.**
  - 8.1 Select a B & W TV receiver and required tools & materials.
  - 8.2 Switch on the power supply.
  - 8.3 Observe the operation.
  - 8.4 Change tuner adjustment.
  - 8.5 Observe the performance.
  - 8.6 Adjust the tuner for best operation.

- 9 Test the vision IF and detector stage with typical fault conditions.**
- 9.1 Select a B & W TV receiver with required tools and materials.
  - 9.2 Observe the connection of the circuit.
  - 9.3 Switch on the power supply.
  - 9.4 Observe the input and output wave shapes of the stages.
  - 9.5 Create some fault in the circuit.
  - 9.6 Observe the effects.
  - 9.7 Remove the faults and observe the result.
- 10 Test the synchronization (sync) separator stage with typical fault conditions.**
- 10.1 Select a black & white TV receiver with required tools and materials.
  - 10.2 Identify the sync. separator stage.
  - 10.3 Switch on the power supply.
  - 10.4 Observe input and output wave shapes.
  - 10.5 Create some faults in the stage and observe the effect.
  - 10.6 Remove the fault for normal operation.
- 11 Test the sound stage with typical fault conditions.**
- 11.1 Select on B & W TV receiver with required materials and tools.
  - 11.2 Identify the sound stage.
  - 11.3 Switch on the power supply.
  - 11.4 Observe sound and wave shapes at typical points.
  - 11.5 Create some faults in the circuit and observe the effect.
  - 11.6 Remove the fault and observe the operation.
- 12 Test the video output stage with typical fault conditions.**
- 12.1 Select a B & W TV receiver with required tools and materials.
  - 12.2 Identify the video output stage.
  - 12.3 Switch on the power supply.
  - 12.4 Observe the wave shapes at typical points.
  - 12.5 Create some faults and observe the effect.
  - 12.6 Remove the fault and observe the operation.
- 13 Test the power supply stage a with typical fault conditions.**
- 13.1 Select a B & W TV receiver with required tools and materials.
  - 13.2 Identify the power supply stage.
  - 13.3 Measure voltages at typical points.
  - 13.4 Create some faults.
  - 13.5 Observe the effect.
  - 13.6 Remove the fault and observe the operation.
- Visit a Television studio and prepare a report.

## REFERENCE BOOKS

1. Monochrome and Color Television  
– R R Gulati
2. Basic Television and Video Systems  
– Benrard Grob

**AIMS**

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of measurement and measuring instruments of electrical quantities with special emphasis on;

- Accuracy, precision, sensitivity and error in electrical measuring instruments.
- Concept of operation of different types of electrical measuring instruments.
- Selection of correct type of meters for particular measurement.
- Concept of Oscilloscope and wave analyzer

**SHORT DESCRIPTION**

Fundamentals of measurements; Indicating instruments; Digital instruments; Current & voltage measuring instruments; Oscilloscope and wave analyzer.

**DETAIL DESCRIPTION****Theory:****FUNDAMENTALS OF MEASUREMENTS****1. Understand the basic concept of measurements.**

- 1.1 Define measurements of electrical quantities.
- 1.2 Discuss significance of measurements.
- 1.3 Describe the terms accuracy, precision, sensitivity and resolution or discrimination.
- 1.4 Distinguish between accuracy and precision.
- 1.5 Describe errors in measurements.
- 1.6 State true value, static error or absolute error, relative error, static correction, limiting error and percentage limiting error.
- 1.7 Define the loading effect.
- 1.8 Describe the loading effects due to shunt connected instruments.
- 1.9 Describe the loading effects due to series connected instruments.
- 1.10 Solve problems related to errors in measurement.

**2. Understand the classification of measuring instrument.**

- 2.1 Describe measuring instrument.
- 2.2 Name two main types of measuring instruments.
- 2.3 Describe absolute and secondary instruments.
- 2.4 List two types of secondary instruments according to their mode of operation.
- 2.5 List three types of secondary instruments according to their functions.
- 2.6 Describe indicating, recording and integrating instruments.
- 2.7 Discuss the various effects of current or voltage utilized in measuring instrument upon which their operation depends.

**INDICATING INSTRUMENTS****3. Understand the principle of operation of indicating instruments.**

- 3.1 Name the three torque applied in indicating instrument which act upon their moving system.
- 3.2 Discuss deflecting torque and controlling torque.
- 3.3 Discuss spring control and gravity control system.
- 3.4 Compare between spring control and gravity control system.

- 3.5 Solve problems related to spring control and gravity control system.
- 3.6 Explain damping torque.
- 3.7 Name the three systems of damping.
- 3.8 Compare air friction damping, fluid friction damping and eddy current damping.

**4. 4 Understand the constructional features of measuring instruments.**

- 4.1 Name the essential parts of measuring instruments.
- 4.2 Describe the parts of the instrument such as supporting, moving system, balancing, permanent magnets, pointer, scale, zero-adjuster, cases, etc.
- 4.3 Discuss the torque weight ratio.

**CURRENT & VOLTAGE MEASURING INSTRUMENTS**

**5. Understand the concepts of ammeters and voltmeters.**

- 5.1 Explain the principle of operation of ammeter and voltmeter.
- 5.2 Distinguish between the working principle of ammeter and voltmeter.
- 5.3 List the various types of ammeter and voltmeter.

**6. Understand the principle of operation of moving iron instruments.**

- 6.1 Describe the construction and working principle of moving iron attraction type instruments.
- 6.2 Express the deduction of the torque equation of the moving iron attraction type instruments.
- 6.3 Describe the construction and working principle of repulsion type moving iron instrument.
- 6.4 Express the deduction of the torque equation.
- 6.5 List the advantages and disadvantages of moving iron instruments.
- 6.6 Discuss errors in moving iron instruments.
- 6.7 Solve problems related to torque equation of moving iron instruments.

**7. Understand the principle of operation of moving coil instruments.**

- 7.1 Describe the construction and working principle of permanent magnet moving coil instruments.
- 7.2 Express the deduction of the torque equation of the moving coil instrument.
- 7.3 Mention the advantages and disadvantages of permanent magnet moving coil instruments.
- 7.4 Describe the construction and working principle of dynamometer type moving coil instruments.
- 7.5 Indicate the arrangement of coils of dynamometer type instruments for measurements of current and voltage.
- 7.6 Discuss the errors of moving coil instruments.
- 7.7 Solve problems related to torque equation of moving coil instruments.

**DIGITAL INSTRUMENTS**

**8. Understand the concept of digital instrument.**

- 8.1 Explain the principle of operation of digital instruments.
- 8.2 Describe the advantages of digital instruments.
- 8.3 Compare digital instruments with the analog instruments.

**9. 10 Understand the concept of digital display system.**

- 9.1 Mention the different types of digital display system.
- 9.2 Describe seven segment display and 3x5 dot matrix display.
- 9.3 Describe the construction of liquid crystal display.
- 9.4 Describe the operation of gas discharge plasma display.

9.5 Explain resolution in digital meter and sensitivity of digital meters.

**10. Understand the concept of digital voltmeter.**

10.1 Describe the operation of transistor voltmeter (TVM).

10.2 Describe the operation of ramp type digital voltmeter (DVM).

**10.3** Describe the operation of successive approximation digital voltmeter.

**11. Understand the multimeter.**

11.1 Describe the uses of multimeter.

11.2 Explain the circuit of analog multimeter.

11.3 Describe the construction of analog multimeter

11.4 Describe the construction of digital multimeter.

**12. Understand the features of oscilloscope.**

12.1 State the basic principle of oscilloscope.

12.2 Mention the important features of cathode ray tubes (CRT).

12.3 Describe the function of sweep generator.

12.4 Describe the block diagram of oscilloscope.

12.5 Describe the operation of dual beam CRO.

12.6 Describe the operation of dual trace oscilloscope.

12.7 Describe the operation of storage oscilloscope.

12.8 Explain the method of measurement of phase angle and frequency by lissajous pattern.

12.9 Describe the characteristics of CRO probe.

**13. Understand the features of signal generator.**

13.1 Describe the operation of AF sine and square wave generator.

13.2 Describe the operation of function generator.

13.3 Explain the function of TV sweep generator.

13.4 Describe the operation of video pattern generator.

13.5 Describe the operation of color bar generator.

**14. Understand the features of wave analyzer.**

14.1 State the principle of basic wave analyzer.

14.2 Describe the operation of heterodyne wave analyzer.

14.3 Describe the basic principle of harmonic distortion analyzer.

14.4 Explain the function of spectrum analyzer.

**Practical:**

**1. Study the various types of measuring instruments.**

1.1 Select at least eight different measuring instruments.

1.2 Identify the types of given instruments for measuring electrical

1.2.1. quantities.

1.3 Observe the ranges of instruments.

**2. Study the operation of indicating, integrating, recording and digital instruments.**

2.1 Choose one indicating, one integrating, one recording and one digital

2.2 instrument.

2.3 Select the tools and materials required.

2.4 Connect each instrument to the supply system with proper load, if

2.5 necessary.

2.6 Observe the operation of moving system of each instrument.

**3. Study the parts of different types of measuring instruments.**

3.1 Select two types of measuring instruments.

3.2 Disassemble the magnet, moving iron parts, controlling and damping

3.3 parts, pointer, scale and case.

3.4 Observe the balancing system of the moving parts.



- 3.5 Assemble the parts as original.
- 4. Select the correct type of ammeter and voltmeter.**
- 4.1 Collect some ammeters and voltmeters.
  - 4.2 Collect required numbers of tools to open ammeters and voltmeter.
  - 4.3 Disassemble the parts of the instrument.
  - 4.4 Identify the controlling and damping system.
  - 4.5 Identify the parts of the meter.
  - 4.6 Identify the types of meter.
- 5. Measure voltage, time period and frequency using a CRO.**
- 5.1 Select a CRO and some signal source for measurement.
  - 5.2 Connect the signal probe to oscillator input.
  - 5.3 Switch on the power supplies.
  - 5.4 Adjust the voltage and sweep selector knob.
  - 5.5 Adjust other required controls.
  - 5.6 Observe the wave shape.
  - 5.7 Record horizontal distance and vertical distance for a single wave.
  - 5.8 Calculate voltage, time period and frequency from the knob's settings.
- 6. Measure the rise, fall and delay time using a CRO.**
- 6.1 Select the appropriate oscilloscope, required signal source and materials.
  - 6.2 Connect the signal input to the oscilloscope.
  - 6.3 Switch on the power supply.
  - 6.4 Make required adjustments.
  - 6.5 Observe the condition of the signal.
  - 6.6 Determine the value of rise, fall and delay time from the conditions.
- 7. Test the operation of a function generator.**
- 7.1 Select pulse generator and required equipment & materials.
  - 7.2 Connect the output of the pulse generator to the CRO.
  - 7.3 Switch on the power supply.
  - 7.4 Make adjustment of function generator.
  - 7.5 Observe the wave shapes of the oscilloscope.
- 8. Check the calibration of low frequency and high frequency signal generator using AC milli voltmeter, calibrated CRO and digital frequency counter.**
- 8.1 Select the low frequency, high frequency oscillators and required measuring equipments.
  - 8.2 Set the oscillator selector switches at mid position and increase or decrease in steps.
  - 8.3 Check the voltage with AC milli voltmeter.
  - 8.4 Compare the value with the calibration.
  - 8.5 Check the frequency calibration with CRO and digital frequency meter.
  - 8.6 Check the other parameters such as time period.

## **REFERENCE BOOKS**

- 1. Measurement & Measuring Instruments  
– Goldings
- 2. A course in Electrical and electronic measurements and instrumentation  
– A. K. Sawhrey.
- 3. A Text Book of Electrical Technology  
– B.L. Theraja
- 4. Electric Instrumentation  
– H. S. Kalsi

**AIMS**

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of advanced communication system with special emphasis on:

- Different switching systems and DSL technology
- Optical fiber communication system , Optical fiber and light sources for optical fiber
- satellite communication system
- Special purpose satellite
- SONET, ATM, ISDN
- Mobile communication
- Networks
- Mobile communication and cellular telephone

**SHORT DESCRIPTION**

Switching systems, ADSL, Optical fiber, light source for optical fiber, optical fiber communication systems, satellite communication, satellite ground station, special purpose communication satellite, satellite applications, ATM, SONET, ISDN, Interface standard, LAN, WAN, Advanced network and mobile communication.

**DETAIL DESCRIPTION****Theory:****DETAIL DESCRIPTION****THEORY:**

- 1 Understand Communication Switching System.
  - 1.1 Mention the elements of communication switching system
  - 1.2 Describe the criteria for the design of Telecommunication system.
  - 1.3 Explain the centralized switching and distributed switching.
  - 1.4 Discuss the typical hierarchical network structure.
- 2 Understand Electronic Switching System
  - 2.1 Mention the classification of switching system.
  - 2.2 Discuss the functions of switching system.
  - 2.3 Recognize the requirements of switching system.
  - 2.4 Explain centralized and distributed SPC switching system.

