



BANGLADESH TECHNICAL EDUCATION BOARD

Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

ELECTRONICS TECHNOLOGY

TECHNOLOGY CODE: **668**

4th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

ELECTRONICS TECHNOLOGY (668)

4th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	66743	Electrical Circuits & Machine	3	3	4	60	90	25	25	200
2	66842	Principles of Digital Electronics	3	3	4	60	90	25	25	200
3	66845	Industrial Electronics	2	3	3	40	60	25	25	150
4	66841	Networks, Filters & Transmission Lines	3	3	4	60	90	25	25	200
5	66844	Electronic Servicing -1	0	3	1	0	0	25	25	50
6	66631	Programming Essentials	2	3	3	40	60	25	25	150
7	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
Total			15	18	21	300	450	150	150	1050

OBJECTIVES:

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of Electrical circuits and machines with special emphasis on:

- Provide understanding and skill on AC circuits.
- Develop concept of poly phase system.
- Familiarize with the construction and operating principle of transformer.
- Develop understanding of the principles of DC motor.
- Develop knowledge and skill of 1-phase and 3-phase induction motor.
- Develop understanding of the principle of synchronous motor.

SHORT DESCRIPTION

Complex algebra – application to AC circuits; RLC series and parallel circuits; Poly phase system; Star and delta connection; Transformer; DC motor; 3-phase induction motor; 1-phase induction motor; Synchronous motor and stepper motor.

DETAIL DESCRIPTION**Theory:****1. Apply the Principle of Scalar and vector Quantities.**

- 1.1 Define the concept of Scalar and Vector Quantities.
- 1.2 Explain the Vector representation of alternating voltage and current.
- 1.3 Explain the Vector in polar and rectangular form.
- 1.4 Formulate the relation between Vectors Expressed in rectangular and polar co-ordinate.
- 1.5 Solve problems related to Vector sum and difference, multiplication and division.

2. Apply the concept of AC series and Parallel circuits containing resistor, Inductor and Capacitor .

- 2.1 Draw the circuit containing resistor, Inductor and Capacitor.
- 2.2 Draw the Vector diagram of RLC series circuit.
- 2.3 Derive the Impedance equation of RLC series circuit in Rectangular form and polar form notation.
- 2.4 Solve problems of RLC series circuit in rectangular co-ordinate system and polar co- ordinate system.
- 2.5 Draw the circuit containing resistor, Inductor and Capacitor In parallel.
- 2.6 Draw the Vector diagram of RLC parallel circuit.
- 2.7 Derive the Admittance of parallel AC circuit in Rectangular and polar form notation.
- 2.8 Solve problems on parallel Ac circuit in Rectangular and polar form notation.

3. Understand the application of complex algebra for power calculation.

- 3.1 Calculate power employing complex form.
- 3.2 Calculate VAR employing complex form.
- 3.3 Describe the conjugate method of calculating Real power.
- 3.4 Describe the conjugate method of calculating Reactive power.

4. Understand the concept of poly-phase system.

- 4.1 State the term poly-phase system.
- 4.2 List the advantages of poly-phase system over single phase system.
- 4.3 State the generation of poly-phase emf.
- 4.4 Sketch the phase voltage wave diagram.
- 4.5 Identify the phase sequence of poly-phase system.
- 4.6 State the effects of reverse phase sequence.

5. Apply the concept of poly phase for interconnection.

- 5.1 Write down possible ways of interconnection of three phase system.
- 5.2 Draw the circuit diagram of star connected 3-phase, 3-wire system.
- 5.3 List the application of 3-phase, 3-wire, star connected system.
- 5.4 Sketch 3-phase, 4-wire, star connection system.
- 5.5 List application of 3-phase, 4-wire star connection system.

6. Understand the function of 3-phase star connection system.

- 6.1 Define the concept of Balance and Unbalance System
- 6.2 Find neutral wire in a 3-phase star connection system.
- 6.3 Evaluate the current in the neutral wire in a balanced 3-phase, 4-wire, star connected system.
- 6.4 Draw the phasor diagram of 3-phase, 4-wire star connected system.
- 6.5 Discuss the formula $I_L = I_p$ and $V_L = \sqrt{3} V_p$
- 6.6 Calculate volt-ampere, power and power factor in a balanced 3-phase, 4-wire star connected system.
- 6.7 Solve problems on star connected (balanced) power system.

7. Understand the features of 3-phase delta connection system.

- 7.1 Draw the circuit diagram of a 3-phase delta connected system.
- 7.2 Draw the phasor diagram of delta connected system.
- 7.3 Express the deduction of the formula $V_L = V_p$ and $I_L = \sqrt{3} I_p$ for connected system.
- 7.4 Calculate the volt-ampere, power and power factor in a balanced 3-phase, delta connected system.
- 7.5 Solve problems on delta connected balanced system.
- 7.6 Compare the advantages of star connected system with those of delta connected system.

8. Understand the principle of operation of transformer.

- 8.1 Define the concept of transformer.
- 8.2 Mention different types and Uses of transformers.
- 8.3 Explain the working principle of transformer.
- 8.4 Derive the emf equation of a transformer.
- 8.5 Explain transformation ratio (voltage, current and turns).
- 8.6 List the different types of losses in transformer.
- 8.7 Explain the factors affecting core loss and copper loss.
- 8.8 Deduct the equation for voltage regulation of a transformer.
- 8.9 Solve problems on transformation ratio and emf equation of Transformer.

9. Understand the principle of DC motor.

- 9.1 Define the concept of DC motor.
- 9.2 Specify different types of DC motor.
- 9.3 Explain the working principle of DC motor.
- 9.4 Explain generator action of motor.
- 9.5 Describe the constructional features of DC motor.
- 9.6 Clarify the function of commutator.
- 9.7 Describe starting methods of DC motor.
- 9.8 Illustrate speed control of DC motor.

10. Understand the principle of induction motor.

- 10.1 Explain the principle of induction motor.
- 10.2 Mention the types of Single phase and three phase induction motor.
- 10.3 Distinguish between the principles of induction motor and
- 10.4 Define slip and slip speed.
- 10.5 Explain the construction of 3-phase induction motor.
- 10.6 List the uses of Single phase and 3-phase induction motor.

- 10.7 Describe the methods of starting 3-phase induction motor.
- 10.8 State the principles of speed control of 3-phase induction motor.

11. Understand the working principle of 1-phase induction motor.

- 11.1 Explain working principle of 1-phase induction motor.
- 11.2 Explain the self starting method of single phase motor.
- 11.3 Describe the principles of operation of standard split phase motor.
- 11.4 Describe the principles of operation of capacitor motor.
- 11.5 Describe the principles of operation of shaded pole motor and repulsion motor.
- 11.6 Mention the Uses of hysteresis motor, universal motor, reluctance motor and AC series motor.
- 11.7 Mention the methods of speed control of single phase induction motor.

12. Understand the working principle of synchronous motor and Stepper motor.

- 12.1 Explain the principle of operation of synchronous motor.
- 12.2 Describe the constructional features of synchronous motor.
- 12.3 Describe the starting methods of synchronous motor.
- 12.4 Explain the working principle of stepper motor.
- 12.5 List the different types of stepper motor.
- 12.6 Describe construction of different stepper motors.

PRACTICAL:

1. Determine the value of resistance, inductance & capacitance and draw vector diagram of RLC series circuit.

- 1.1 Sketch the circuit diagram for RLC series circuit.
- 1.2 Select equipment, tools & materials for the experiment.
- 1.3 Connect the circuit according to the circuit diagram.
- 1.4 Check all connection points before energizing the circuit.
- 1.5 Record the readings from the meter connecting power supply to the circuit.
- 1.6 Find the values of resistance, inductance, capacitance and phase angle from the relevant data.
- 1.7 Verify the impressed voltage is equal to the vector sum of voltage drops in each parameter.
- 1.8 Sketch the vector diagram with the help of relevant data as obtained.

2. Determine the values of resistance, inductance, capacitance and draw the vector diagram of RLC parallel circuit.

- 2.1 Sketch the circuit diagram for RLC parallel circuit.
- 2.2 Select equipment, tools & materials for the experiment.
- 2.3 Connect the circuit according to the circuit diagram.
- 2.4 Check all connection points before energize the circuit.
- 2.5 Record the readings from the meter connecting power supply to the circuit.
- 2.6 Find the value of resistance, inductance, capacitance and phase angle from the relevant data.
- 2.7 Verify the line current is equal to the vector sum of branch currents.
- 2.8 Sketch the vector diagram with the relevant data as obtained.

3. Measure line and phase voltage & current in a 3-phase star connected inductive load.

- 3.1 Sketch the circuit diagram for 3-phase star connected load.
- 3.2 Select equipment, tools & materials for the experiment.
- 3.3 Connect the circuit according to the circuit diagram
- 3.4 Check all connection points before connecting power supply.
- 3.5 Record the readings of instruments.
- 3.6 Compare the recorded values with calculated values.
- 3.7 Note down the observations remarks.

4. Measure line and phase current & voltage in 3-phase delta connected inductive load.

- 4.1 Sketch the circuit diagram for 3-phase delta connected load.
- 4.2 Select equipment, tools & materials for the experiment.

- 4.3 Connect the circuit according to the circuit diagram.
- 4.4 Check all connection points before connecting power supply.
- 4.5 Record the readings of the instruments.
- 4.6 Compare the recorded values with calculated values.
- 4.7 Note down the observations.

5. Measure current, voltage and power in a balanced 3-phase star connected inductive load and construction of vector diagram.

- 5.1 Sketch the circuit diagram for measuring power by 3 watt meters of a 3-phase system.
- 5.2 Select equipment, tools & materials for the experiment.
- 5.3 Connect the circuit according to the circuit diagram.
- 5.4 Check all connection points and equipment & instruments before actual operation.
- 5.5 Record the readings from the meters in the circuit.
- 5.6 Calculate the power from the formula
 $P_t = W_1 + W_2 + W_3$ and $3V_p I_p \cos \theta$
- 5.7 Draw the vector diagram using relevant data as obtained.
- 5.8 Note down the observations.

6. Measure current, voltage and power in a balanced 3-phase delta connected inductive load and construction of vector diagram.

- 6.1 Draw the circuit diagram for measuring power by 3-watt meter method of 3-phase delta connected load.
- 6.2 Select equipment, tools & materials for the experiment.
- 6.3 Connect the circuit according to the circuit diagram.
- 6.4 Check all connections, equipment and instruments before actual operation.
- 6.5 Record the reading from the meters used in the circuit.
- 6.6 Calculate the power from the formula
 $P_t = W_1 + W_2 + W_3$ and $P_t = \sqrt{3} V_{LL} I_{LI} \cos \theta$
- 6.7 Draw the vector diagram using obtained data.
- 6.8 Note down the observations.

7. Find the transformation ratio of a transformer.

- 7.1 Develop a circuit to perform the experiment.
- 7.2 Select required equipment and materials.
- 7.3 Connect the components according to the circuit diagram.
- 7.4 Check the connections.
- 7.5 Record the primary (E_p) and secondary (E_s) voltages.
- 7.6 Calculate the transformation ratio using the relation $\frac{E_s}{E_p} = \frac{N_s}{N_p} = K$
- 7.7 Note down the observations.

8. Construct load versus speed characteristic curve of DC shunt motor.

- 8.1 Draw the required circuit diagram for the experiment.
- 8.2 Select the instrument and materials required.
- 8.3 Connect all the instruments according to diagram.
- 8.4 Take the necessary data from the connected instruments.
- 8.5 Draw the required curve.
- 8.6 Note down the observations.

9. Study the components/parts of a 3-phase induction motor.

- 9.1 Prepare a list of the parts of a 3-phase induction motor.
- 9.2 Dismantle the components/parts of the motor.
- 9.3 Develop sketches of each part.
- 9.4 Sketch the developed diagram of the windings of the motor.

9.5 Assemble the dismantled parts.

9.6 Note down the observations.

10. Operate a 3-phase induction motor.

10.1 Sketch the circuit diagram.

10.2 Select required, equipment, tools and materials.

10.3 Connect starter with motor.

10.4 Connect power supply to the circuit.

10.5 Observe the operation.

10.6 Measure the speed of the rotor.

10.7 Note down the observations.

11. Start a 1-phase capacitor type motor/ceiling fan with regulator.

11.1 Select the equipment and tools required for the experiment.

11.2 Sketch a working diagram.

11.3 Identify the two sets of coils.

11.4 Connect the capacitor with the proper set of coil.

11.5 Connect power supply to the fan motor.

11.6 Test the rotation of the motor opposite direction by changing the capacitor connection.

11.7 Note down the observations.

REFERENCE BOOKS:

- 1 DC Machines – Samadder & Gongopadhya
- 2 A course in Electrical Power - J. B. Gupta
- 3 A Text Book of Electrical Technology - B. L. Theraja
- 4 Automotive Electrical Equipment - H.W. Crouse, P.L. Kohli

AIMS:

- To develop knowledge & skill on number systems, codes and binary arithmetic operation.
- To provide knowledge & skill on logic gates, logic circuits, Boolean algebra and logic families.
- To assist to acquire the knowledge & skill on combinational logic circuit.

SHORT DESCRIPTION

Basic concept of digital electronics; Number system & codes; Logic gates, Boolean algebra and logic simplification & Combinational logic circuits.

DETAIL DESCRIPTION**Theory:****1. Understand basic concept of digital electronics.**

- 1.1 Define digital electronics & Digital Signal.
- 1.2 Mention the characteristics of digital signal.
- 1.3 Describe the advantages of working in digital mode.
- 1.4 Define logic level of digital signal.
- 1.5 Identify DC voltage level of digital signal.
- 1.6 Describe parameters of a digital pulse waveform such as rise time, fall time, pulse width and duty cycle.

2. Understand the number system and binary arithmetic operation.

- 2.1 Define decimal, binary, octal and hexadecimal number system
- 2.2 Describe decimal, binary, octal and hexadecimal number system.
- 2.3 Convert one number system to another.
- 2.4 Compute binary arithmetic & Complement subtraction Technique.
- 2.5 State the applications of different number system.