- 2.5 Discuss circuit switching, message switching and packet switching.
- 3 Understand Digital Switching System.
  - 3.1 Define digital switching.
  - 3.2 Mention the evaluation of digital switching.
  - 3.3 Mention the advantages and disadvantages of digital transmission.
  - 3.4 Describe the digital signal encoding formats.
  - 3.5 Discuss asynchronous and synchronous transmission.
  - 3.6 Describe space division switching.
  - 3.7 Describe analog time division and digital time division switching.
  - 3.8 Explain ST, TS, STS & TST SWITCHING.
- 4 Understand Digital subscriber Line (DSL) Technology
  - 4.1 Define XDSL & ADSL.
  - 4.2 Mention various types of XDSL.
  - 4.3 State the principle of XDSL
  - 4.4 Discuss encoding and modulation in XDSL.
  - 4.5 Mention the frequency spectrum of ADSL.
  - 4.6 Describe the topology & frame format for ADSL system.
  - 4.7 Mention the capabilities of ADSL.
  - 4.8 Mention the advantages of ADSL.
- 5 Understand the optical fiber communications.
  - 5.1 Mention the electromagnetic spectrum showing the region used for optical fiber communications
  - 5.2 Describe the block diagram of an optical fiber communication system.
  - 5.3 Define optical fiber.
  - 5.4 Describe the basic structure of an optical fiber.
  - 5.5 Explain propagation of light waves in optical fiber.
  - 5.6 Illustrate the acceptance angle, and numerical aperture of a fiber.
  - 5.7 Describe the types of optical fiber.
  - 5.8 Describe the dispersion in an optical fiber.
  - 5.9 Describe the construction of optical fiber cables.
  - 5.10 Mention the advantages and disadvantages of optical fibers.
- 6 Understand the light sources and detector for optical fibers.
  - 6.1 Describe the structure of LED.
  - 6.2 Explain the method of fiber LED coupling.
  - 6.3 Describe the laser operation.
  - 6.4 Describe the structure of semiconductor laser diode.
  - 6.5 Mention the advantages of semiconductor laser diode.
  - 6.6 Describe the basic principle of photo detectors.
  - 6.7 State the characteristics of photo detector.
- 7 Understand optical fiber joints, couplers and isolators
  - 7.1 List the possible misalignment occur during fiber joints
  - 7.2 Mention the connection problems when joining fibers
  - 7.3 Define fiber splice

- 7.4 Describe different fiber splices
  - 7.5 Recognize different types fiber connectors
  - 7.6 Discuss fiber couplers
  - 7.7 Describe optical Isolators and circulators
- 8 Understand the satellite communication.
- 8.1 Define the term satellite.
  - 8.2 State the classification of satellite.
  - 8.3 Mention the frequency allocations and band spectrum of satellite communication.
  - 8.4 Describe the general structure of satellite communication system.
  - 8.5 Describe the satellite orbits.
  - 8.6 State the footprint of a satellite and solar eclipse.
  - 8.7 Explain the satellite location with respect to earth.
- 9 Understand the communication satellite subsystem.
- 9.1 Describe the satellite earth station with block diagram.
  - 9.2 Describe the block diagram of the Transponder.
  - 9.3 Discuss the telemetry system of communication satellites.
  - 9.4 Describe the command system of communication satellites.
  - 9.5 Discuss the tracking and ranging system of communication satellites.
  - 9.6 Explain the attitude control of satellite with block diagram.
  - 9.7 Describe the components of satellite electric power system.
- 10 Understand the special purpose communication satellite.
- 10.1 Describe the very small terminals (VSATs).
  - 10.2 Describe the function of international telecommunication satellite (INTERSAT).
  - 10.3 Describe mobile satellite (MSAT) communication system..
  - 10.4 Explain the Global positioning system (GPS).
  - 10.5 Describe the block diagram of a handheld GPS receiver.
  - 10.6 Compare the satellite communication with respect to fiber optic communication.
  - 10.7 Mention the fields of satellite application.
- 11 Understand the data communication network.**
- 11.1 Define the term network.
  - 11.2 State the types of network.
  - 11.3 Describe the network topologies.
  - 11.4 State the various data-link protocols.
  - 11.5 Explain the term Token passing and VOIP.
  - 11.6 Describe the Ethernet.
  - 11.7 Illustrate the function of modem.
- 12 Understand Synchronous Optical Network (SONET)
- 11.1 Define SONET & SDH
  - 11.2 Mention the characteristics of SONET.
  - 11.3 State SONET Signal Hierarchy.

- 11.4 Mention SONET components.
  - 11.5 Discuss SONET Network and Layers.
  - 11.6 Recognize the SONET Frame Format.
  - 11.7 Describe SONET Multiplexing.
  - 11.8 Explain SONET Topologies.
- 13 Understand ATM technology.
- 13.1 Define ATM technology.
  - 13.2 List the Advantages of ATM.
  - 13.3 Explain the concepts of ATM.
  - 13.4 Discuss ATM Header Structure.
  - 13.5 Describe ATM Layers.
- 14 Understand The integrated Services Digital Network (ISDN).
- 14.1 Define ISDN.
  - 14.2 Mention the ISDN services.
  - 14.3 List the advantages of ISDN.
  - 14.4 Describe the ISDN interfaces.
  - 14.5 Describe the ISDN channels.
  - 14.6 Describe the ISDN switching, functional grouping and reference points.
- 15 Understand mobile communication.
- 15.1 Define mobile communication.
  - 15.2 State the Cellular telephone system.
  - 15.3 Describe the basic composition of mobile communication system.
  - 15.4 Explain the generation of the Cellular telephone system.
  - 15.5 Describe cell splitting, frequency reuse, roaming, and handoff in cellular telephone.
  - 15.6 Mention the channels and bands of the different Cellular telephone system.
  - 15.7 Describe the subscriber identification techniques.
- 16 Understand Cellular telephone network
- 16.1 Explain the term GSM network.
  - 16.2 Describe the architecture of The GSM network.
  - 16.3 Describe the typical call flow sequence in GSM (location updating, mobile call origination mobile call termination, authentication and encryption) .
  - 16.4 State the basic principle of CDMA.
  - 16.5 Mention the CDMA frequency and channel allocations.
  - 16.6 Describe Short Message Management Protocol.
  - 16.7 Describe the block diagram of a modern mobile phone hand set.
  - 16.8 Explain the term Bluetooth, WiMAX & WAP.

**Practical:**

1. *Observe the frequency response of Fiber optic Receiver.*
2. *Perform voice communication Using MIC, Speaker and OF.*
3. *Study the voice communication using AM receiver and optical fiber Link.*
4. *Study the voice communication using FM receiver and optical fiber Link.*
5. *Study the connection & operation of MODEM (Modulation/Demodulation) in the PC.*
7. *Study the FSK modulator and demodulator through OF.*
8. *Study the ASK modulator and demodulator through OF.*
9. *Identify with physical layout, location of stages and major components of a cellular phone.*
10. *Install the LAN (Local Area Network) in your computer Lab.*
11. *Visit nearest MSC, BSS, Railway station, ISP, Ground satellite station and write a report on your visit.*

#### **REFERENCE BOOKS**

1. Telecommunication Switching and Networks
  - P. Gnanasivam
2. Data Communication and Networking
  - Behrouz A. Forouzan
3. Principles of Communications Satellites.
  - Gray D. Gordon and Walter L. Morgan.
4. Mobile and Personal Communication Systems and Services.
  - Raj Panday
5. Optical fiber communication principles and practice,
  - John M. Senior..

**AIMS**

- To assist to acquire the skills needed for drawing & designing by ECAD package.
- To provide the skill needed for PCB design and schematic drawing by typical package.
- To provide the skill needed for making PCB designed by ECAD.

**SHORT DESCRIPTION**

Setting up drawing environments and aids; Drawing and editing schematic circuits; Analyzing a schematic Circuit; Organizing the drawing information on layers; Exporting PCB Netlist; Creating a simple PCB layout; editing the PCB layout; Printing, plotting PCB layout and making PCB.

**DETAIL DESCRIPTION****1. Set up the drawing environment and drawing aids.**

- 1.1. Start an ECAD Package and identify the different areas of ECAD screen.
- 1.2. Identify the menu bar, toolbar, drawing area and special windows for circuit simulation and testing purpose.
- 1.3. Familiarize with tools, toolkits and buttons (such as arrow, wire, text, delete etc)
- 1.4. Familiarize with workspace, conventions, preferences, shortcuts and hotkeys.
- 1.5. Place components such as resistors, transistors, power supply etc.
- 1.6. Save the drawing environment.
- 1.7. Exit from the ECAD package.

**2. Draw schematic Circuit.**

- 2.1 Select an electronic Circuit diagram.
- 2.2 Place Devices according to circuit diagram (such as resistors, transistors, IC, power supply, grounds etc) in the workspace Selected ECAD package.
- 2.3 Wire devices together.
- 2.4 Edit devices with values and parameters.

**3. Analyze a schematic Circuit.**

- 3.1 Add device meter to circuit diagram and set device meter values.
- 3.2 Simulate the circuit.
- 3.3 View Circuit voltage and current or digital logic level.
- 3.4 Change a device value and quickly analyze the circuit.
- 3.5 Perform DC and AC analysis of the circuit using circuit analyzer/oscilloscope.

**4. Organize the drawing information on layers.**

- 4.1. Identify the layer control options.
- 4.2. Create and name the layers.
- 4.3. Make the layer current and control layer visibility.
- 4.4. Freeze, lock and unlock the layers.
- 4.5. Set the layer color & line type.

**5. Export PCB Netlist.**

- 5.1. Familiarize PCB Netlist requirement.

- 5.2. Create a PCB Netlist file.
- 5.3. Export the PCB Netlist file in appropriate format.
- 5.4. Run appropriate PCB layout and auto routing Program.
- 5.5. Load PCB Netlist file.
- 5.6. Define the board size.
- 5.7. Use auto placement feature for placing Netlist component on the board.

**6. Create a simple PCB layout.**

- 6.1 Select the schematic diagram comprising of resistors, capacitors, transistors, op-amps, logic gates, etc.
- 6.2 Run any professional PCB layout packages.
- 6.3 Load the layout drawing (symbols, pads, lines, components, etc.) from the components library.
- 6.4 Configure the system for units and co-ordinates.
- 6.5 Use commands to display the grids.
- 6.6 Zoom and unzoom the drawing area.
- 6.7 Connect the pads with tracks to make the schematic circuit diagram.
- 6.8 Save & exit the layout.

**7. Edit the PCB layout.**

- 7.1 Load or open the PCB layout.
- 7.2 Delete & insert the nodes, track and layout entities.
- 7.3 Change the size and shape of pad, track and symbols.
- 7.4 Duplicate and rearrange the layout entities (use copy, move & rotate commands).
- 7.5 Change the width of the tracks.
- 7.6 Set up & use layouts and colors.
- 7.7 Include the text in the layout.
- 7.8 Save the PCB layout.

**8. Print and plot the PCB layout.**

- 8.1 Open the PCB layout.
- 8.2 Select the output format.
- 8.3 Set up the printing options.
- 8.4 Set up the area of plot size.
- 8.5 Compensate for printer or plotter in accuracy.
- 8.6 Print on tracing paper PCB layout.

**9. Make the photo resist coating emulsion.**

- 9.1 Select the required materials such as sona code and dichromate.
- 9.2 Prepare photo coating emulsion.

**10. Make the PCB using screen printing techniques.**

- 10.1 Select the required frame with silkscreen.
- 10.2 Take printed tracing paper PCB layout.
- 10.3 Prepare the screen by proper steps for PCB printing.
- 10.4 Prepare the PCB by proper steps.

**11. Build the project.**

- 11.1 Place the components on the PCB.
- 11.2 Solder the components.
- 11.3 Test the circuit for proper operation.



**NB: Students can select projects from the following list.**

- i) Regulated power supply.
- ii) Timers using 555 and other oscillators.
- iii) Clapping switch and IR switch.
- iv) Blinkers.
- v) Sirens and hooters.
- vi) Single band AM or FM Radio receiver.
- vii) Cell charger, battery charger, mobile charger.
- viii) Fire or smoke alarm.
- ix) Liquid level controller.
- x) Counters.
- xi) Combination locks.
- xii) Electronic musical instruments.
- xiii) Audio amplifiers.
- xiv) Automotive stabilizer/CVT.
- xv) Emergency light.
- xvi) Fan regulator.

**AIMS**

- To be able to acquire the knowledge & skill on counters, shift registers and their applications.
- To be able to acquire the knowledge & skill on semiconductor memories & ALU
- To be able to acquire the knowledge & skill on A/D and D/A converters
- To familiarize with PLD & simple computer (SAP-1)

**SHORT DESCRIPTION**

Sequential system concept; Flip-flops; Registers & counters;  
Semiconductor Memories; A/D & D/A converters, PLD and SAP-1.

**DETAIL DESCRIPTION****Theory:****1. Understand the clocked Flip Flops.**

- 1.1 Describe the operation of sequential logic system with block diagram.
- 1.2 Define the synchronous and asynchronous sequential logic circuit.
- 1.3 State the concept of level clocking and edge triggering.
- 1.4 Explain the operation of clocked SR Flip Flop.
- 1.5 State the advantages of edge triggering in Flip Flop.
- 1.6 Explain the operation of clocked D, T, JK and Master-slave Flip Flops.
- 1.7 Describe the operation of RS Flip Flop as a de-bounce switch.
- 1.8 Describe the operation of Flip Flop as a frequency division circuit.
- 1.9 State the application field of Flip Flops.

**2. Understand registers and its application.**

- 2.1 Define register.
- 2.2 Mention different types of registers.
- 2.3 Mention the use of shift registers.
- 2.4 List the different types of common shift register IC chips
- 2.5 Describe the operation of buffer register.
- 2.6 Explain the basic principle of operation of serial in - serial out shift registers.
- 2.7 Explain the operation of parallel in- parallel out shift registers.
- 2.8 Describe the operation of left shift, right shift and universal shift registers.
- 2.9 Describe the states (both two and three) of registers.

**3. Understand the binary counter circuits.**

- 3.1 Define binary counter.
- 3.2 State the difference between asynchronous and synchronous counter.
- 3.3 Explain the operation of asynchronous, synchronous and decade counter.
- 3.4 State the modulus of a counter.
- 3.5 Describe the principle of divide - by- n counter.
- 3.6 Describe the operation of a binary up - down counter.
- 3.7 State the principle of ring & Johnson counter.
- 3.8 State the application of different types of counters.
- 3.9 Describe the operation of digital clock.

**4. Understand semiconductor memories.**

- 4.1 List the type of memories.

- 4.2 Describe the principle of serial and parallel access memory.
- 4.3 Explain the internal organization of semiconductor memory.
- 4.4 Describe the technique of memory addressing.
- 4.5 Explain the read and write operation of semiconductor memory.
- 4.6 Explain the principle of static and dynamic RAM.
- 4.7 Describe the principle and operation of ROM, PROM, EPROM and EEPROM.
- 4.8 List the application of some commercial memory ICs.

#### **5. Understand arithmetic logic circuit.**

- 5.1 Mention the basic principle of ALU.
- 5.2 List the application of ALU.
- 5.3 Identify some commercial ALU chips.
- 5.4 Mention the principle of digital comparators.
- 5.5 Mention the principle of binary rate multiplier with block diagram.
- 5.6 List the application of digital comparators.
- 5.7 Identify some commercial comparators and binary rate multiplier ICS.

#### **6. Understand D/A converter.**

- 6.1 Mention the principle of level conversion.
- 6.2 Describe the principle of D/A conversion.
- 6.3 Mention the types of D/A converter.
- 6.4 Explain the operation of a binary weighted D/A and R-2R ladder D/A converter.
- 6.5 State the terms – resolution, percentage resolution, and accuracy, offset error and settling time as specification of D/A converter.
- 6.6 Solve problems on resolution, full scale output current, output voltage and accuracy of D/A converter.
- 6.7 State the application field of D/A converter.
- 6.8 List the application of popular D/A converter ICS.