3. Understand the arithmetic codes and code conversion.

- 3.1 Define 8421, Excess-3 code, Gray code, BCD code, Hamming code, Unicode, and ASCII code.
- 3.2 Describe 8421, Excess-3 code, Gray code, BCD code, Hamming code, Unicode, and ASCII code.
- 3.3 Practice the conversion of one code to another.
- 3.4 Describe the addition and subtraction of 8421, Excess-3 and BCD coded number.
- 3.5 State parity checked code and Hamming code.
- 3.6 Describe the error detection and correction with Hamming code. And parity checked code.

4. Understand the concept of Logic gates.

- 4.1 Define logic gate.
- 4.2 Classify logic gate.
- 4.3 Explain logical statement, truth table, Boolean equation and symbol of AND, OR, NOT, NOR, NAND, EX-OR and EX-NOR gates.
- 4.4 Show NAND & NOR gates used as Universal logic gates.
- 4.5 State the applications of logic gates.

5. Understand the features of the logic families and digital IC's.

- 5.1 Classify logic families.
- 5.2 Define SSI, MSI, LSI and VLSI.
- 5.3 Describe Transistor logic families (DTL & TTL).
- 5.4 Describe MOS logic families (P-MOS, N-MOS & C-MOS)

- 5.5 State the meaning of the terms propagation delay time, speed, noise immunity, power dissipation, fan-in, fan-out, operating temperature and power rating of logic circuits.
- 5.6 State the characteristics of digital IC's.
- 6. Understand the concepts of electronic circuit of logic gates.**
- 6.1 Describe the operation of standard TTL NAND gate.
- 6.2 Describe the operation of CMOS NAND & NOR gates.
- 6.3 State special logic gates such as buffer, tri-state and expandable gates.
- 6.4 Mention the basic principle of ORing and ANDing.
- 7. Understand digital IC's**
- 7.1 Define Digital IC's
- 7.2 Describe fixed function Integrated circuit IC's such as AND, OR, NAND etc.
- 7.3 Mention IC package, code numbers, and important specification of TTL/MOS commercial IC gates.
- 7.4 Mention the applications of different logic IC's.
- 8. Understand logic simplification & design of digital circuit.**
- 8.1 State the theorems of Boolean algebra.
- 8.2 State DeMorgan's theorems and its applications.
- 8.3 Determine the terms-Sum of Product (SOP) form and Product of Sum (POS) form.
- 8.4 Determine the SOP & POS form from truth table.
- 8.5 Define Karnaugh Map.
- 8.6 State the structure of Karnaugh map.
- 8.7 State the simplification process of Boolean expression from a K-map and design logic circuit (up to 4 variables).
- 9. Understand various combinational logic circuits.**
- 9.1 Define combinational logic circuit with example.
- 9.2 Describe the operation of half adder and half Sub tractor.
- 9.3 Explain the operation of full adder and full Sub tractor.
- 9.4 Describe the operation of 4 bit parallel adder.
- 9.5 Explain the operation of 4 bit subtraction circuit.
- 9.6 Describe the operation of parity generator and detector circuit.
- 9.7 Describe the operation of 4 bit BCD adder.
- 9.8 Explain the operation of multipliers & divisors.
- 9.9 Mention the application of combinational logic circuit.
- 10. State the principle of operation of LCD, LED, seven-segment and dot matrix display.**
- 10.1 Explain the operation of commonly used 4-bit BCD decoder/driver for seven segment display of common Anode/Cathode type.
- 10.2 Describe the operation of parity generator & detector circuits
- 10.3 Describe the operation of encoder and decoder circuit.
- 11. Understand the features of multiplexers and demultiplexer.**
- 11.1 Define multiplexers and demultiplexer.
- 11.2 Describe the operation of 2:1, 4:1 and 8:1 multiplexer with logic diagram.
- 11.3 Describe the operation of 1:2, 1:4 and 1:8 demultiplexers with logic diagram.
- 11.4 State the use of multiplexer & demultiplexer.
- 11.5 Explain the operation of Binary comparator.
- 11.6 Describe the Pin diagram of commonly used 4-bit comparator ICs.
- 11.7 Distinguish between Decoder and Demultiplexer.
- 12. Understand the features of sequential logic circuits.**

- 12.1 Define sequential logic circuit
- 12.2 State the terms clock, timing diagram & latch of digital system.
- 12.3 Explain the operation of flip-flop

PRACTICAL:

- 1. Verify the truth tables of logic gates (OR, AND, NOT, NAND & NOR)**
 - 1.1 Select logic gate ICs.
 - 1.2 Select appropriate circuits, required tools, equipments and materials.
 - 1.3 Insert the selected IC to the Breadboard.
 - 1.4 Connect the circuits as per diagram on trainer board.
 - 1.5 Switch on the DC power supply,
 - 1.6 Verify the truth tables.
- 2. Verify the Truth table of X-OR & X-NOR gate using basic gates.**
 - 2.1 Select logic gate ICs.
 - 2.2 Select appropriate circuits, required tools, equipments and materials.
 - 2.3 Insert the selected IC to the Breadboard.
 - 2.4 Connect the circuits as per diagram on trainer board.
 - 2.5 Switch on the DC power supply,
 - 2.6 Verify the truth tables.
- 3. Show the operation of NAND & NOR gate as universal gates.**
 - 3.1 Select logic gate IC of NAND gate & NOR gate.
 - 3.2 Select appropriate circuits, required tools, equipments and materials.
 - 3.3 Insert the selected IC to the Breadboard.
 - 3.4 Connect the circuits as per diagram for AND OR & NOT gate on trainer board.
 - 3.5 Switch on the DC power supply,
 - 3.6 Verify the truth tables of AND OR & NOT gate operation.
- 4. Design & develop a code converter circuits and observe its output operation.**
 - 4.1 Select logic gate ICs.
 - 4.2 Select appropriate circuits, required tools, equipments and materials.
 - 4.3 Insert the selected IC to the Breadboard.
 - 4.4 Connect the circuits as per diagram on trainer board.
 - 4.5 Switch on the DC power supply,
 - 4.6 Verify the truth tables
- 5. Verify the functions of half adder & half sub tractor.**
 - 5.1 Select ICs.
 - 5.2 Draw the pin diagram and internal connection.
 - 5.3 Draw appropriate circuits.
 - 5.4 Select required tools, equipments and materials.
 - 5.5 Connect the circuits as per diagram on trainer board.
 - 5.6 Switch on the DC power supply,
 - 5.7 Verify the truth tables.
- 6. Verify the functions of full adder & full sub tractor.**
 - 6.1 Select ICs.
 - 6.2 Draw the pin diagram and internal connection.
 - 6.3 Draw appropriate circuits.
 - 6.4 Select required tools, equipments and materials.
 - 6.5 Connect the circuits as per diagram on trainer board.
 - 6.6 Switch on the DC power supply,
 - 6.7 Verify the truth tables.

7. Verify the output operation of binary 4 bit parallel adder.

- 7.1 Select appropriate ICs.
- 7.2 Draw the pin diagram and internal connection.
- 7.3 Draw appropriate circuits.
- 7.4 Select required tools, equipments and materials.
- 7.5 Connect the circuits as per diagram on trainer board.
- 7.6 Switch on the DC power supply,
- 7.7 Verify the truth tables.

8. Show the operation of encoder & decoder.

- 8.1 Select appropriate ICs.
- 8.2 Draw the pin diagram and internal connection.
- 8.3 Draw appropriate circuits.
- 8.4 Select required tools, equipments and materials.
- 8.5 Connect the circuits as per diagram on trainer board.
- 8.6 Switch on the DC power supply,
- 8.7 Verify the truth tables.

9. Show the operation of a decoder driver & display operation using 7 segment display.

- 9.1 Select appropriate ICs.
- 9.2 Draw the pin diagram and internal connection.
- 9.3 Draw appropriate circuits.
- 9.4 Select required tools, equipments and materials.
- 9.5 Connect the circuits as per diagram on trainer board.
- 9.6 Switch on the DC power supply,
- 9.7 Verify the truth tables.

10. Show the operation of multiplexer & demultiplexer.

- 10.1 Select appropriate ICs.
- 10.2 Draw the pin diagram and internal connection.
- 10.3 Draw appropriate circuits.
- 10.4 Select required tools, equipments and materials.
- 10.5 Connect the circuits as per diagram on trainer board.
- 10.6 Switch on the DC power supply,
- 10.7 Verify the truth tables.

11. Verify the operation of Binary comparator.

- 11.1 Select appropriate ICs.
- 11.2 Draw the pin diagram and internal connection.
- 11.3 Draw appropriate circuits.
- 11.4 Select required tools, equipments and materials.
- 11.5 Connect the circuits as per diagram on trainer board.
- 11.6 Switch on the DC power supply.
- 11.7 Verify the truth tables.

REFERENCE BOOKS

- 1. Digital Fundamentals - Thomas L. Floyd
- 2. Digital Principles – Roger L. Tokhem
- 3. Digital system – Ronald J. Tocci and Widmer.
- 4. Principle of Digital Electronics & Application - Malvino

AIMS

- To develop the knowledge and skill on using semiconductor diode in power electronics.
- To familiarize with power switching device.
- To develop the knowledge & skill on inverter , Chopper & Cycloconverter
- To familiarize dc and ac control drive.
- To develop knowledge & skill on photo diode, Photo Transistor & Photo Resistor .
- To develop knowledge & skill on Solar Power system.
- To develop knowledge & skill on UPS, IPS & AVR.
- To develop knowledge & skill on electronic safety system.

SHORT DESCRIPTION

Power switching devices, Semiconductor diode in power electronics, Inverter, Chopper , Cycloconverter , Control of ac and dc drives, Photo diode , Photo Transistor , Photo Resistor , Solar Power system , UPS,IPS , AVR & safety system .

DETAIL DESCRIPTION**Theory:****1. Understand the Concept of Power Electronics and Power diode.**

- 1.1 Define the term power electronics.
- 1.2 Mention the scope and application of power electronics.
- 1.3 List the merits and demerits of power electronics.
- 1.4 Mention the types of power semiconductor devices.
- 1.5 List the characteristics of different types of Power diode.
- 1.6 Mention the V-I characteristics of series connected diodes.
- 1.7 Mention the V-I characteristics of parallel connected diodes.

2. Understand the features of power Transistor.

- 2.1 Classify power transistor.
- 2.2 Describe the construction and operation of IGBT.
- 2.3 Compare IGBT with MOSFET.
- 2.4 Mention the application of IGBT.
- 2.5 Describe the construction and operation of MCT.

3. Understand the features of GTO

- 3.1 Describe the construction of GTO.
- 3.2 Mention turn-on and turn-off process of GTO.
- 3.3 Identify Gold-doped and anode-shortened GTO.
- 3.4 Compare between GTO and thyristor.

4. Understand the features of Inverter.

- 4.1 Define inverter.
- 4.2 Mention the basic principle of line-commutated and force commutated inverter.
- 4.3 Describe the operation of single-phase line-commutated full-controlled inverter.
- 4.4 Describe the operation of three-phase line-commutated full-controlled inverter.
- 4.5 Explain single-phase parallel-capacitor commutated inverter.
- 4.6 Describe the operation of single-phase parallel inverter with feedback diodes.
- 4.7 Describe the operation of single-phase series inverter.
- 4.8 Describe the operation of three phase forced-commutated bridge inverter.

5. Understand the features of choppers.

- 5.1 Define chopper.
- 5.2 Mention the principle of operation of chopper.
- 5.3 Describe the operation of voltage step-down chopper.
- 5.4 Explain the operation of voltage step-up chopper.
- 5.5 Explain the operation of ac chopper.

6. Understand the features of cycloconverter.

- 6.1 Define cycloconverter.
- 6.2 Mention the types of cycloconverter.
- 6.3 Describe the operation of single phase/single phase (mid-point and bridge configuration) cycloconverter.
- 6.4 Analyze the operation of three phase / single phase (circulating and non circulating type) cycloconverter.
- 6.5 Describe the operation of a three phase/three phase cycloconverter.

7. Understand the features of dc drives.

- 7.1 Define electric drive.
- 7.2 Mention the elements of electric drive using power electronic converter.
- 7.3 State the basic performance equation of dc motor.
- 7.4 Explain the principle of operation of single phase (a) Half wave converter drive (b) full wave semi converter drive, (c) full wave full converter drive.
- 7.5 Explain the principle of operation of three phases (a) Half wave converter drive (b) full wave semi converter drive, (c) full wave full converter drive.

8. Understand the Features of photo resistors , photo diodes and Photo transistors

- 8.1 Describe the basic structure of photo resistors , photo diodes and photo transistors
- 8.2 Explain the operating principles of photo resistors, photo diodes and photo transistors.
- 8.3 List typical application of photo resistors, photo diodes and photo transistors.
- 8.4 Explain a block Diagram showing how photo Detectors used in speed measuring system
- 8.5 Explain the operation of photo diode & photo transistor switching circuit.

9. Understand Solar Power System.

- 9.1 Define Photovoltaic (PV) effect.
- 9.2 Describe the operation of a solar cell.
- 9.3 List the materials suitable for solar cell.
- 9.4 Discuss series/parallel operation in solar panel.
- 9.5 Mention the types of PV power system.
- 9.6 Describe the operation of various types of charge controllers.

10. Understand the features of induction and dielectric Heating.

- 10.1 Define induction and dielectric heating.
- 10.2 Describe the principle of induction and dielectric heating.
- 10.3 List the effects of frequency on induction and dielectric heating.
- 10.4 Mention the effects of source voltage on induction and dielectric heating.
- 10.5 Describe the factors for choosing frequency of induction and dielectric heating.
- 10.6 List the advantages and applications of Induction and dielectric heating.

11. Understand the Features of Power Supply

- 11.1 Explain the principle and operation of SMPS with block and circuit diagram.
- 11.2 Explain the principle and operation of UPS and IPS with block diagram.
- 11.3 Explain the principle and operation of automatic voltage regulator (AVR).

12. Understand the features of safety system.

- 12.1 Define electronic safety system and Fire Sensor.
- 12.2 Mention the types of Fire sensor.

12.3 Explain the operation of the Fire detection system with block diagram.

12.4 Describe the operation of touch and non touch type person (thief) detector using infrared detection system with block diagram.

Practical:

1. Determine the V-I characteristics of series/parallel connected diodes.

- 1.1 Select an appropriate circuit, required materials, tools and equipments for the experiment.
- 1.2 Connect the circuit as per diagram with meters.
- 1.3 Check the circuit and switch on the power supply.
- 1.4 Record the data for V-I curve.
- 1.5 Plot the curve.