#### **7. Understand A/D converter.**

- 7.1 State the general principle of A/D conversion
- 7.2 List the type of A/D converter.
- 7.3 State the working principle of 3-bit parallel A/D converter.
- 7.4 Describe the operation of Digital Ramp A/D converter
- 7.5 Explain the operation of successive approximation, dual slope and Flash A/D converter.
- 7.6 State the terms – resolution, accuracy, and conversion time as specification of A/D converter.
- 7.7 List the applications of popular A/D converter ICS.
- 7.8 Describe the operation of sample & hold circuits and its application.

#### **8. Understand the programmable logic devices.**

- 8.1 Defines PLD.
- 8.2 State the advantages of PLD.
- 8.3 Describe the principle of PLD.
- 8.4 Discuss simplified logic diagram of PLA, PAL and GAL.
- 8.5 Describe the architecture of two input PLA, PAL and GAL.
- 8.6 State the basic feature of FPGA.
- 8.7 Describe the programming process SPDL
- 8.8 Describe the complex programmable logic device (CPDL).
- 8.9 Interpret standard PAL and GAL numbering.

#### **9. Understand the organization of a SAP-1**

- 9.1 State the meaning of SAP.
- 9.2 State the function of each stage of SAP-1 with block diagram.
- 9.3 State the function of control signals i.e. Enable, Load, Clock and

- 9.4 Clear of each register.
- 9.5 State the instruction for accessing and storing data in RAM of SAP-1.
- 9.6 Describe the bus organization of SAP- 1.

#### **10. Understand the Micro and Macro Instruction of SAP-1**

- 10.1 Describe the function of controller sequencer.
- 10.2 State the control word/micro instruction of controller sequencer.
- 10.3 State the meaning of macro instructions and their corresponding binary op-code used in SAP-1
- 10.4 State the concept of machine cycle, fetch cycle, execution cycle and instruction cycle
- 10.5 Describe the fetching steps of micro instruction in different T states.
- 10.6 Describe the execution steps of micro instruction in different T states.

#### **Practical:**

1. To prepare the clocked RS, D, T, JK & Master-slave flip-flops and check its truth table/operations.
2. To prepare different types of shift registers and check its operation.
3. To prepare different types of counter and check its operation.
4. To prepare an asynchronous binary counter and check the output.
5. To prepare a synchronous decade counter and check the output.
6. Check the operation of ALU.
7. To show the read / write operation of a 4 bit memory chip.
8. To show the D/A conversion procedure of D/A converter.
9. To show the A/D conversion procedure of A/D converter.
10. To the operation of digital clock
11. To the operation of digital voltmeter.
12. Construct and verify the operation of SPLD by using logic gates.

#### **REFERENCE BOOKS**

1. Digital principles and application  
– A P Malvino
2. Digital Computer Electronics  
– A P Malvino
3. Digital System  
– Tocci
4. Modern Digital Electronics  
- R. P. Jain
5. Digital Fundamentals.  
– FLOYD

**OBJECTIVES**

- To develop knowledge and skill to prepare programs in C.
- To develop knowledge and skill to create, compile, debug & execute C programs.

**SHORT DESCRIPTION**

Basics of C program; Data types; Variables; Operators; Expressions; Input-Output statements; Branching and Looping statements; Arrays; preprocessors, Functions, Pointers; Structures and Unions; File operations and Graphics.

**DETAIL DESCRIPTION****Theory:****1 Understand fundamentals of C Programming**

- 1.1 Describe the historical development of C Programs.
- 1.2 Describe the Basic structure of C program and programming style .
- 1.3 State the difference of C with other high level languages.
- 1.4 Explain the process of program planning.
- 1.5 Describe algorithm and flow chart.
- 1.6 Prepare algorithm and flow chart for simple problems.
- 1.7 State the process of compiling C program.
- 1.8 Write simple programs using basic structure of C program.

**2 Understand data types, constants and variables.**

- 2.1 Describe the data types in C.
- 2.2 Explain constants and variables in C.
- 2.3 Describe the keywords and identifiers in C.
- 2.4 Mention the use of qualifiers in data types.
- 2.5 Declare variables and assign values to variables.
- 2.6 State the type conversion and type definition in C.
- 2.7 Write simple programs using constants and variables.

**3 Understand Operators and Expressions.**

- 3.1 State C operators and their classification.
- 3.2 Describe the arithmetic, relational, logical, assignment, increment, decrement and conditional operators.
- 3.3 Explain the bitwise and special operators.
- 3.4 Write arithmetic expression & its evaluation.
- 3.5 Describe the precedence of arithmetic operators.
- 3.6 Mention operator precedence and associativity.
- 3.7 Write simple programs using operators and expressions.

**4 Understand the input and output operations.**

- 4.1. Describe the statement getting input from keyboard.
- 4.2. Describe the statements printing output on screen and by printer.
- 4.3 State the codes used for formatted I/O.Statements.
- 4.4 Mention the escape sequence in C.
- 4.5 Write programs using I/O statements.

**5 Understand the Branching and Looping Statements.**

- 5.1 Describe the conditional and unconditional branching flow.
- 5.2 State the statement for conditional and unconditional branching.
- 5.3 Explain the format for branching statements.
- 5.4 Describe the conditional and unconditional Looping flow.
- 5.5 State the statement for conditional and unconditional Looping.
- 5.6 Explain the format for looping statements.
- 5.7 Write programs using branching and looping statements.
- 6 Understand arrays
  - 6.1 Define arrays
  - 6.2 Describe the dimension of arrays.
  - 6.3 Initialize arrays.
  - 6.4 Write programs using arrays.
- 7. Understand preprocessor statements in C.
  - 7.1 Describe the preprocessor directives and their functions.
  - 7.2 Define header.
  - 7.3 Describe the process of including header in routine.
  - 7.4 Explain the use of macro.
  - 7.5 Describe the advantage of macros over functions in programs
  - 7.6 Write programs using preprocessor statements.
- 8 Understand pointer and its application.
  - 8.1 Define pointer.
  - 8.2 Describe the characteristics of pointer.
  - 8.3 Explain pointer expressions.
  - 8.4 Write programs using pointers.
- 9 Understand Function.
  - 9.1 Explain library function and user defined function.
  - 9.2 Describe the process of calling functions and returning values from functions in C.
  - 9.3 Describe arguments used in functions.
  - 9.4 Mention function prototype.
  - 9.5 Write programs using library function and user defined function..
- 10 Understand structure and union.
  - 10.1 Describe structure and union.
  - 10.2 Mention structure and union declaration.
  - 10.3 Distinguish between structure and union.
  - 10.4 Write simple programs using structure and union.
- 11 Understand file operations.
  - 11.1 Describe file operations.
  - 11.2 State the modes of opening files.
  - 11.3 Describe the functions that support character I/O.
  - 11.4 Explain the routines for performing formatted I/O to files
  - 11.5 Write programs for reading, writing and editing files.
- 12 Understand graphics elements and its application in C.
  - 12.1 Define Text and Graphics
  - 12.2 Describe how graphics are created in computers.
  - 12.3 State the concept of pixel and resolution of CRT/LCD/LED display.
  - 12.4 State the format and use of line( ), rectangle( ), bar( ), bar3d( ), Circle( ),

- ellipse( ), fillellipse( ) and sector( ) functions with example
- 12.5 State the format and use of Arc( ), pieslice( ), drawpoly( ) and fillpoly( ) outtextxy( ) & settextstyle( ), cleardevice( ), delay( ), sound( ) & nosound( ), functions with example
- 12.6 Mention the use of modified cprintf( ) and cscanf( ) functions for I/O operation.
- 12.7 Write program for developing color image using above graphics functions.
- 12.8 State the procedure of saving and loading an image in C.
- 12.9 Show the procedure to move text string on the screen.
- 12.10 Describe the statements used to copy and move text and graphics.
- 12.11 Write programs to create simple graphics.

#### Practical:

1. Perform the task to create, compile, debug & execute a C programs
  - a) To print a message.
  - b) To add two integer/float numbers.
2. Perform the task to create, compile, debug & execute a C programs using constants and variables
  - a) To calculate the average of N numbers.
  - b) To convert the given temperature in Fahrenheit to Celsius and vice versa.
  - c) To calculate the area of a circle.
3. Perform the task to create, compile, debug & execute a C programs using operators and expressions.
  - a) To convert days to months and days.
  - b) To calculate the area of a triangle.
  - c) To compare two integer numbers
4. Perform the task to create, compile, debug & execute a C programs using I/O statements
  - a) To read integer/real number.
  - b) To find the sum of three floating point numbers from keyboard.
  - c) To convert centimeter to inch using scanf ( ) and Printf ( ) statements.
5. Perform the task to create, compile, debug & execute a C programs using Branching Statements.
  - a) To select and print the largest number of three numbers.
  - b) To compute the roots of a quadratic equation.
  - c) To count vowels from a string of ten characters using switch statement.
- 6 Perform the task to create, compile, debug & execute a C programs using Looping Statements
  - a) To print odd or even numbers from N numbers.
  - b) To find the maximum or minimum number from a set of numbers.
  - c) To search prime numbers.
- 7 Perform the task to create, compile, debug & execute a C programs using arrays
  - a) To sort numbers in ascending or descending order using one dimensional array.
  - b) To print numbers in two dimensional form.
  - c) for matrix multiplication.
- 8 Perform the task to create, compile, debug & execute a C programs using preprocessor statements.
  - a) To determine hypotenuse of right angled triangle using macro.
  - b) To determine the area of a triangle using nested macro.
- 9 Perform the task to create, compile, debug & execute a C programs using pointers
  - a) To illustrate the use of pointers in arithmetic operations.
  - b) To compute the sum of all elements stored in an array.

- 10 Perform the task to create, compile, debug & execute a C programs using functions
  - a)To calculate the area of a triangle
  - b)To sort an array of integer numbers.
  - c)To calculate factorial of any integer using recursive function.
- 11 Perform the task to create, compile, debug & execute a C programs using structure and union
  - a)To store and retrieve data using structure.
  - b) To store and retrieve data using union.
- 12 Perform the task to create, compile, debug & execute a C programs using files
  - a)To store/read information to/from sequential file.
  - b) To store/read information to/from random file.
  - c) To convert lower case to upper case and vise versa.
- 13 Perform the task to create, compile, debug & execute a C programs using graphics
  - a)To draw a line with different styles.
  - b)To draw a circle with different colors.
  - c)To generate nested ellipse.
14. To develop a complete project using C program that include text, graphics and sound in VGA mode.

Reference books and sites:

1. programming in C – E. Balagurusamy.
2. Teach yourself C \_ Herbert Schildt.
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com) › Computers & Internet
4. [www.freebookcentre.net](http://www.freebookcentre.net) › Programming Languages Books
- 5 [www.4shared.net/c+programming+ebook](http://www.4shared.net/c+programming+ebook)



**AIMS**

- To be able to understand the principles and practices of book keeping and accounting.
- To be able to understand the procedures of general accounting, financial accounting and their applications.

**SHORT DESCRIPTION**

Concept of book keeping and accounting; Transactions; Entry systems; Accounts; Journal; Ledger; Cash book; Trial balance; Final accounts; Cost account & financial accounting; Depreciation; Public works accounts.

**DETAIL DESCRIPTION****1 Understand the concept of book keeping and accounting.**

- 1.1 Define book keeping and accountancy.
- 1.2 State the objectives of book keeping.
- 1.3 State the advantages of book keeping.
- 1.4 Differentiate between book keeping and accounting.
- 1.5 State the necessity and scope of book keeping and accounting.

**2 Understand the transactions.**

- 2.1 Define transactions and business transaction.
- 2.2 Explain the importance of transactions.
- 2.3 Describe the characteristic features of transactions.
- 2.4 Discuss the classification of transaction.
- 2.5 Identify the transaction from given statements stating reasons.

**3 Understand the entry system.**

- 3.1 State the aspects of transactions.
- 3.2 Define single entry system.
- 3.3 State the objectives of single entry system.
- 3.4 Discuss the disadvantages of single entry system.
- 3.5 Define double entry system.
- 3.6 Discuss the principles of double entry system.
- 3.7 Justify whether double entry system is an improvement over the single entry system.
- 3.8 Distinguish between single entry and double entry system of book keeping.

**4 Understand the classification of accounts.**

- 4.1 Define accounts.
- 4.2 State the objectives of accounts.
- 4.3 Illustrate different type of accounts with example.
- 4.4 Define "Golden rules of Book keeping".
- 4.5 State the rules for "Debit" and "Credit" in each class of accounts.
- 4.6 Determine Debtor (Dr) and Creditor (Cr.) from given transactions applying golden rules.
- 4.7 Define accounting cycle.
- 4.8 State the different steps of accounting cycle.

**5 Understand the Journal.**

- 5.1 Define Journal.
- 5.2 State the object of Journal.

- 5.3 State the functions of Journal.
- 5.4 Mention the various names of Journal.
- 5.5 Interpret the form of Journal.
- 5.6 Journalize from given transactions.

#### **6 Understand the ledger.**

- 6.1 Define ledger.
- 6.2 Interpret the form of ledger.
- 6.3 State the functions of ledger.
- 6.4 Distinguish between Journal and Ledger.
- 6.5 Prepare ledger from given transactions.
- 6.6 Explain why ledger is called the king of all books of accounts.

#### **7 Understand the cash book.**

- 7.1 Define cash book (single, double and triple column).
- 7.2 Explain cash book as both Journal and Ledger.
- 7.3 Prepare double column cash book from given transactions showing balances.
- 7.4 Prepare triple column cash book from given transaction and find out the balances.
- 7.5 Define petty cash book.
- 7.6 Prepare analytical and imprest system of cash book.
- 7.7 Define discount.
- 7.8 Explain the different types of discount.

#### **8 Understand the trial balance.**

- 8.1 Define trial balance.
- 8.2 State the object of a trial balance.
- 8.3 Discuss the methods of preparation of a trial balance.
- 8.4 Explain the limitations of a trial balance.
- 8.5 Prepare trial balance from given balance.

#### **9 Understand the final accounts.**

- 9.1 State the components of final account.
- 9.2 Distinguish between trial balance and balance sheet.
- 9.3 Identify the revenue expenditure and capital expenditure.
- 9.4 Select the items to be posted in the trading account, profit & loss account and the balance sheet.
- 9.5 State the adjustment to be made from the given information below or above the trial balance.
- 9.6 Prepare trading account, profit & loss account and balance sheet from the given trial balance & other information.

#### **10 Understand the cost and financial accounting.**

- 10.1 Define financial accounting.
- 10.2 State the objectives of financial accounting.
- 10.3 Define cost accounting.
- 10.4 Discuss the relationship between financial Accounting and cost accounting.
- 10.5 State the elements of direct cost and indirect cost.

- 10.6 Prepare cost sheet showing prime cost, factory cost, cost of production, total cost and selling price.
- 10.7 Discuss the capital budgeting
- 10.8 Discuss the discounted cash flow method
- 10.9 Explain the following terms:
  - a. Fixed cost b. Variable cost c. Factory cost d. Overhead cost e. Process cost
  - f. Direct cost g. Operating cost h. Standard cost

## **11 Understand the depreciation**

- 11.1 Define depreciation.
- 11.2 State the objects of depreciation.
- 11.3 Discuss the necessity for charging depreciation.
- 11.4 Describe the different methods of determining depreciation.
- 11.5 Explain the relative merits and demerits of different method of depreciation.

## **12 Understand the public works accounts.**

- 12.1 State the important aspects of public works accounts.
- 12.2 Describe the main features of public works accounts.
- 12.3 Explain "Revenue and Grant".
- 12.4 Define Value Added Tax (VAT)
- 12.5 State the merits and demerits of VAT.
- 12.6 Define Bill and Voucher.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM

***ELECTRONICS TECHNOLOGY (68)***

SYLLABUS  
(COURSE STRUCTURE-2010)

SIXTH SEMESTER

6861	ELECTRONIC MEASUREMENT AND MEASURING INSTRUMENT-2	T	P	C
		3	6	4

### **AIMS**

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of Electronics Measurement and Measuring Instruments with special emphasis on :

- extension of instrument range
- measurement of the resistance of various ranges
- impedance bridge
- the concept of operation of meters for measurement of frequency and power factor.

### **SHORT DESCRIPTION**

Extension of instrument ranges: instrument range; Ammeter shunt, Voltmeter multiplier Measurement of resistance: Low resistance, Medium resistance and Special measuring instruments and Impedance bridge. Frequency Meter: Principle of measurement, construction and operation; Construction and principles of operation; Digital power factor meter.

### **DETAIL DESCRIPTION**

#### **Theory:**

#### **EXTENSION OF INSTRUMENT RANGE**

- 1 Understand extension of instrument range.**
  - 1.1 List different types of instrument for which extension is required.
  - 1.2 Explain the necessity for extension of instrument range.
  - 1.3 Describe the principles of extension of instrument range.
- 2 Understand the concept of ammeter shunt.**
  - 2.1 Describe the ammeter shunt for DC circuit.
  - 2.2 Express the deduction of the relation:  $R_s = \frac{R_m}{N-1}$
  - 2.3 Explain ammeter shunt for AC circuit.
  - 2.4 Solve problems relating to ammeter shunt.
- 3 Understand the concept of voltmeter multiplier.**
  - 3.1 Describe voltmeter multiplier.
  - 3.2 Describe the swamping resistance.
  - 3.3 Explain voltmeter multiplier for AC instrument.
  - 3.4 Solve problems relating to voltmeter multipliers.

#### **MEASUREMENT OF RESISTANCE**

- 4 Understand the measurement of resistance.**
  - 4.1 Classify resistance.
  - 4.2 Explain low, medium and high range of resistance.
- 5 Understand the principle of measurement of low resistance.**
  - 5.1 List the methods of measurement of low resistance.
  - 5.2 Describe the ammeter – voltmeter method.
  - 5.3 Describe Kelvin's double bridge method.
  - 5.4 Solve problems on Kelvin's double bridge method.

**6 Understand the measurement of medium resistance.**

- 6.1 List the method of measurement of medium resistance.
- 6.2 Describe Wheatstone bridge method of measurement of medium resistance.
- 6.3 Mention the advantages of Wheatstone bridge method.
- 6.4 Discuss the precaution in measuring medium resistance by Wheatstone bridge method.
- 6.5 Solve problems related to Wheatstone bridge method.

**7 Understand the features of Impedance Bridge.**

- 7.1 Describe the method of measurement of inductance by Maxwell's bridge.
- 7.2 Explain the principle of Wein's bridge.
- 7.3 Describe the Murray and Varley loop test methods for localization of cable faults.
- 7.4 Describe the methods of testing for the localization of ground fault.
- 7.5 Solve Problem on R, L & C measurement using ac bridge.

**8 Understand the features of special measuring instruments**

- 8.1 Describe the operation of audio power meter.
- 8.2 Explain the basic principle of distortion factor meter.
- 8.3 Describe the operation of Q meter.
- 8.4 Describe the operation of RX meter.
- 8.5 Explain the basic principle of automatic bridge.
- 8.6 Describe the operation of transistor and IC tester.
- 8.7 Describe the operation of curve tracer.
- 8.8 Discuss the operation and uses of megger.

**FREQUENCY METER**

**9 Understand the principle of measurement of frequency.**

- 9.1 Name the methods of measuring frequency.
- 9.2 Explain the principle of mechanical resonance.
- 9.3 Explain the principle of electrical resonance.
- 9.4 List different types of frequency meter.

**10 Understand the operation of digital frequency meter.**

- 10.1 Describe the principle of operation of digital frequency meter.
- 10.2 Sketch the block diagram of a digital frequency meter.
- 10.3 Describe each block of a digital frequency meter.
- 10.4 Describe the function of time base selector in digital frequency meter.
- 10.5 Draw the logic diagram of a digital frequency meter.
- 10.6 Explain the operation of logic diagram of the digital frequency meter.

**POWER FACTOR METER**

**11 Understand the construction and principle of operation of power factor meter.**

- 11.1 List different types of power factor meter.
- 11.2 Describe the principle of operation of digital power factor meter.
- 11.3 Draw the block diagram of a power factor meter.
- 11.4 Describe each block of a digital power factor meter.

**PRACTICAL:**

**1 Determine the shunt resistance of an ammeter for extension of its range.**

- 1.1 Sketch the circuit diagram for determining the shunt resistance of an ammeter.
- 1.2 Collect the tools, equipment and materials required.
- 1.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 1.4 Check the equipment before connecting power supply.
- 1.5 Record the readings from the meter.
- 1.6 Calculate the value of shunt resistance.

**2 Determine the value of resistance of a voltmeter multiplier.**

- 2.1 Sketch the circuit diagram for determining the resistance of voltmeter multiplier.

- 2.2 Connect the tools, equipment and materials required.
- 2.3 Prepare the circuit according to the circuit diagram.
- 2.4 Check the circuit before connecting power supply.
- 2.5 Record the reading from the meter.
- 2.6 Calculate the value of resistance of the multiplier.

**3 Perform the measurement of low resistance by Ammeter–Voltmeter method.**

- 3.1 Draw the circuit diagram for the measurement of low resistance by ammeter-voltmeter method.
- 3.2 Connect the tools, equipment and materials required.
- 3.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 3.4 Check the circuit before connecting power supply.
- 3.5 Record the meter readings.
- 3.6 Calculate the resistance from the meter readings.

**4 Perform the measurement of medium resistance by wheatstone bridge.**

- 4.1 Draw the circuit diagram for measuring medium resistance by Wheatstone bridge.
- 4.2 Select tools, equipment and materials required.
- 4.3 Prepare the circuit according to the circuit diagram.
- 4.4 Check all the connection before connecting power supply.
- 4.5 Record the meter readings.
- 4.6 Calculate the value of unknown resistance.

**5 Perform the measurement of high resistance by a megger.**

- 5.1 Select a high resistance.
- 5.2 Select a megger.
- 5.3 Connect the resistance with the megger.
- 5.4 Measure the resistance from the reading of the megger.

**6 Perform the measurement of frequency by a frequency meter.**

- 6.1 Sketch the circuit diagram.
- 6.2 Select a frequency meter.
- 6.3 Select tools, equipment and materials.
- 6.4 Connect the frequency meter to the supply or circuit whose frequency is to be measured.
- 6.5 Measure the supply frequency from the meter.

**7 Perform the measurement of power factor by a power factor meter.**

- 7.1 Sketch the circuit diagram for measurement of power factor of a load by a power factor meter.
- 7.2 Select the tools, equipment and materials required.
- 7.3 Prepare the circuit according to the circuit diagram using proper equipment.
- 7.4 Check the circuit before connecting power supply.
- 7.5 Record power factor from the power factor meter.

**8 Measure the inductance with an AC bridge.**

- 8.1 Select maxwell bridge with required materials.
- 8.2 Connect unknown inductance in the unknown arm.
- 8.3 Switch on the power supply.
- 8.4 Balance the bridge with varying quantity in the variable arms.
- 8.5 Calculate the inductance from the values of the known arms.

**9 Measure the resistance, inductance and capacitance using RLC bridge.**

- 9.1 Select the bridge with required materials.
- 9.2 Connect the component to be measured to the unknown arm.
- 9.3 Set up the knobs for proper measurement.
- 9.4 Switch on the power supply and adjust for the null position.

9.5 Determine the value of the unknown parameter.

**10 Measure the Q of a coil with a Q-meter.**

- 10.1 Select a Q-meter, radio frequency coil and required materials.
- 10.2 Connect the coil with the Q-meter.
- 10.3 Switch on the power supply.
- 10.4 Make proper adjustment.
- 10.5 Determine Q of the coil directly.

**11 Test the transistor using semiconductor tester.**

- 11.1 Select the equipment and required tools & materials.
- 11.2 Set the transistor in the proper place for testing.
- 11.3 Switch on the power supply.
- 11.4 Make required adjustment.
- 11.5 Observe the condition of the component.
- 11.5 Note the result.

**12 Measure the distortion of a low frequency signal generator using a distortion factor meter.**

- 12.1 Select required equipment, tools and materials.
- 12.2 Connect the signal generator output to the distortion factor meter.
- 12.3 Switch on the power supply.
- 12.4 Make power adjustment.
- 12.5 Measure the distortion.

**13 Test the diode, SCR and FET using semiconductor tester.**

- 13.1 Select required tools, equipment and materials.
- 13.2 Set the test device in the proper place.
- 13.3 Switch on the power supply.
- 13.4 Make required adjustment.
- 13.5 Observe the condition of the component.
- 13.6 Note the result.

**14 Measure the separate resistive and reactive components by RX meter.**

- 14.1 Select required equipment, tools and materials.
- 14.2 Construct the circuit as per diagram.
- 14.3 Connect oscillator to the bridge and other to the mixer.
- 14.4 Adjust frequency of oscillators.
- 14.5 Adjust variable resistance and capacitance for null meter.
- 14.6 Observe the reading of the dial for parallel impedance.

**REFERENCE BOOKS**

- 1. Electronic Instrumentation  
– HS Kalsi
- 2. Electrical and Electronic Measurements and Instrumentation  
– A. K. Sawhney
- 3. Industrial Instrumentation and control  
– S. K Singh.
- 4. Elements of Electronic Instrumentation and Measurement  
– Joseph J. Carr
- 5. Measuring Instruments  
– Goldings



***AIMS***

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of color television and video system with special emphasis on:

- color television signal
- color television system
- color picture tube
- associate and color circuits
- video equipment
- video camera & ENG

***SHORT DESCRIPTION***

Optics of color television; Fundamentals of color television signal; Complete transmitted signal; Color television systems; Color picture tube; Associated and color circuit of color TV receiver; Video equipment, ENG and remote control.

***DETAIL DESCRIPTION*****Theory :****1 Understand the concept of optics of color television.**

- 1.1 Define the nature of visible light.
- 1.2 Describe the perception of colors.
- 1.3 Describe the mechanism of color vision.
- 1.4 Define the terms photothic, scotothic, hue, brightness, saturation, luminance, chrominance, color temperature, peakwhite and gray.
- 1.5 Describe additive and subtractive color mixing.
- 1.6 Describe chromaticity diagram.

**2 Understand the fundamentals of color television signal.**

- 2.1 Describe the production of color difference signals.

- 2.2 Calculate the values amplitude of luminance and chrominance signals for different colors bar signal at different saturation.
- 2.3 Calculate the phase angle of color bar signals and any color signal.
- 2.4 Describe the polarity and band width of color difference signals.
- 2.5 Describe channel band width for PAL system.

**3 Understand the concept of complete transmitted signal.**

- 3.1 Describe the principles of quadrature amplitude modulation.
- 3.2 Define weighted and un-weighted signal.
- 3.3 Evaluate the magnitudes of weighting factors.
- 3.4 Describe signal phasors with weighted values.
- 3.5 Describe the exact value of subcarrier frequency for color television.
- 3.6 Describe composite color signal with step by step conversion from camera signals.

**4 Understand the concept of color television system.**

- 4.1 . Mention the major color TV standards for PAL system.
- 4.2 Describe the operation of PAL transmitter (Encoder) with block diagram.
- 4.3 Describe the operation of PAL receiver (Decoder) with block diagram.
- 4.4 Describe the basic principles of NTSC and SECAM system.
- 4.5 Compare PAL, SECAM and NTSC color TV systems.

**5 Understand the features of color picture tube.**

- 5.1 Mention different types of color picture tube.
- 5.2 Describe the construction of Trinitron color picture tubes.
- 5.3 Describe the operation of Trinitron picture tube.
- 5.4 Describe the meaning of static, dynamic, differential convergence and purity.
- 5.5 Describe the function of the external components required for different color picture tube.
- 5.6 Describe the adjustment procedure of external components required for different color picture tube.
- 5.7 Describe removal, installation precautions and color reproduction procedure of color picture tube.
- 5.8 Mention the specification of color picture tube.

**6 Understand the operation of associate circuits of color TV receivers.**

- 6.1 .Describe the chrominance signal processing sections of a PAL receiver with block diagram.

- 6.2 Describe the operation of Chroma bandpas Amplifier, Automatic Colour Control, burst blanking, color killer, Sub carrier oscillator, AFPC, color matrix, DC clamps, color difference amplifier circuit.
- 6.3 Describe the procedure of color purity, static and dynamic convergence and grey scale tracking to color TV receiver.
- 6.4 Describe the operation of ADG circuit.
- 6.5 Describe the operation of luminance section with delay line.
- 6.6 Describe the sound section of color TV receiver.
- 6.7 Describe the V-channel switching and need for ident signal.
- 6.8 Describe the factory adjustment of color TV receiver.
- 6.9 Describe the control panel of television receiver with diagram.
- 6.10 Describe the modern TV receiver (Projection, Digital, 3D and HDTV) with block diagram.
- 6.11 Describe the modern plasma TV, LCD, LED Television.

## **7 Understand the features of video equipment .**

- 7.1 Describe the basic principle of different types of video formats.
- 7.2 Describe the basic principle of operation of VCD & DVD with block diagram.
- 7.3 Describe the process of VCD & DVD to auxiliary equipment interconnection with diagram and recording system.
- 7.4 Mention the adjustment procedure of VCD and DVD.
- 7.5 Describe the operation of CCD multi system, Beta CAM and DV-CAM color video camera.
- 7.6 Describe the basic principle of operation of TV tuner Card.
- 7.7 Describe the basic principle of operation digital color Camera, 3CCD Camera
- 7.8 Describe the Dolby system.
- 7.9 Mention Dolby Noise reduction digital & analog recording.