2. Determine the V-I characteristics of IGBT.

- 2.1 Select an appropriate circuit, required materials, tools and equipments for the experiment.
- 2.2 Connect the circuit as per diagram with meters.
- 2.3 Check the circuit and switch on the power supply.
- 2.4 Record the data for I-V curve.
- 2.5 Plot the curve.

3. Determine the V-I characteristics of GTO.

- 3.1 Select an appropriate circuit, required materials, tools and equipments for the experiment.
- 3.2 Connect the circuit as per diagram with meters.
- 3.3 Check the circuit and switch on the power supply.
- 3.4 Record the data for I-V curve.
- 3.5 Plot the curve.

4. Study the operation of inverter circuit.

- 4.1 Select an appropriate circuit for experiment.
- 4.2 Select required tools, equipments and materials.
- 4.3 Connect the circuit as per diagram with Oscilloscope.
- 4.4 Check the connection and switch on the power supply.
- 4.5 Observe the output wave shapes of the circuit.

5. Construct the step down & step up operation of dc choppers.

- 5.1 Select an appropriate circuit for experiment.
- 5.2 Select required tools, equipments and materials.
- 5.3 Connect the circuit as per diagram.
- 5.4 Check the connection and switch on the power supply.
- 5.5 Measure the input and output voltage.

6. Study the operation of Cycloconverter.

- 6.1 Select an appropriate circuit for experiment.
- 6.2 Select required tools, equipments and materials.
- 6.3 Connect the circuit as per diagram.
- 6.4 Check the connection and switch on the power supply.
- 6.5 Measure the input and output frequency with Oscilloscope/frequency counter.

7. Determine the V-I characteristics curve of photo diode/photo transistor.

- 7.1 Select an appropriate circuit, required materials, tools and equipments for the experiment.
- 7.2 Connect the circuit as per diagram with meters.
- 7.3 Check the circuit and switch on the power supply.
- 7.4 Record the data for I-V curve with different light intensity.
- 7.5 Plot the curve.

8. Study the operation of a Solar system.

- 8.1 Select an appropriate Solar system for experiment.
- 8.2 Select required tools, equipments and materials.
- 8.3 Connect the circuit as per diagram.
- 8.4 Check the connection.
- 8.5 Observe output condition.

9. Study the operation of SMPS.

- 9.1 Select an appropriate SMPS.
- 9.2 Select required tools, equipments and materials.
- 9.3 Switch on the power supply.
- 9.4 Vary input voltage and observe output voltage.

10. Study the operation of UPS/IPS.

- 10.1 Select an appropriate UPS/IPS.
- 10.2 Select required tools, equipments and materials.
- 10.3 Switch on the power supply.
- 10.4 Disconnect main supply and observe output condition.

11. Visit a place where fire safety system is used.

REFERENCES:

- 1 Power Electronics Hand Book - Muhammad H. Rashid
- 2 Industrial Electronics and Control - Biswanath Paul
- 3 Industrial and Power Electronics - G. K. Mithal, Dr. Maneesha Gupta
- 4 Power Electronics - Dr. P. S. Bhimbra
- 5 Introduction to Power Electronics- Denis Fewson

AIMS

- To provide the comprehensive knowledge and skill on four terminal network.
- To provide the understanding and skill on attenuator & filters.
- To familiarize with the transmission line.
- To provide the understanding and skill on antenna.
- To familiarize with the propagation of radio waves.

SHORT DESCRIPTION

Network theorems, Four terminal networks; Half section network; Attenuators and filters; Transmission line; Line constant & impedance matching; Antenna; Propagation of radio wave; Effect of earth curvature & ionosphere on wave propagation.

DETAIL DESCRIPTION**Theory:****1. Understand the features of network theorems.**

- 1.1 State and explain Superposition theorem.
- 1.2 State and explain Thevenin's and Norton's theorem.
- 1.3 State and explain Reciprocity and Maximum power transfer theorem.

2. Understand the features of four terminal networks.

- 2.1 Define network
- 2.2 Define the terms (a) Active element (b) passive element (c) linear & non linear element (d) Unilateral & Bilateral elements.
- 2.3 State the classification of networks.
- 2.4 Define symmetrical and asymmetrical networks.
- 2.5 Illustrate the characteristic impedance, propagation constant, attenuation constant and phase constant of general four terminal symmetrical networks connected in services.
- 2.6 Illustrate iterative impedance, image impedance, image transfer constant and insertion loss of general four terminal asymmetrical networks connected in series.

3. Understand the features of special network.

- 3.1 Distinguish between the unbalanced and balanced structure ladder network.
- 3.2 State the meaning of lattice network and Bridge T-network.
- 3.3 Draw unbalanced and balanced ladder network as series of T, π and L sections.
- 3.4 Explain the equivalence between balanced and unbalanced sections.
- 3.5 Mention the parameters of four terminal networks.

4. Understand the features of T, π , L and half section networks.

- 4.1 Express the deduction of the characteristic impedance (Z_0) in terms of lumped impedance (Z_1, Z_2) of symmetrical T section and π section networks.
- 4.2 Express the deduction of the Z_0 in terms of Z_{oc} and Z_{sc} for T and π section.
- 4.3 Express the deduction of the propagation constants in terms of Z_1 and Z_2 for T & π section.
- 4.4 Draw the symmetrical T and π section into half section network.
- 4.5 Express the deduction of the iterative, image, open and short circuit impedance of half section networks.

- 4.6 Draw the unbalanced and balanced forms of L sections.
- 4.7 Express the deduction of the iterative and image impedance of L section network.
- 4.8 Draw the T as star and π as a mesh network.
- 5. Understand the features of attenuators.**
- 5.1 Define attenuator.
- 5.2 Express attenuation in decibel and neper unit.
- 5.3 Mention the general characteristics of attenuating network.
- 5.4 Show mathematically the attenuators involving symmetrical, asymmetrical, L and π type network.
- 5.5 Explain the variable and ladders attenuator.
- 6. Understand the features of filter.**
- 6.1 Define resonance circuit
- 6.2 Mention the types of resonance circuit.
- 6.3 Analyze series and parallel resonance circuit.
- 6.4 Define electronic filter.
- 6.5 List the types of filters.
- 6.6 Mention the general properties of low pass, high pass, band pass, band stop filters.
- 6.7 Mention the application of low pass, high pass, band pass, band stop filters.
- 6.8 Represent the low pass filter in symmetrical unbalanced and balanced T-section and symmetrical unbalanced and balanced π section forms.
- 6.9 State the theorem connecting α (alpha) and Z_0 .
- 7. Understand the features of special filter.**
- 7.1 Explain the cut off frequency of filter network.
- 7.2 Mention the reactance frequency characteristics of T and π low pass and high pass filters.
- 7.3 Identify the attenuation vs. frequency, phase shift vs. frequency, characteristic impedance vs. frequency curve.
- 7.4 Mention the significance of T and π section low and high pass filters.
- 7.5 Express the deduction of M-derived filters.
- 7.6 Explain the operation of crystal filters.
- 7.7 Describe the impedance matching of filters.
- 7.8 Mention the difference between active and passive filters.
- 8. Understand the features of transmission line.**
- 8.1 Identify the different types of transmission lines.
- 8.2 Identify the implications and shape of different types of transmission lines (including 300 ohms antenna feeder cable, 75 ohms co-axial cable).
- 8.3 List the application of transmission lines.
- 8.4 Explain the velocity of propagation and characteristics impedance of transmission line.
- 8.5 Define infinite line.
- 8.6 Explain the short transmission line terminated in Z_0 .
- 8.7 Explain the current and voltage wave along a transmission line.
- 8.8 Mention the propagation, attenuation and phase constant of a transmission line.
- 8.9 Describe the voltage, current and power reflection of transmission line.
- 8.10 Describe the conception of transmission lines at high frequencies.
- 9. Understand the features of line constant & impedance matching.**
- 9.1 State the meaning of the terms primary and secondary line constants.
- 9.2 Express the deduction of secondary line constant such as alpha, beta, gamma and Z_0 in terms of primary line constants.
- 9.3 Express the deduction of the condition of minimum attenuation, minimum distortion and distortion less condition of transmission line.
- 9.4 Describe continuous loading and lumped loading.