## **8 Understand the features of ENG & remote control.**

- 8.1 .Describe the Basic principle of ENG (Electronic news Gathering).
- 8.2 Describe the operation of ENG with block diagram.
- 8.3 Describe the basic principle of command encoding system for remote control
- 8.4 Describe the basic principle of command decoding & system control (such as ON/OFF brightness, volume, contrast, color program etc.)
- 8.5 Describe interfacing system of remote control with TV and DVD.

## **Practical :**

### **1 Study the process of generation and addition of colors with a color bar pattern generator.**

- 1.1 Select a color TV receiver, a color bar pattern generator and required materials.
- 1.2 Connect the pattern generator to the color TV receiver.
- 1.3 Switch on the power supply for each of the equipment.
- 1.4 Produce red, green and blue color on the screen.
- 1.5 Add the colors to produce yellow, cyan, magenta and white.

### **2 Locate the stages, major components and signal flow in a color TV receiver.**

- 2.1 Select a color TV receiver with a circuit diagram.
- 2.2 Observe the circuit diagram and the circuit board.
- 2.3 Observe the layout of the components.
- 2.4 Note the stages and identify the components numbers.
- 2.5 Determine the stages of the major components.
- 2.6 Observe the signal flow in the PCB as well as in the circuit diagram.

### **3 Perform the identification of the front panel control and their adjustments in color TV receiver.**

- 3.1 Select a color TV receiver and required tools & equipment.
- 3.2 Identify the various front panel control knobs and their circuit locations.
- 3.3 Adjust the knobs in different positions.
- 3.4 Observe the performance for various adjustments.
- 3.5 Identify the best possible adjustments.

### **4 Reassemble of color picture tube and allied parts in a color TV receiver.**

- 4.1 Select a color TV receiver and required tools equipment & materials.
- 4.2 Dismantle the picture tube and its allied parts.
- 4.3 Identify different parts and connections of color TV receiver.
- 4.4 Reassemble the tubes and allied parts.
- 4.5 Observe the operation of color TV receiver.

### **5. Study the tuner section of color TV receiver.**

- 5.1 Select a color TV receiver with circuit diagram and required tools & equipment.
- 5.2 Identify the different types of the tuner.
- 5.3 Identify components and connections of tuner section.
- 5.4 Measure voltages at different test points.

5.5 Observe the wave shapes.

5.6 Draw the circuit diagram.

**6 Study the IF section of a color TV receiver.**

6.1 Select a TV receiver with circuit diagram and required tools & equipment.

6.2 Identify different components of IF section.

6.3 Identify the connections of IF section.

6.4 Observe the voltage wave at different points.

6.5 Draw the circuit of IF section.

**7 Study the detector section of color TV receiver.**

7.1 Select a TV receiver with circuit and required tools and equipment & materials.

7.2 Identify the detector.

7.3 Identify its connection.

7.4 Observe the input and output voltage waves.

7.5 Draw the circuit diagram.

**8 Study the power supply section of a color TV receiver.**

8.1 Select a color TV receiver with circuit and required tools & equipment.

8.2 Identify different components of power supply section.

8.3 Identify connections of power supply section.

8.4 Measure voltages at different test points.

8.5 Draw the circuit diagram.

**9 Study the sync. separator section of color TV receiver.**

9.1 Select a color TV receiver with circuit and required tools & equipment.

9.2 Identify different components.

9.3 Trace the circuit connection.

9.4 Draw the circuit diagram.

9.5 Switch on the power supply.

9.6 Observe the expected wave in oscilloscope.

**10 Study the vertical section of a color TV receiver.**

10.1 Select a color TV receiver with circuit and required tools & equipment.

10.2 Identify different components.

10.3 Trace circuit connection.

10.4 Draw the circuit of vertical section.

- 10.5 Switch on the power supply.
- 10.6 Observe the wave shapes at test points.

**11 Study the horizontal section of a color TV receiver.**

- 11.1 Select a color TV receiver with circuit and necessary tools & equipment.
- 11.2 Identify different components.
- 11.3 Identify circuit connection.
- 11.4 Draw the circuit diagram.
- 11.5 Switch on the power supply.
- 11.6 Observe the wave shapes.

**12 Study the video amplifier section of a color TV receiver.**

- 12.1 Select a color TV receiver with circuit and necessary tools & equipment.
- 12.2 Identify different components.
- 12.3 Identify the circuit connections.
- 12.4 Draw the circuit diagram.
- 12.5 Measure voltages at test points.
- 12.6 Observe the wave shapes.

**13 Study the audio section of a color TV receiver.**

- 13.1 Select a color TV receiver with circuit and necessary tools & equipment.
- 13.2 Identify different components.
- 13.3 Identify the circuit connections.
- 13.4 Draw the circuit diagram.
- 13.5 Measure voltages at various test points.

**14 Study the chroma section of a color TV receiver.**

- 14.1 Select a color TV receiver with circuit and necessary tools & equipment.
- 14.2 Identify the different components of chroma section.
- 14.3 Trace the component connections.
- 14.4 Draw the circuit diagram.
- 14.5 Make the power supply on.
- 14.6 Observe the color plexed composite video signal.
- 14.7 Identify different components of a composite video signal.

**15 Adjust the control knobs in chrominance amplifier and associated circuits.**

- 15.1 Select a color TV receiver, tools, equipment and materials.
- 15.2 Switch on the power supply.

- 15.3 Trace the signals at different points in the chrominance amplifier and associated circuit.
- 15.4 Change the adjustments.
- 15.5 Observe the performance of chrominance amplifier.
- 15.6 Adjust the control for best performance.

**16 Align the subcarrier reference oscillator and associated circuit.**

- 16.1 Select a color TV receiver with necessary tools, equipment and materials.
- 16.2 Switch on the power supply.
- 16.3 Trace the signals at different points.
- 16.4 Observe the performance for different adjustments.
- 16.5 Adjust the controls for proper signal.

**17 Adjust the controls in color difference, luminance and associated circuits.**

- 17.1 Select a color TV receiver and required tools, equipment & materials.
- 17.2 Switch on the power supply.
- 17.3 Observe the signals at different points.
- 17.4 Adjust the controls and observe the performance.
- 17.5 Set the controls for proper functioning.
- 17.6 Switch off the power supply.

**18 Perform the exercise in setting up color killer adjustment.**

- 18.1 Select a color TV receiver with circuit diagram and required tools & equipment.
- 18.2 Identify the location of color killer.
- 18.3 Observe the test signals at different points.
- 18.4 Change the adjustments.
- 18.5 Observe the results.
- 18.6 Identify the best adjustment.

**19 Perform the exercise in setting up purity adjustment.**

- 19.1 Select a color TV receiver and required tools, equipment & materials.
- 19.2 Identify different purity magnets.
- 19.3 Switch on the supply.
- 19.4 Observe the picture.
- 19.5 Change the setting & observe the result.
- 19.6 Readjust the magnet for proper functioning.

**20 Prepare exercise in setting up convergence.**

- 20.1 Select a color TV receiver and required tools, equipment & materials.
- 20.2 Identify the controls for static convergence.
- 20.3 Identify the circuits for dynamic convergence.
- 20.4 Switch on the power supply.
- 20.5 Observe the picture.
- 20.6 Change the adjustment and observe the result.
- 20.7 Readjust the setting for proper functioning.

**21 Perform the exercise in checking up degaussing, high voltage and focus control.**

- 21.1 Select a color TV receiver and required tools, equipment & materials.
- 21.2 Identify the given sections.
- 21.3 Observe the connections and controls.
- 21.4 Switch on the power supply.
- 21.5 Check high voltage with necessary precautions.
- 21.6 Adjust for focus control.
- 21.7 Check up degaussing.
- 21.8 Apply external degaussing if necessary.

**22 Perform setting up gray scale tracking.**

- 22.1 Select a color TV receiver with required tools, equipment & materials.
- 22.2 Connect pattern generator to receiver.
- 22.3 Remove video modulating signal.
- 22.4 Adjust required controls.
- 22.5 Modulate channel carrier (pattern generator) with video signal for white circle and gray background.
- 22.6 Make required controls.
- 22.7 Repeat the procedure to ensure no color production for no color input.

**23 Practice the fault finding process and remedy for color TV receiver.**

- 23.1 Select a particular model of color TV receiver and required tools, equipment & materials.
- 23.2 Switch off the power supply.
- 23.3 Observe the symptoms of the fault.
- 23.4 Diagnose the symptoms and determine the causes on priority basis.
- 23.5 Select most possible cause and make possible correction.



23.6 Repeat the work until the fault is eliminated.

**24 Study the operation of external control in a video cassette recorder (VCR).**

24.1 Select a VCR and required tools and materials.

24.2 Switch on the power supply.

24.3 Change the controls.

24.4 Observe the performance.

24.5 Set up the controls for proper operation.

**25 Study the operation of a VCD/DVD**

25.1 Select a VCD/DVD and required tools & equipment.

25.2 Compare the block diagram with VCD/DVD.

25.3 Compare major components in different stages.

25.4 Observe the tape transport mechanism.

25.5 Connect the VCD/DVD and TV receiver.

25.6 Load the cassette.

25.7 Observe the recording and playing.

**26 Practice the fault finding procedure and remedy of a VCD/DVD .**

26.1 Select a fault VCD/DVD and required tools & equipment.

26.2 Switch on the power supply.

26.3 Observe the symptoms.

26.4 Diagnose possible cause.

26.5 Make proper action for causes on priority basis.

**27 Study the operation of video camera.**

27.1 Select a video camera and required tools.

27.2 Load the cassette.

27.3 Observe the recording and playing procedure.

❖ Visit a Television studio and ENG transmission system.

**REFERENCE BOOKS**

2. Monochrome and Color Television

– R R Gulati

3. Basic Television and Video Systems

– Benrard Grob

3. Internet Browsing

## AIMS

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of instrumentation and process control with special emphasis on:

- transducer
- signal conditioning
- measuring techniques of special quantities
- data acquisition
- control theory
- application of process control
- Recorders.

## SHORT DESCRIPTION

Transducers; Passive transducer; Self generating type transducer; Measuring technique by transducer; Signal conditioning; Recorders; Measuring techniques of special quantities; Data acquisition; Control theory; Servo control; Application of process control and application of recorders.

## DETAIL DESCRIPTION

### Theory:

- 1. Understand the basic features of transducers.**
  - 1.1 State the meaning of transducer and sensor.
  - 1.2 Mention different types of transducer and sensor.
  - 1.3 Describe difference between transducers and sensors
  - 1.4 Describe the parameters of electrical transducer.
  - 1.5 Describe the factors to be considered in selecting a transducer.
  - 1.6 Describe mechanical devices as primary detector.
  - 1.7 Mention the different electrical phenomena employed in transducers.
- 2 Understand the features of passive transducers.**
  - 2.1 Describe the operation of different types of resistive transducers.
  - 2.2 Explain the basic principle of strain gauges
  - 2.3 Describe the working principle of resistance thermometer.
  - 2.4 Describe the construction of different types of thermistor.
  - 2.5 Describe the working principle of inductive transducer.
  - 2.6 Explain the operation of differential output transducers.
  - 2.7 Describe the construction and working principle of linear variable differential transformer (LVDT)
  - 2.8 Describe the construction and working principle of Rotary variable differential transformer (RVDT)
  - 2.9 Describe the working principle of pressure inductive transducer.
  - 2.10 Describe the working principle of pressure capacitive transducer.
- 3 Understand the features of self-generating type transducers.**
  - 3.1 Describe the working principle of Piezoelectric transducers
  - 3.2 Explain the basic principle of photo emissive, photoconductive and photo voltaic cell.
  - 3.3 Describe the construction of thermocouples and thermopile.

- 3.4 Describe the working principle of thermocouple and thermopile.
- 3.5 Describe the concept of digital encoding transducer
- 3.6. Describe the principle and operation of optical displacement transducer.
- 3.7 Describe the principle and operation of photo optic transducer.

#### **4 Understand the measuring technique by transducers.**

- 4.1 Describe the weight measuring technique by load cell (pressure cell).
- 4.2 Explain the basic principle of resistance temperature detector (RTD).
- 4.3 Explain the basic principle of reluctance pulse pick-up.
- 4.4 Describe the working principle of magnetic flow meter.
- 4.5 Describe the sound intensity measurement technique by capacitor microphone.
- 4.6 Describe the liquid level measurement technique by dielectric gauge.
- 4.7 Describe the torque measurement technique by magnetostriction gauge.
- 4.8 Explain synchro system.
- 4.9 Describe the angular displacement measurement technique by synchro system.

#### **5 Understand the concept of signal conditioning.**

- 5.1 Describe signal conditioning system with block diagram.
- 5.2 Explain the basic principles of DC and AC signal conditioning system.
- 5.3 Explain the basic principle of data conversion system.
- 5.4 Describe the operation of an instrumentation amplifier.
- 5.5 Describe the basic principle of instrumentation system.
- 5.6 Describe use of operational amplifier with capacitive displacement transducer.
- 5.7 Describe radio telemetry with block diagram.

#### **6 Understand the features of recorders.**

- 6.1 State the necessity of recorder in instrumentation system.
- 6.2 State different types of recorders.
- 6.3 Describe the principle of operation of strip chart recorder.
- 6.4 Describe the principle of operation of X-Y recorder (galvanometer and null type).
- 6.5 Describe the principle of operation of magnetic recorder.
- 6.6 Describe the operation of frequency modulation recording.
- 6.7 Explain the method of recording temperature and sound by strip chart recorder.

#### **7 Understand the measuring techniques of special quantities.**

- 7.1 Describe the method of Temperature, compensation and cancellation Techniques.
- 7.2 Describe the method of measurement of pressure using electrical transducer
- 7.3 Describe the method of measurement of torque by using different method such as by inductive transducer, digital method.
- 7.4 Describe the method of measurement of temperature by using thermometer, thermocouple.
- 7.5 Describe the method of measurement of flow by electromagnetic flow meter.
- 7.6 Describe the method of measurement of humidity by humidity hygrometers

#### **8 Understand the concept of data acquisition.**

- 8.1 Explain the basic principle of data acquisition system.
- 8.2 Describe the component of analog and digital data acquisition system.
- 8.2 Describe the principle single channel and multi channel data acquisition system.
- 8.4 Describe the basic principle of operation of data logger.