- 9.5 List the use of continuous loading and lumped loading.
- 9.6 Describe the construction of loading coils.
- 9.7 Mention the use of loading coils.
- 9.8 Explain the input impedance of transmission line.
- 9.9 Explain the impedance matching, single stub, double stub and quarter wave transformer.
- 9.10 Mention the characteristics of the high frequency transmission line.
- 9.11 Concept of reflection and standing wave, definition of reflection co-efficient, SWR and VSWR and their relation.

10. Understand the features, construction & operation of antenna.

- 10.1 State the physical idea of radiation of electromagnetic energy from antenna.
- 10.2 Define point source, power gain directivity, aperture, effective area, radiation pattern, beam angle, radiation angle, beam and radiation distance related to antenna.
- 10.3 Describe the construction, operation and radiation pattern of dipole, folded dipole, yagi, marconi and whip antenna.
- 10.4 Explain the construction of end-fire and broad-side array.
- 10.5 Explain the operation of end-fire and broad-side array.
- 10.6 Mention the coupling and impedance matching procedure of antenna.
- 10.7 Explain the construction and operation of the log periodic antenna.

11. Understand the propagation of radio waves.

- 11.1 Mention the nature of electromagnetic waves.
- 11.2 Mention the characteristics including polarization of electromagnetic waves.
- 11.3 Mention the modes of radio wave propagation.
- 11.4 Mention the classification of radio wave on the basis of frequency, distance and application.
- 11.5 Mention the characteristics of ground, space and sky wave propagation.
- 11.6 Explain the Sommerfeld equation and effect of terrain for ground wave propagation.
- 11.7 State the effect of environment in propagation of waves.
- 11.8 Describe the field strength and range of propagation in terms of antenna height for space wave propagation.

12. Understand the effect of earth curvature & ionosphere on wave propagation.

- 12.1 Mention the effect of earth curvature and atmosphere on space wave propagation.
- 12.2 Explain the duct propagation, multi-hop propagation and tropo-scatter propagation.
- 12.3 Explain the term ionosphere.
- 12.4 Identify the layers of ionosphere.
- 12.5 List the basic properties of different layers of the ionosphere.
- 12.6 Explain the reflection and refraction through ionosphere.
- 12.7 Describe the ionosphere variation and effects of earth's magnetic fields.
- 12.8 Define skip distance, skip zone and M. U. F.
- 12.9 Explain the fading and noise in sky wave propagation.

PRACTICAL:

1. Measure the characteristic impedance of a symmetrical T network.

- 1.1 Select the required components, connecting board, meter and necessary materials.
- 1.2 Build up a diagram of symmetrical T network.
- 1.3 Set the components on the board as per diagram.
- 1.4 Check the connections.
- 1.5 Find the characteristic impedance.
- 1.6 Compare the observed result with theoretical value.

- 2. Measure the image impedance of a given asymmetrical T network.**
 - 2.1 Select the required components.
 - 2.2 Select the connecting board, meter and materials.
 - 2.3 Select a circuit diagram.
 - 2.4 Set the components on the board according to the circuit diagram.
 - 2.5 Check the connections.
 - 2.6 Record the characteristic impedance.
 - 2.7 Compare the observed result with theoretical value.
- 3. Measure the attenuation of symmetrical T type attenuator.**
 - 3.1 Select the attenuator circuit.
 - 3.2 Select the components, meters, board and materials.
 - 3.3 Connect the components of the board as per diagram.
 - 3.4 Check the connections.
 - 3.5 Record the required data.
 - 3.6 Calculate the attenuation.
- 4. Determine the impedance characteristics of prototype low pass filter.**
 - 4.1 Select a T or π low pass filter circuit.
 - 4.2 Select the component board, tools and materials.
 - 4.3 Connect the components according to the diagram.
 - 4.4 Record the impedance for various frequencies.
 - 4.5 Draw the reactance frequency curve from the data.
 - 4.6 Show the pass band and attenuation band.
- 5. Determine the attenuation characteristics of a prototype low pass filter.**
 - 5.1 Select the required circuit.
 - 5.2 Select the components, board, meter and materials.
 - 5.3 Connect the circuit components as per diagram.
 - 5.4 Energize the circuit.
 - 5.5 Record the required data for various frequencies.
 - 5.6 Calculate the attenuations by collected data.
 - 5.7 Draw the attenuation frequency curve from the data.
 - 5.8 Observe the graph.
- 6. Determine the impedance characteristics of a high pass filter.**
 - 6.1 Select a high filter circuit.
 - 6.2 Select the components, board, meter and materials.
 - 6.3 Connect the components and energize the circuit.
 - 6.4 Record the impedance for various frequencies.
 - 6.5 Draw the reactance frequency curve.
 - 6.6 Show the pass band and attenuation band.
- 7. Determine the attenuation characteristics of a high pass filter.**
 - 7.1 Select the required circuit.
 - 7.2 Select the components, board, meter and materials.
 - 7.3 Connect the components as per diagram.
 - 7.4 Collect the required data for various frequencies.
 - 7.5 Calculate the attenuations by collected data.
 - 7.6 Plot the graph.

8. Measure the velocity of propagation through a parallel wire transmission line.

- 8.1 Select a parallel wire transmission line.
- 8.2 Select the required equipment and tools.
- 8.3 Use a proper reactance meter to measure the inductance and capacitance per mile.
- 8.4 Use the formula $V = \frac{1}{\sqrt{LC}}$ to measure the inductance and capacitance per loss less line.
- 8.5 Add the correction factor due to loss.

9. Measure the characteristic impedance of a transmission line.

- 9.1 Select a transmission line.
- 9.2 Select the required equipment, tools and materials.
- 9.3 Connect the meter to measure required line constant.
- 9.4 Calculate the characteristic impedance from line constants.

10. Design and verify the impedance matching of transmission line with a quarter wave transformer.

- 10.1 Select a transmission line with given R_i and Z_0 .
- 10.2 Select required equipment and tools for verification.
- 10.3 Design the quarter wave transformer using formula $Z_0 = \sqrt{Z_{in} Z_L}$
- 10.4 Connect the quarter wave transformer between load and transmission line.
- 10.5 Observe the matching with the energy transmission.

11. Determine the radiation pattern of dipole antenna.

- 11.1 Select a source (test antenna), receiver, indicator, power supply, mounting frame.
- 11.2 Select the required equipment and tools.
- 11.3 Connect the radiator dipole with the power supply and receiver to the indicator.
- 11.4 Place the source and radiator in the flexible mounting frame.
- 11.5 Energize the system.
- 11.6 Rotate the receiver at constant radius around the source.
- 11.7 Record the power received by the indicator.
- 11.8 Plot the output versus angular location curve.
- 11.9 Find the radiation pattern.

12. Construct a yagi antenna.

- 12.1 Select the folded dipole, director and reflector of the antenna.
- 12.2 Select the required equipment, tools and materials.
- 12.3 Build up the antenna element with proper design data.
- 12.4 Connect the antenna with transmission line to the TV receiver.
- 12.5 Observe the receiver output.

REFERENCE BOOKS

- 1 Network, Filters and Transmission Lines - P. K. Jain.
- 2 Electronics and Radio Engineering - M. L. Gupta.
- 3 Network, Filters and Transmission Lines - A. K. Chakarvorty.
- 4. Network Theory and Filter Design - Vasudev K. Aatre.

AIMS

- Able to learn about safety Rules & Regulations related to servicing of electronic goods.
- Able to select tools, measuring and testing instruments in servicing of electronic goods.
- Able to trace layout diagram of faulty sections in PCB.
- Able to test the active & passive faulty components.
- Able to De-soldering of components/devices from PCB of a Radio Receiver and then solder.
- Able to Find out the fault & Service of PSU/SMPS, Home alliance devices such as microwave oven, Induction cooker, Rice cooker, IPS, UPS, Mobile charger, Emergency Light, Power saving lamps, etc.
- Able to Find out the fault & Service of office appliance such as Public Addressing system, FAX & Modem, etc.
- Able to find out the fault & Service of Industrial appliance such as Digital balance/weight balance, Card reader, Infrared detector, etc.

SHORT DESCRIPTION

Identify and Test of active & passive components/devices of electronic circuits in PCB/Mother board/Card unit/Instruments. Servicing of PSU/SMPS, microwave oven, Induction cooker, Rice cooker, IPS, UPS, Mobile charger, Emergency Light, Power saving lamps, Public Addressing system, FAX & Modem, Digital balance/weight balance, Card reader, Infrared detector.

DETAIL DESCRIPTION

- 1. Learn about safety rules & Regulations and Select the tools, measuring & testing instruments for servicing.**
 - 1.1. List the safety Rules.
 - 1.2. List the workshop safety regulations.
 - 1.3. Learn about Electrical & Electronics equipment safety policy.
 - 1.4. Collect tools, testing & measuring Instruments.
 - 1.5. Identify tools, testing & measuring Instruments for desire servicing.
 - 1.6. Practice the use of above tools, testing & measuring Instruments.
- 2. Show skills to Trace the Printed circuit board**
 - 2.1. Select a printed circuit board.
 - 2.2. Locate the major components in PCB.
 - 2.3. Trace out interconnection of among major components.
 - 2.4. Draw the layout diagram.
 - 2.5. Develop the schematic circuit diagram.
- 3. Show skills to test the active and passive components (Diode, transistor, SCR, Diac, Triac, FET, Transformer, Resistor, Capacitor, Inductor, etc).**
 - 3.1. Collect active and passive components.
 - 3.2. Select the testing and measuring equipments.
 - 3.3. Check the components.
 - 3.4. Identify faulty components/devices.
- 4. Show skills on De-soldering major components & than Soldering to the PCB**
 - 4.1. Extract the PCB/Mother board from a selected Circuit.
 - 4.2. Identify the major components such as diode, power transformer, filter capacitor, Transistors, etc.
 - 4.3. De-solder the components/devices from the PCB.
 - 4.4. Re-solder the components to the PCB.
 - 4.5. Set the PCB to the cabinet box.

- 5. Perform the Servicing of a Power supply Unit & SMPS.**
 - 5.1. Apply a visual check.
 - 5.2. Apply an off line check.
 - 5.3. Identify the symptoms.
 - 5.4. Apply a power check.
 - 5.5. Identify the faulty components.
 - 5.6. Replace the faulty components.
 - 5.7. Test the power supply unit & SMPS.
- 6. Show skills on Servicing of IPS & UPS.**
 - 6.1. Apply an off line check.
 - 6.2. Apply a power check
 - 6.3. Observe and record the symptoms.
 - 6.4. Write down the possible causes for the symptoms.
 - 6.5. Locate the faulty section.
 - 6.6. Measure and test the faulty components.
 - 6.7. Replace the damage components.
 - 6.8. Restart the IPS & UPS.
- 7. Perform the Servicing of Emergency Light, Power saving lamps & Mobile charger.**
 - 7.1. Apply an off line check.
 - 7.2. Apply a power check.
 - 7.3. Identify the symptoms.
 - 7.4. Write down the possible causes for the symptoms.
 - 7.5. Identify the faulty components.
 - 7.6. Measure and test the faulty components.
 - 7.7. Replace the faulty components.
 - 7.8. Test the selected device.
- 8. Perform the Servicing of Microwave oven, Induction cooker, Rice cooker.**
 - 8.1. Apply an off line check.
 - 8.2. Apply a power check.
 - 8.3. Observe and record the symptoms.
 - 8.4. Write down the possible causes for the symptoms.
 - 8.5. Locate the faulty section.
 - 8.6. Check & test the possible causes one by one
 - 8.7. Measure and test the faulty components.
 - 8.8. Replace the damage components.
 - 8.9. Restart the Device.
- 9. Show skills on Servicing of a Public Addressing system.**
 - 9.1. Apply an off line check.
 - 9.2. Apply a power check.
 - 9.3. Observe and record the symptoms.
 - 9.4. Apply signal-tracing technique to identify the fault of a single circuit.
 - 9.5. Identify the faulty components.
 - 9.6. Replace the faulty components.
 - 9.7. Test the Public Addressing system.
- 10. Perform the Servicing of a Multimedia Projector.**
 - 10.1. Apply an off line check.
 - 10.2. Apply a power check.
 - 10.3. Observe and record the symptoms.

- 10.4. Check & test the possible causes one by one.
- 10.5. Apply signal-tracing technique to identify the fault of a single circuit.
- 10.6. Locate the faulty section.
- 10.7. Measure and test the faulty components.
- 10.8. Replace the damage components.
- 10.9. Restart the multimedia projector.
- 10.10. Observe the performance of the multimedia projector.

11. Show skills on Servicing of Digital balance/weight scale.

- 11.1. Apply an off line check.
- 11.2. Apply a power check.
- 11.3. Observe and record the symptoms.
- 11.4. Check and test the possible causes one by one.
- 11.5. Locate the faulty section.
- 11.6. Measure and test the faulty components.
- 11.7. Replace the damage components.
- 11.8. Observe the performance of Digital balance/weight scale.

12. Perform the Servicing of Card reader & Infrared detector

- 12.1. Apply an off line check.
- 12.2. Apply a power check.
- 12.3. Observe and record the symptoms.
- 12.4. Locate the faulty section.
- 12.5. Check or test the possible causes one by one.
- 12.6. Measure and test the faulty components.
- 12.7. Replace the damage components.
- 12.8. Observe the performance of Card reader & Infrared detector.