- 8.5 Describe the method of data transmission.
- 8.6 Describe the digital recording and use of recorder in digital system.
- 9 Understand the concept of control theory.**
  - 9.1 Mention the types of control systems.
  - 9.2 Describe the principles of open loop & closed loop control system.
  - 9.3 State the meaning of transfer lag.
  - 9.4 Describe two-step & three step control systems.
  - 9.5 Describe proportional, derivative and integral control.
  - 9.6 Explain compound control system such as PI, PD, DI & PID control.
  - 9.7 Mention the advantages & disadvantages of proportional, derivative and integral control system.
- 10 Understand the concept of servo control.**
  - 10.1 Describe the construction of DC servo, AC servo, stepper motor, electrical modulator, hydraulic servomotor and hydraulic modulator.
  - 10.2 Describe the principle of operation of DC servo & AC servo stepper motor, electrical modulator, hydraulic servomotor and hydraulic modulator.
  - 10.3 Describe the basic concepts of DC position control with servo system.
  - 10.4 Describe the idea of AC position control with synchro sensing element.
  - 10.5 Describe the speed control system for sheet metal processing unit.
  - 10.6 Describe Online and Offline computer control system with block diagram.
- 11 Understand the different applications of process control.**
  - 11.1 Explain the basic concept of process control.
  - 11.2 Describe the pneumatic system and controller with block diagram.
  - 11.3 Describe the analogue electronic process controller.
  - 11.4 Explain the temperature, speed, pressure and flow control using an analogue electronic controller.
  - 11.5 Describe the injection molding system for plastic, PET, PVC production process with block diagram.

## **Practical :**

- 1. Measure the displacement by linear variable resistance transducer.**
  - 1.1 Select a potentiometer and required tools & materials.
  - 1.2 Couple the object with sliding contact to the potentiometer.
  - 1.3 Build up the circuit for measurement of displacement.
  - 1.4 Switch on the power supply.
  - 1.5 Measure input and output voltage of the potentiometer.
  - 1.6 Measure the displacement or force using appropriate formula.
- 2. Measure the temperature by resistance thermometer.**
  - 2.1 Select a resistance thermometer (such as platinum resistance thermometer) and a heat source with mounting facility and required tools & materials.
  - 2.2 Measure the thermometer resistance at room temperature.
  - 2.3 Record the temperature of heat source.
  - 2.4 Make the temperature of the source steady.
  - 2.5 Measure the resistance of the thermometer.

- 2.6 Calculate the temperature using appropriate formula.
- 3. Determine the temperature coefficient of thermistor.**
  - 3.1 Select a thermistor and required tools & equipments.
  - 3.2 Connect the thermistor with measuring equipment.
  - 3.3 Provide a temperature regulated heat source for the thermistor.
  - 3.4 Rise temperature in step and measure the corresponding resistance of the thermistor.
  - 3.5 Plot the data for temperature verses resistance characteristics.
  - 3.6 Observe the graph.
- 4. Measure the thickness of a material by capacitive transducer.**
  - 4.1 Select an appropriate capacitive transducer with required tools and materials.
  - 4.2 Set up the materials to measure the thickness between the plates of the capacitor.
  - 4.3 Connect the meter and source as required.
  - 4.4 Switch on the power supply.
  - 4.5 Measure the capacitance between two plates.
  - 4.6 Calculate the thickness using appropriate data and formula.
- 5. Measure the displacement by linear variable differential transformer (LVDT).**
  - 5.1 Select an iron core, wire and required tools & equipments.
  - 5.2 Construct a LVDT with an iron core and coil with one primary and secondary keeping iron movable.
  - 5.3 Connect the primary with AC source.
  - 5.4 Connect the two secondary with the oscilloscope.
  - 5.5 Move the iron core from left to right.
  - 5.6 Observe the wave shapes.
  - 5.7 Observe the null position.
  - 5.8 Measure the voltage increasing or decreasing with core movement or displacement.
- 6. Measure the temperature by thermo couple.**
  - 6.1 Select a thermocouple (such as iron-constant) and required tools & materials.
  - 6.2 Connect one end of the thermocouple to a voltmeter with proper arrangement.
  - 6.3 Apply heat on the other end of the thermocouple in the fire.
  - 6.4 Observe the reading of the meter.
  - 6.5 Calibrate the meter for temperature.
  - 6.6 Measure the temperature.
- 7. Measure the strain by strain gauge.**
  - 7.1 Select a strain gauge bridge and required tools & materials.
  - 7.2 Attach the strain gauge at the point where strain or torque is to be measured.
  - 7.3 Apply strain.
  - 7.4 Read the change in the resistance due to strain.
  - 7.5 Calculate the value of strain or torque using appropriate formula.
- 8. Measure the light intensity by photocell.**
  - 8.1 Select a photoelectric device, light source and required tools & materials.
  - 8.2 Construct the circuit with photoelectric device.
  - 8.3 Separate the light source from the photoelectric device with a window having small aperture which is controlled by force summing member of the pressure transducer.
  - 8.4 Open the aperture for the photoelectric device.

- 8.5 Measure the change in output.
- 8.6 Measure the light intensity.
- 9. Measure the vibration by Piezoelectric transducer.**
  - 9.1 Select a Piezoelectric crystal and necessary tools & materials.
  - 9.2 Construct the circuit for Piezoelectric pickup.
  - 9.3 Set up the object whose displacement or pressure is to be measured to the appropriate crystal plane.
  - 9.4 Energize the circuit and measure the voltage and hence measure the displacement or pressure.
- 10. Study the operation of magnetic tape recorder.**
  - 10.1 Select a magnetic tape recorder.
  - 10.2 Observe the tape transport mechanism.
  - 10.3 Identify the electronic components of magnetic tape recorder.
  - 10.4 Observe the recording and playback operation.
- 11. Study the operation of closed loop speed control with DC servo system.**
  - 11.1 Select a DC servo system with required tools & materials.
  - 11.2 Construct the circuit as per diagram.
  - 11.3 Adjust all the controls properly.
  - 11.4 Change speed of the system.
  - 11.5 Observe the operation of DC servo system.
- 12. Study the operation of AC servo system.**
  - 12.1 Select required equipment, tools & materials.
  - 12.2 Construct the circuit as per diagram.
  - 12.3 Change the input signal.
  - 12.4 Observe mechanism of control.
- 13. Study the operation of an analogue electronic control system.**
  - 13.1 Select required materials, tools and equipment.
  - 13.2 Construct the circuit as per diagram.
  - 13.3 Change the command input.
  - 13.4 Observe mechanism of the control system.
  - 13.5 Observe the output.

#### Preference Books

1. Mechanical and Industrial Measurement  
- R. K. Jain
2. Control Engineering  
- Nole M. Morris
3. Feedback Control System Analysis & Synthesis  
- J.J.D Azzo
4. Industrial Electronics  
- G. K. Mithal
5. Electrical and Electronic Measurement and Instrumentation  
- A.K. Sawhney
6. Elements of Electronic Instrumentation and Measurement  
- Joseph J. Carr

7. Electronic Instrumentation  
- HS Kalsi
8. Control system Engineering  
- Nagrath and Gopal

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**AIMS**

- To be able to learn about safety precautions and electronics workshop safety regulations.
- To be able to write a final report
- To be able to identify the tools, measuring and testing instruments used in servicing
- To be able to trace the circuit from a assembled circuit board.
- To be able to test the passive components.
- To be able to Test the semiconductor Devices.
- To be able to perform the Servicing of a Power supply Unit.
- To be able to perform the Servicing of a Emergency Light
- To be able to perform the Servicing of a security system.
- To be able to perform the Servicing of a Radio Receiver.
- To be able to perform the Servicing of a Monochrome Television Receiver.
- To be able to perform the Servicing of a Color Television Receiver.
- To be able to perform the Servicing of a IPS & UPS
- To be able to perform the Servicing of a VCR,CD player, VCD player and DVD player.
- To be able to perform the Servicing of a Multimedia projector
- To be able to perform the Servicing of a Microwave Oven
- To be able to perform the Servicing of a Washing machine.
- To be able to perform the Servicing of a Refrigerator.
- To be able to perform the Servicing of a Air conditioner.
- To be able to perform the Servicing of a Video Camera.
- To be able to perform the Servicing of a FAX & Modem.
- To be able to perform the Servicing of a Photo Copier.
- To be able to perform the Servicing of a Digital Telephone Set.
- To be able to perform the Servicing of a Mobile Phone Set.
- To be able to familiarize the hard ware Component of a microcomputer system.

**SHORT DESCRIPTION**

- Identification and testing of passive components and semiconductor devices. Servicing a power supply unit, emergency light, security system, Radio Receiver, Monochrome Television Receiver, Color Television Receiver, IPS & UPS, VCR,CD player, VCD player and DVD player, Multimedia projector, Micro wave oven , washing machine, Refrigerator, Air conditioner, Video Camera, FAX, Modem, Photo Copier, Digital Telephone Set, Mobile phone Set and microcomputer system.

**DETAIL DESCRIPTION****1. Learn about safety and precautions.**

- 1.1 List the safety precautions
- 1.2 List the workshop safety regulations.
- 1.3 Learn about Electrical & Electronics equipment safety policy.

**2. Practice to Write a final report.**

- 2.1. Mention the physical description of the circuit./Device/Machine
- 2.2. List the components and their specification used in the circuit.
- 2.3. Discuss the operation of the circuit.
- 2.4. List the types of problems.
- 2.5. Draw the PCB layout.(If necessary)
- 2.6. Draw the schematic diagram.



- 2.7. Mention the complete description of the methods you used in determining the fault.
- 2.8. List the Precaution you followed.
- 2.9. State your own opinion in discussion.

**3. Identify the tools, measuring and testing instruments used in servicing.**

- 3.1. Collect the tools, measuring and testing instruments used in servicing.
- 3.2. Draw the tools, measuring and testing instruments used in servicing.
- 3.3. Practice to use the above tools, measuring and testing instruments used in servicing.

**4. Trace the circuit from assembled circuit board**

- 4.1. Select an assembled circuit board.
- 4.2. Locate the components.
- 4.3. Observe the interconnection of among the components.
- 4.4. Draw the connection diagram from a assembled circuit.
- 4.5. Develop the schematic circuit diagram.

**5. Test the active and passive components (Resistor, Capacitor, Inductor, Transformer, Diode, transistor, SCR, Diac, Triac etc).**

- 5.1. Collect active and passive components.
- 5.2. Select the testing and measuring equipments.
- 5.3. Check the components.

**6. Perform the Servicing of a Power supply Unit.**

- 6.1. Identify the symptoms.
- 6.2. Apply a visual check.
- 6.3. Apply a cold check.
- 6.4. Apply a power check
- 6.5. Apply a sensory check.
- 6.6. Identify the faulty components.
- 6.7. Replace the faulty components.
- 6.8. Test the power supply unit.

**7. Perform the Servicing of an Emergency Light.**

- 7.1. Identify the symptoms.
- 7.2. Apply a visual check.
- 7.3. Apply a cold check.
- 7.4. Apply a power check
- 7.5. Apply a sensory check.
- 7.6. Identify the faulty components.
- 7.7. Replace the faulty components.
- 7.8. Test the device.

**8. Perform the Servicing of a security system.**

- 8.1. Identify the symptoms.
- 8.2. Apply a visual check.
- 8.3. Apply a cold check.
- 8.4. Apply a power check
- 8.5. Apply a sensory check.
- 8.6. Identify the faulty components.
- 8.7. Replace the faulty components.
- 8.8. Test the device.

**9. Perform the Servicing of a of Radio Receiver.**

- 9.1 Select the proper tools, equipments and manuals.
- 9.2 Observe and record the symptoms.
- 9.3. Write down the possible causes for the symptoms
- 9.4. Turn off the radio receiver.
- 9.5. Unscrew and remove the cover of the radio receiver.

- 9.6. Locate the faulty section.
- 9.7. Check or test the possible causes one by one starting with the easiest one.
- 9.8. Measure and test the faulty components.
- 9.9. Replace the damage components.
- 9.10. Restart the radio receiver.
- 9.11. Observe the performance of the radio receiver.

**10. Perform the Servicing of a Public Addressing system.**

- 10.1. Identify the symptoms.
- 10.2. Apply a power check
- 10.3. Apply a sensory check.
- 10.4. Apply signal-tracing technique to isolate the fault to a single circuit.
- 10.5. Apply fault analysis to isolate the fault further to a single component or group of components.
- 10.6. Identify the faulty components.
- 10.7. Replace the faulty components.
- 10.8. Test the Public Addressing system
- 10.9. Observe the performance of the radio receiver.

**11. Perform the Servicing of a Monochrome Television Receiver.**

- 11.1. Select the proper tools, equipments and manuals.
- 11.2. Observe and record the symptoms.
- 11.3. Write down the possible causes for the symptoms
- 11.4. Turn off the Monochrome Television Receiver.
- 11.5. Unscrew and remove the cover of the Monochrome Television Receiver.
- 11.6. Locate the faulty section.
- 11.7. Check or test the possible causes one by one starting with the easiest one.
- 11.8. Measure and test the faulty components.
- 11.9. Replace the damage components.
- 11.10. Restart the Monochrome Television Receiver.
- 11.11. Observe the performance of the Monochrome Television Receiver.

**12. Perform the Servicing of a Color Television.**

- 12.1. Select the proper tools equipments and manuals.
- 12.2. Observe and record the symptoms.
- 12.3. Write down the possible causes for the symptoms
- 12.4. Turn off the Color Television.
- 12.5. Unscrew and remove the cover of the Color Television.
- 12.6. Locate the faulty section.
- 12.7. Check or test the possible causes one by one starting with the easiest one.
- 12.8. Measure and test the faulty components.
- 12.9. Replace the damage components.
- 12.10. Restart the Color Television.
- 12.11. Observe the performance of the Color Television.

**13. Perform the Servicing of a VCR, CD player, VCD player & DVD Player.**

- 13.1. Select the proper tools equipments and manuals.
- 13.2. Observe and record the symptoms.
- 13.3. Write down the possible causes for the symptoms
- 13.4. Turn off the VCR, CD player, VCD player & DVD Player.
- 13.5. Unscrew and remove the cover of the VCR, CD player, VCD player & DVD Player.
- 13.6. Locate the faulty section.
- 13.7. Check or test the possible causes one by one starting with the easiest one.
- 13.8. Measure and test the faulty components.
- 13.9. Replace the damage components.
- 13.10. Restart the VCR, CD player, VCD player & DVD Player.
- 13.11. Observe the performance of the VCR, CD player, VCD player & DVD Player.

**14. Perform the Servicing of a Multimedia Projector.**

- 14.1. Select the proper tools equipments and manuals.
- 14.2. Observe and record the symptoms.
- 14.3. Write down the possible causes for the symptoms
- 14.4. Turn off the multimedia projector.
- 14.5. Unscrew and remove the cover of the multimedia projector.
- 14.6. Locate the faulty section.
- 14.7. Check or test the possible causes one by one starting with the easiest one.
- 14.8. Measure and test the faulty components.
- 14.9. Replace the damage components.
- 14.10. Restart the multimedia projector.
- 14.11. Observe the performance of the multimedia projector.

**15. Perform the Servicing of a Microwave Oven.**

- 15.1. Select the proper tools equipments and manuals.
- 15.2. Observe and record the symptoms.
- 15.3. Write down the possible causes for the symptoms
- 15.4. Turn off the microwave oven.
- 15.5. Unscrew and remove the cover of the microwave oven.
- 15.6. Locate the faulty section.
- 15.7. Check or test the possible causes one by one starting with the easiest one.
- 15.8. Measure and test the faulty components.
- 15.9. Replace the damage components.
- 15.10. Restart the microwave oven.
- 15.11. Observe the performance of the microwave oven.

**16. Perform the Servicing electronic control section of a washing machine.**

- 16.1. Select the proper tools equipments and manuals.
- 16.2. Observe and record the symptoms.
- 16.3. Write down the possible causes for the symptoms
- 16.4. Turn off the washing machine.
- 16.5. Unscrew and remove the cover of the washing machine.
- 16.6. Locate the faulty section.
- 16.7. Check or test the possible causes one by one starting with the easiest one.
- 16.8. Measure and test the faulty components.
- 16.9. Replace the damage components.
- 16.10. Restart the washing machine.
- 16.11. Observe the performance of the washing machine.

**17. Perform the Servicing electronic control section of a Refrigerator.**

- 17.1. Select the proper tools equipments and manuals.
- 17.2. Observe and record the symptoms.
- 17.3. Write down the possible causes for the symptoms
- 17.4. Turn off the Refrigerator.
- 17.5. Unscrew and remove the cover of the Refrigerator.
- 17.6. Locate the faulty section.
- 17.7. Check or test the possible causes one by one starting with the easiest one.
- 17.8. Measure and test the faulty components.
- 17.9. Replace the damage components.
- 17.10. Restart the Refrigerator.
- 17.11. Observe the performance of the Refrigerator.

**18. Perform the Servicing electronic control section of an Air-conditioner.**

- 18.1. Select the proper tools equipments and manuals.
- 18.2. Observe and record the symptoms.
- 18.3. Write down the possible causes for the symptoms
- 18.4. Turn off the air-conditioner.
- 18.5. Unscrew and remove the cover of the air-conditioner.
- 18.6. Locate the faulty section.
- 18.7. Check or test the possible causes one by one starting with the easiest one.

- 18.8. Measure and test the faulty components.
- 18.9. Replace the damage components.
- 18.10. Restart the air-conditioner
- 18.11. Observe the performance of the air-conditioner.
- 19. Perform the Servicing of a IPS & UPS.**
  - 19.1. Select the proper tools equipments and manuals.
  - 19.2. Observe and record the symptoms.
  - 19.3. Write down the possible causes for the symptoms
  - 19.4. Turn off the IPS & UPS.
  - 19.5. Unscrew and remove the cover of the IPS & UPS..
  - 19.6. Locate the faulty section.
  - 19.7. Check or test the possible causes one by one starting with the easiest one.
  - 19.8. Measure and test the faulty components.
  - 19.9. Replace the damage components.
  - 19.10. Restart the IPS & UPS.
  - 19.11. Observe the performance of the IPS & UPS.
- 20. Perform the Servicing of a of Video Camera.**
  - 20.1. Select the proper tools equipments and manuals.
  - 20.2. Observe and record the symptoms.
  - 20.3. Write down the possible causes for the symptoms
  - 20.4. Turn off the Video Camera.
  - 20.5. Unscrew and remove the cover of the Video Camera.
  - 20.6. Locate the faulty section.
  - 20.7. Check or test the possible causes one by one starting with the easiest one.
  - 20.8. Measure and test the faulty components.
  - 20.9. Replace the damage components.
  - 20.10. Restart the Video Camera.
  - 20.11. Observe the performance of the Video Camera.
- 21. Perform the Servicing of a FAX and Modem.**
  - 21.1. Select the proper tools equipments and manuals.
  - 21.2. Observe and record the symptoms.
  - 21.3. Write down the possible causes for the symptoms
  - 21.4. Turn off the FAX and Modem.
  - 21.5. Unscrew and remove the cover of the FAX and Modem.
  - 21.6. Locate the faulty section.
  - 21.7. Check or test the possible causes one by one starting with the easiest one.
  - 21.8. Measure and test the faulty components.
  - 21.9. Replace the damage components.
  - 21.10. Restart the FAX and Modem.
  - 21.11. Observe the performance of the FAX and Modem.
- 22. Perform the Servicing of a Photo Copier.**
  - 22.1. Select the proper tools equipments and manuals.
  - 22.2. Observe and record the symptoms.
  - 22.3. Write down the possible causes for the symptoms
  - 22.4. Turn off the Photo Copier.
  - 22.5. Unscrew and remove the cover of the Photo Copier.
  - 22.6. Locate the faulty section.
  - 22.7. Check or test the possible causes one by one starting with the easiest one.
  - 22.8. Measure and test the faulty components.
  - 22.9. Replace the damage components.
  - 22.10. Restart the Photo Copier.
  - 22.11. Observe the performance of the Photo Copier.
- 23. Perform the Servicing of a Digital Telephone Set.**
  - 23.1. Select the proper tools equipments and manuals.
  - 23.2. Observe and record the symptoms.

- 23.3. Write down the possible causes for the symptoms
- 23.4. Turn off the Digital Telephone Set.
- 23.5. Unscrew and remove the cover of the Digital Telephone Set.
- 23.6. Locate the faulty section.
- 23.7. Check or test the possible causes one by one starting with the easiest one.
- 23.8. Measure and test the faulty components.
- 23.9. Replace the damage components.
- 23.10. Restart the Digital Telephone Set.
- 23.11. Observe the performance of the Digital Telephone Set.

**24. Perform the Servicing of a Mobile phone Set.**

- 24.1. Select the proper tools equipments and manuals.
- 24.2. Observe and record the symptoms.
- 24.3. Write down the possible causes for the symptoms
- 24.4. Turn off the Mobile phone Set.
- 24.5. Unscrew and remove the cover of the Mobile phone Set.
- 24.6. Locate the faulty section.
- 24.7. Check or test the possible causes one by one starting with the easiest one.
- 24.8. Measure and test the faulty components.
- 24.9. Replace the damage components.
- 24.10. Restart the Mobile phone Set.
- 24.11. Observe the performance of the Mobile phone Set.

**25. Identify and solve the software problem of Mobile phone set.**

- 25.1. Select a personal computer (PC) system.
- 25.2. Install the mobile software in the PC and reboot the PC.
- 25.3. Connect the proper I/O unit, cables and cords with system unit.
- 25.4. Select the proper software for the specific model.
- 25.5. Format the mobile set.
- 25.6. Flash the phone using older version of UFS device.
- 25.7. Try to change the speed of flashing software.
- 25.8. Flash the phone with the blue tooth option Enable/ Disable.

**26. Perform the Servicing of a microcomputer system (desktop, laptop).**

- 26.1. Select the proper tools equipments and manuals.
- 26.2. Observe and record the symptoms.
- 26.3. Write down the possible causes for the symptoms
- 26.4. Turn off the microcomputer system.
- 26.5. Unscrew and remove the cover of the microcomputer system.
- 26.6. Locate the faulty section.
- 26.7. Check or test the possible causes one by one starting with the easiest one.
- 26.8. Measure and test the faulty components.
- 26.9. Replace the damaged hardware.
- 26.10. Restart the microcomputer system.
- 26.11. Observe the performance of the microcomputer system.

## 6865 MICROPROCESSOR & APPLICATIONS

<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>3</b>	<b>4</b>

### **AIMS :**

- To familiarize with the 8-bit & 16-bit microprocessor.
- To provide understanding & skill on the instruction sets of 8-bit and 16-bit microprocessor.
- To develop the knowledge & skill on simple programming using the instruction sets of 8-bit and 16-bit microprocessor.
- To familiarize with the peripherals chips compatible to the 8-bit and 16-bit microprocessor.
- To provide understanding of the interfacing technique of 8-bit and 16-bit microprocessor.
- To develop comprehensive knowledge and skill on the interfacing principle and peripheral devices.

### **SHORT DESCRIPTION :**

Fundamentals of 8-bit microprocessor; Intel 8085 and 8086 microprocessor; Architecture of 16-bit microprocessor; Intel 8085 And 8086 based microprocessor system; Interfacing principle and peripheral devices.

### **THEORY**

#### **1. Understand the architecture of Intel 8085 microprocessor.**

- 1.1. Define Microprocessor.
- 1.2 List 8-bit Microprocessor mentioning number of data and address line.
- 1.3. Mention the important features of Intel 8085 microprocessor.
- 1.4. Sketch the internal architecture of 8085 microprocessor.
- 1.5. Describe the function of each block of the Intel 8085 microprocessor.
- 1.6. Describe the software model of 8085.
- 1.7. Describe the pins and signals of 8085.
- 1.8. Classify the 8085 signals.

#### **2. Understand the features of the Intel 8085 based microprocessor system.**

- 2.1. Draw the Block diagram of 8085 based microprocessor system.
- 2.2. Explain the operation of the system.
- 2.3. Describe clock and Reset circuit of 8085 microprocessor.
- 2.4. Explain the process of de-multiplexing AD7 - AD0 bus using latch.
- 2.5. State the difference between memory-mapped I/O & standard I/O.
- 2.6. Draw a logic schematic diagram to generate memory & I/O read & writes control signals using 8085 IO/M, RD & WR signals.

#### **3. Understand the instruction set and addressing mode of 8085 Microprocessor.**

- 3.1. Define instruction and addressing mode.
- 3.2. Mention the classification of the instructions of 8085.
- 3.3. Explain the meaning of each instruction of the 8085 instruction set.
- 3.4. Describe the 8085 addressing modes.
- 3.5. Define clock period, fetch cycle, execution cycle and machine cycle.
- 3.6. Explain the timing diagrams of instruction fetch, memory read and memory write operation.
- 3.7. Write the simple programs using different type of the 8085 instructions.

- 3.8. Describe subroutine and stack operation of 8085 Microprocessor.
- 3.9. Explain the I/O read and write operation with timing diagram.
- 3.10. Calculate execution time of simple program with and without branch instruction.

#### **4. Understand the architecture of standard 16-bit microprocessor.**

- 4.1. List of 16-bit, 32-bit and 64-bit microprocessor mentioning data and address line.
- 4.2. Mention the General feature of 8086 and 8088 microprocessor.
- 4.3. Describe the architecture of Intel 8086 microprocessor. .
- 4.4. Describe the minimum and maximum mode signals of 8086.
- 4.5. Describe minimum and maximum mode system of the 8086 with block diagram.
- 4.6. Explain the register structure of Intel 8086 microprocessor.
- 4.7. Describe the memory segmentation of Intel 8086 microprocessor.
- 4.8. Explain the instruction format of 8086 microprocessor.
- 4.9. Mention instruction set and addressing modes of 8086 microprocessor.
- 4.10. Mention the difference between 8088 & 8086 microprocessor

#### **5. Understand Assembly Language programming .**

- 5.1. Describe deferent types of programming language.
- 5.2. State the purpose of Assembler, compiler and linker.
- 5.3. Describe the programming process with flowchart.
- 5.4. State the assembler directives.
- 5.5. Describe the meaning of each field of assembly language program.
- 5.6. Describe the commonly used assembler directives.
- 5.7. Write simple program using assembly language.

#### **6. Understand interrupt system**

- 6.1 Define the term interrupt.**
- 6.2 Mention the types of interrupt.**
- 6.3 Define the term vector location and interrupt service subroutine.**
- 6.4 Mention the vector location of hard ware and software interrupt of the 8085.**
- 6.5 Mention priority of interrupt signals of the 8085.**
- 6.6 Describe enabling and disabling the 8085 interrupts.**

#### **7. Understand the memory chip interfacing.**

- 7.1. Define the term interfacing.
- 7.2. Describe the pins and associated signals of RAM and ROM chip with block diagram..
- 7.3. Describe the memory mapping techniques.
- 7.4. Describe the chip select scheme by decoding address lines.
- 7.5 Describe the system of interfacing memory to a 16-bit ,32-bit and 64-bit data bus.

#### **8 Understand the features of basic I/O interface and DMA Operation.**

- 8.1 Explain the operation of the basic input and output interface.
- 8.2 Describe decoding system of 16 bit and 32 bit I/O device to use any I/O port address.
- 8.3 Define DMA operation.
- 8.4 Explain the operation of the HOLD and HLDA direct memory access control signals.

#### **9 Understand the support chips.**

- 9.1. Define support chips.
- 9.2. Describe the pins and signals of PPI the Intel 8255A
- 9.3. Describe the block diagram of the Intel 8255A.
- 9.4. Describe the control word and mode setting of the Intel 8255A

- 9.5. Describe the block diagram and signals of the Intel 8237A DMA controller.
- 9.6. Describe the Intel 8279 keyboard /display controller.
- 9.7. Sketch the interfacing circuit of 8255A, 8237 and 8279 with 8085

#### **10 Understand the real world interfacing :**

- 10.1 Describe the interfacing of LED Display with program to the microprocessor.
- 10.2 Describe the interfacing of seven segment LED display with program to the microprocessor.
- 10.3 Describe the interfacing of Multiple Digit Display with program to the microprocessor.
- 10.4 Describe the method of interfacing of stepper motor to the microprocessor.
- 10.5 Describe the microprocessor based DC motor speed control system.

#### **Practical:**

1. Input and run assembly language program to perform arithmetic and logical operation using 8085 / 8086 / 8088 microprocessor trainer.
2. Input and run assembly language program to compute 1's and 2's complement of binary number using 8085 / 8086 / 8088 microprocessor trainer.
3. Input and run assembly language using 8085 / 8086 / 8088 microprocessor trainer for data transfer between I/O and memory with different I/O technique.
4. Input and run assembly language using 8085 / 8086 / 8088 microprocessor trainer to implement the branching and looping structures.
5. Input and run assembly language 8085 / 8086 / 8088 / microprocessor trainer to implement the subroutine operation.
6. Study the interfacing system of different peripheral device to the Intel Microprocessor

#### **REFERENCE BOOKS**

1. Microprocessor Architecture, Programming And Application with 8085  
- Ramesh S. Gaonkar.
2. Microprocessor & Interfacing  
- A.P. Godse & D.A. Godse
4. Intel Microprocessors  
- Barry B. Brey



## 5840 ENVIRONMENTAL MANAGEMENT

<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>2</b>

### AIMS

- To be able to understand the basic concepts of environment and environmental pollution.
- To be able to understand the concepts of ecology, ecosystems, global environmental issues, air pollution, water pollution, soil pollution, radioactive pollution, sound pollution, etc.
- To be able to understand the methods of controlling air pollution, water pollution and sound pollution.
- To be able to understand the management of waste, soil and pesticide pollution and
- To be able to understand the major environmental issues and problems in Bangladesh.

### SHORT DESCRIPTION

Basic concepts of environment; Ecology & eco-systems; global environmental issues Air and atmospheric layers; Air pollution sources & effects; climate change, green house effect and depletion of ozone layer; Control of air pollution; Water pollution sources & effects; Monitoring of water pollution; Waste water treatment; Sound pollution and its control; Soil pollution and its management; Radioactive pollution and its control; Solid waste management; Major environmental issues and disaster management- Arsenic pollution; Pesticides pollution and its management, Environmental legislations and guidelines frame work and policy in Bangladesh.

### DETAIL DESCRIPTION

#### 1. Understand the basic concepts of environment.

- 1.1 Define: environment, Marine environment, Freshwater environment, Nutrients, Mangrove forest, Photo-chemical oxidant, Pollutant, Receptor, Sink, Pathways of pollutant, Speciation.
- 1.2 Mention the main components of environment.
- 1.3 Mention the functions of environment.
- 1.4 Describe natural environment, man-made environment and social environment.

#### 2. Understand ecology and eco-systems.

- 2.1 Define ecology and eco-system.
- 2.2 Mention the range of tolerance in eco-system.
- 2.3 Explain the biotic and abiotic components of eco-system.
- 2.4 Explain briefly how does eco-system work.
- 2.5 Explain the stability of eco-system.
- 2.6 Explain the following ecological terms:  
Food chain, Food web, Biodiversity, Biomass, Ecological pyramid, Pyramid of biomass, Pyramid of energy, Bio-concentration, Bio-magnification, Restoration ecology.
- 2.7 Narrate the following bio-geochemical cycles of eco-system.
  - a) Carbon cycle
  - b) Nitrogen cycle
  - c) Phosphorus cycle
  - d) Sulphur cycle.
  - e) Hydrologic cycle
- 2.8 Describe the following global environmental issues: Global environment, Earth and other environmental summits, climate change and ozone layer depletion.

#### 3. Understand the air and the atmospheric regions.

- 3.1 Mention different layers of atmosphere.

- 3.2 Mention the average composition of the atmosphere at sea level.
- 3.3 Describe the chemical species and particulates present in the atmosphere.
- 3.4 Describe the importance ozone layer.

**4 Understand the air pollution and its sources & effects.**

- 4.1 Define air pollution.
- 4.2 Mention the composition of clean dry atmospheric air.
- 4.3 List the air pollutants.
- 4.4 Identify the sources of air pollutions.
- 4.5 List the green house gases.
- 4.6 Mention the effects of air pollution on human health, animals, plants and non-living things.
- 4.7 Explain the formation of photo-chemical smog and its effect.
- 4.8 List the disasters of major air pollution in the world mentioning location, causes and effects.
- 4.9 Explain the causes of acid rain and its effect on eco-system.

**5 Understand the control of air pollution at the sources.**

- 5.1 Mention the methods of air pollution control.
- 5.2 Describe the following devices: gravitational settling chamber, cyclone separator, wet scrubber, centrifugal scrubber, fabric filter, catalytic converter.

**6 Understand the sources of water pollution and its effects.**

- 6.1 Define water pollution.
- 6.2 Mention the specification of ideal water as per recommendation of the World Health Organization (WHO).
- 6.3 List the different types of water pollutants.
- 6.4 Describe the sources of water pollution.
- 6.5 Describe the effects of water pollution on human health, animal, plants and environment.

**7 Understand the monitoring of water pollution.**

- 7.1 Define the following terms:
  - (i) Dissolved oxygen (DO).
  - (ii) Biochemical oxygen demand (BOD).
  - (iii) Chemical oxygen demand (COD).
  - (iv) Total organic carbon (TOC).
  - (v) Threshold limit value (TLV).
- 7.2 Mention the method of determination of pH value of water.
- 7.3 Mention the method of determination of dissolved oxygen (DO) in a sample of water.
- 7.4 Mention the method of determination of biochemical oxygen demand (BOD) in a sample of water.
- 7.5 Mention the method of determination of chemical oxygen demand (COD) in a sample of water.

**8 Understand the waste water treatment.**

- 8.1 Define the primary treatment, secondary treatment and tertiary treatment of waste water.
- 8.2 Define the following terms; ETP, Oxidation pond, waste stabilization pond, trickling filter, Activated slug.
- 8.3 Mention the methods of primary and secondary treatment of industrial waste water.

**9 Understand the sound pollution and its control.**

- 9.1 Define sound, sound wave and sound pollution.
- 9.2 Mention the scale of measuring sound intensity.
- 9.3 Mention the sources of sound pollution.
- 9.4 Describe the effect of sound pollution on human health.
- 9.5 Describe the methods of control of sound pollution.

**10 Understand the soil pollution and its management.**

- 10.1 Define soil pollution.
- 10.2 List the classification of soil pollution.
- 10.3 Mention the sources of soil pollution.
- 10.4 Describe the effect of soil pollution on human health.

## **11 Understand the radioactive pollution and its control.**

- 11.1 Define radioactive pollution.
- 11.2 Mention the sources of radioactive pollution.
- 11.3 List the causes of radioactive pollution.
- 11.4 Explain the effect of radioactive pollution on human health.
- 11.5 Describe the method of control of radioactive pollution.

## **12 Understand the solid waste management.**

- 12.1 Define solid waste.
- 12.2 List the sources of solid waste.
- 12.3 Mention the classification of solid waste.
- 12.4 Mention the methods of collection of solid waste.
- 12.5 Mention the waste management strategies in Bangladesh.
- 12.6 Describe the recycling of solid wastes.
- 12.7 Describe the potential method of disposal of solid waste.

## **13 Understand the major environmental issues in Bangladesh.**

- 13.1 List the major environmental issues in Bangladesh.
- 13.2 Describe the following disaster management of Bangladesh flood, cyclone, tidal surge, Cyclone(SIDR, AILA, Nargis, Tsunami), landslide, earthquakes and salinity.

## **14 Understand the arsenic pollution in Bangladesh.**

- 14.1 Mention the arsenic pollution of water in Bangladesh.
- 14.2 Explain the effects of arsenic pollution on human health.
- 14.3 Describe the causes of arsenic in ground water.

## **15 Understand the pesticide pollution in Bangladesh and its management.**

- 15.1 Define pesticide.
- 15.2 Make a list of pesticides.
- 15.3 Mention the causes of pesticide pollution in Bangladesh.
- 15.4 Describe the effect of pesticide pollution in the environment.

## **16 Understand the national environmental legislations and guidelines environmental frame work and policy in Bangladesh.**

- 16.1 Define, EA, EIA, IEA, NEMAP, DOE, BELA, GPS, GIS
- 16.2 Mention environmental act and legislations prescribed for air and water quality.
- 16.3 Describe environmental act prescribed for industries in Bangladesh.
- 16.4 Describe the guide lines of environment prescribed for industries in Bangladesh.
- 16.5 Describe the environmental frame work in Bangladesh.

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২. বিপন্ন পরিবেশ ও বাংলাদেশ

- |     |   |                               |
|-----|---|-------------------------------|
|     | —   | ডঃ এফ এম মনিরুজ্জামান         |
| ৩.  | বায়ু ও পানি দূষণ এবং প্রতিকার                    |                               |
|     | —   | মুহাম্মদ কাউছার হাবিব ভূইয়া  |
| ৪.  | পরিবেশ বিজ্ঞান                                    |                               |
|     | —   | মুহাম্মদ কাউছার হাবিব ভূইয়া  |
| ৫.  | শব্দ ও তেজস্ক্রিয় দূষণ এবং প্রতিকার              |                               |
|     | —   | মুহাম্মদ কাউছার হাবিব ভূইয়া  |
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**AIMS**

- To be able to develop the working condition in the field of industrial or other organization.
- To be able to understand develop the labor management relation in the industrial sector.
- To be able to develop the management techniques in the process of decision making.
- To be able to manage the problems created by trade union.
- To be able to understand the network , PERT, CPM & MBO
- To be able to perform the marketing.
- To be able to maintain inventory.

**SHORT DESCRIPTION**

Basic concepts of management; Principles of management; Scientific management; Organization; Span of supervision; Motivation; Personnel management and human relation; Staffing and manpower planning ; Training of staff; Industrial dispute; Concept of leadership; Concepts and techniques of decision making; Concept of trade union; Inventory control; Economic lot size ; Break even analysis; Labour and industrial law; PERT , CMP ; Network ; Marketing; Production management;

**1 Understand the basic concepts & principles of management.**

- 1.1 Define management and industrial management.
- 1.2 State the objectives of modern management.
- 1.3 Describe the scope and functions of management.
- 1.4 State the principles of management.
- 1.6 State the activity level of industrial management from top personnel to workmen.
- 1.7 Describe the relation among administration, organization & management.
- 1.8 Define Production Management and functions of Production Management.
- 1.9 Explain the social responsibilities of management.

**2 Understand the concept of scientific management.**

- 2.1 Define scientific management.
- 2.2 Discuss the basic principles of scientific management.
- 2.3 Explain the different aspects of scientific management.
- 2.4 Discuss the advantages and disadvantages of scientific management.
- 2.5 Describe the difference between scientific management and traditional management.
- 2.6 Describe the following four periods of management thought:
  - (i) pre-scientific management.
  - (ii) scientific management.
  - (iii) human relations
  - (iv) refinement extension and synthesis of management theories and practices.

**3 Understand the concepts of organization and organization structure.**

- 3.1 Define management organization.
- 3.2 State the elements of management organization.

- 3.3 Discuss the types of organization structure
- 3.4 Describe different forms of organization structure.
- 3.5 Distinguish between line organization and line & staff organization.
- 3.6 Distinguish between line organization and functional organization.
- 3.7 Describe the feature advantages and disadvantages of different organization structure.
- 3.8 Define organizational chart.
- 3.9 Describe the different types of organizational chart.

#### **4 Understand the basic concept of span of supervision.**

- 4.1 Define span of supervision and optimum span of supervision.
- 4.2 Discuss the considering factors of optimum span of supervision.
- 4.3 Discuss advantages and disadvantages of optimum span of supervision.
- 4.4 Define delegation of authority.
- 4.5 Explain the principles of delegation of authority.
- 4.6 Explain the terms: authority, responsibility and duties.

#### **5 Understand the concept of motivation.**

- 5.1 Define motivation.
- 5.2 Discuss the importance of motivation.
- 5.3 Describe financial and non-financial factors of motivation.
- 5.4 State the motivation process or cycle.
- 5.5 Discuss the motivation theory of Maslows and Harzbergs.
- 5.6 Differentiate between theory-X and theory-Y.
- 5.7 Discuss the relation between motivation and morale.

#### **6 Understand the concept of leadership.**

- 6.1 Define leadership.
- 6.2 Discuss the importance and necessity of leadership.
- 6.3 Discuss the functions of leadership.
- 6.4 Identify the types of leadership.
- 6.5 Describe the qualities of a leader.
- 6.6 Distinguish between autocratic leader and democratic leader.

#### **7 Understand the basic concepts and techniques of decision making.**

- 7.1 Define decision making.
- 7.2 Discuss the importance and necessity of decision making.
- 7.3 Discuss different types of decision making .
- 7.4 Describe the steps in decision making.

#### **8 Understand the concept of personnel management and human relation.**

- 8.1 Define personnel management.
- 8.2 Discuss the importance of personnel management.
- 8.3 Discuss the functions of personnel management.
- 8.4 Define staffing.
- 8.6 Define recruitment and selection of employees.
- 8.7 Describe various sources of recruitment of employees.
- 8.8 Describe the various methods of selection of employees.
- 8.9 Discuss the advantages and disadvantages of internal sources of recruitment.
- 8.10 Discuss the disadvantages of external sources of recruitment.
- 8.11 Define training and orientation of employee.
- 8.12 Discuss the importance and necessity of training.
- 8.13 Discuss the various methods of training of workmen, technicians and executive personnel.

## **9. Understand the concept of inventory control**

9.1 Define inventory.& inventory control.

9.2 Describe the function of inventory control.

9.3 Discuss the necessity and importance of inventory control.

9.4 Mention the advantages and disadvantages of inventory control.

9.5 Explain the following terms :

- Bin card or Bin tag.
- Purchase requisition.
- Store requisition.
- Material transfer note.
- First in first out (FIFO).
- Last in first out(LIFO).
- PERT
- CPM
- NETWORK
- MBO

## **10 Understand the concept of economic lot size & break even analysis**

10.1 Define economic lot size.

10.2 Discuss the effects of over supply and under supply.

10.3 Describe the method of determination of economic lot size.

10.4 Explain the terms :

- Safety stock
- Determination of safety stock
- Lead time

10.5 Define break even point and break even chart.

10.6 Explain the terms :

- Break even analysis.
- Fixed cost.
- Variable cost.

10.7 Discuss the importance of break even analysis.

10.8 Describe the method of preparing break even chart.

10.9 Describe different methods of break even analysis.

10.10 Draw break even chart in different method.

10.11 Mention the advantages and disadvantages of break even analysis.

## **11 Understand the concept of Marketing and inventory control**

11.1 Define marketing.

11.2 Discuss the function of marketing.

11.3 State the objectives of marketing.

11.4 Explain the terms :

- Brand
- Producer
- Consumer
- Customer
- Copyright
- Trade mark

11.5 Discuss product life-cycle and marketing strategies in different stages of a product life-cycle

11.6 Define purchasing

11.7 Describe the five “R” of purchasing principles

## **12 Understand the concept of trade union and industrial law**

12.1 Define trade union.

12.2 Mention the objectives of trade union.

- 12.3 Discuss the function of trade union.
- 12.4 Describe different types of trade union.
- 12.5 Mention the names of major trade union in Bangladesh.
- 12.6 Define labour and industrial law.
- 12.7 Discuss the importance of labour and industrial law.
- 12.8 Explain the terms :
- Factory Act. (1965)
  - Minimum Wage Act (1957).
  - Industrial Disputes Act.
  - Work Men Compensation Act.
  - Trade Union Act.