Reference Repair & Service Manuals

1. How to be a successful Electronic Repair By Jestine Yong.
2. Electronic Repair guide,com
3. A shorted Microwave Oven Repaired Model Universal Uni-2040.
4. Repairing Guides by Kent.
5. Sumsung SMPS case History.

OBJECTIVES

- To develop knowledge and skill on programming Basics.
- To develop knowledge and skill to create, compile, debug & execute a program.

SHORT DESCRIPTION

Basics of programming Language; Basics of Python; Variables; Data types; Strings; Operators; Decision making and Looping statements; Lists; Tuples; Functions; File operations;

DETAIL DESCRIPTION**Theory:****1. Basics of Programming.**

- 1.1. State Computer Program and Programming.
- 1.2. Explain Programming Language and its classification.
- 1.3. State Generation of Programming Languages.
- 1.4. Describe Translator Program.
- 1.5. Uses of Computer Programs.
- 1.6. Describe Algorithm and Flowchart.
- 1.7. Prepare Algorithm and Flowchart for simple problems.
- 1.8. Explain the Process of Program Planning.

2. Basics of Python.

- 2.1. Describe the History of Python.
- 2.2. Explain the features of Python.
- 2.3. Describe the Structure of Python Program.
- 2.4. State Identifiers and Keywords.
- 2.5. State Lines, Indentation, Multi-Line Statements and Multiple Statements on a Single Line.
- 2.6. State Quotation and Comments in Python.
- 2.7. State Command Line Arguments.

3. Variable and Data Types.

- 3.1. Assigning Values to Variables.
- 3.2. State Multiple Assignments.
- 3.3. Describe Standard Data Types.
- 3.4. Explain Data Type Conversion.

4. STRINGS.

- 4.1. State Accessing Values in Strings and Updating Strings.
- 4.2. Uses of Escape Characters.
- 4.3. Explain String Special Operators and String Formatting Operator.
- 4.4. Describe Triple Quotes and Unicode String.
- 4.5. Write Simple programs using strings.

5. PYTHON OPERATORS.

- 5.1. State Operators and their types.
- 5.2. Describe Arithmetic Operators, Comparison Operators and Logical Operators.
- 5.3. State Assignment Operators, Bitwise Operators and Membership Operators Identity Operators.
- 5.4. Explain Operators Precedence.

6. DECISION MAKING.

- 6.1. Describe the conditional and unconditional branching flow.
- 6.2. Explain If Statement and If...else Statement.
- 6.3. State the nested if Statement.
- 6.4. Write simple program using if, if...else and nested if.

7. LOOPS.

- 7.1. Describe the conditional and unconditional Looping flow.
- 7.2. State For Loop.
- 7.3. State While Loop.
- 7.4. Explain The Infinite Loop and Nested Loops.
- 7.5. State Break, Continue and pass Statement.
- 7.6. Write simple program using for and while loop.

8. LISTS

- 8.1. Define Lists and its type.
- 8.2. Assigning Values in Lists.
- 8.3. Explain Updating and Deleting List Elements.
- 8.4. State Basic List Operations.
- 8.5. Explain Built-in List Functions and Methods.
- 8.6. Write simple program using Lists.

9. TUPLES

- 9.1. Assigning Values in Tuples.
- 9.2. Explain Updating and Deleting Tuple Elements.
- 9.3. Describe Basic Tuples Operations.
- 9.4. State No Enclosing Delimiters.
- 9.5. Explain Built-in Tuple Functions.
- 9.6. Write simple program using Tuples.

10. FUNCTIONS

- 10.1. Defining a Function.
- 10.2. State Calling a Function.
- 10.3. Explain Passing by Reference Versus Passing by Value.
- 10.4. Describe Function Arguments.
- 10.5. Uses of Date and Time Functions.
- 10.6. Write simple program using functions.

11. FILES I/O

- 11.1. Printing to the Screen.
- 11.2. Reading Keyboard Input.
- 11.3. Uses of input Function.
- 11.4. Describe Opening and Closing Files.
- 11.5. Explain Reading and Writing Files.

PRACTICAL:

Perform skill to create, compile, debug & execute programs to solve specific problems.

1. Simple programs using basic structure of a programming Language (Python).

- 1.1. A program for printing a message.
- 1.2. A program for adding two integer numbers.

2. Simple programs using variables

- 2.1. A program to calculate the average of a set of N numbers.
- 2.2. A program to convert the given temperature in Fahrenheit to Celsius and vice versa.
- 2.3. A program to calculate the area of a circle.
- 2.4. Write similar programs using variables.

3. Programs using operators

- 3.1. A program to convert days to months and days.
- 3.2. A program to calculate the area of a triangle.
- 3.3. A program to compare two integer numbers.
- 3.4. Write similar programs using operators.

4. Programs using Branching Statements.

- 4.1. A program to select and print the largest of the three numbers.
- 4.2. A program to compute the roots of a quadratic equation.
- 4.3. Write similar programs using Branching Statements.

5. Programs using Looping Statements

- 5.1. A program to print odd or even numbers from 1 to 100.
- 5.2. A program to find the maximum or minimum number from a set of numbers
- 5.3. A program for searching prime numbers.
- 5.4. Write similar programs using Loop Statements.

6. Programs using Lists.

- 6.1. A program to sort numbers in ascending or descending order using one dimensional array.
- 6.2. A program to print numbers in two dimensional forms.
- 6.3. Write similar programs using Lists.

7. Programs using functions.

- 7.1. A program to calculate the area of a triangle using function.
- 7.2. A program that uses a function to sort an array of integers.
- 7.3. A program to calculate factorial of any integer using recursive function.
- 7.4. Write similar programs using functions.

8. Programs using files.

- 8.1. A program to store information to or to read information from file.
- 8.2. Write similar programs using files.

REFERENCE BOOKS:

1. Learning Python – Mark Lutz
2. Website List:
 - [http:// python.howtocode.com.bd](http://python.howtocode.com.bd)
 - [http:// www.learnpython.org](http://www.learnpython.org)
 - <http://pythontutor.com>

AIMS:

- To be able to understand the basic concepts and principles of business organization.
- To be able to understand the banking system.
- To be able to understand the trade system of Bangladesh.
- To be able to understand the basic concepts of communication and its types, methods.
- To be able to perform in writing, application for job, complain letter & tender notice.

SHORT DESCRIPTION:

Principles and objects of business organization; Formation of business organization; Banking system and its operation; Negotiable instrument; Home trade and foreign trade. Basic concepts of communication Communication model & feedback; Types of communication; Methods of communication; Formal & informal communication; Essentials of communication; Report writing; Office management; Communication through correspondence; Official and semi- official letters.

DETAIL DESCRIPTION:**Theory:****1. Concept of Business organization.**

- 1.1 Define business.
- 1.2 Mention the objects of business.
- 1.3 Define business organization.
- 1.4 State the function of business organization.

2. Formation of Business organization.

- 2.1 Define sole proprietorship, partnership, Joint Stock Company. and co-operative
- 2.2 Describe the formation of sole proprietorship, partnership, joint stock Company, & co operative.
- 2.3 Mention the advantages and disadvantages of proprietorship, partnership and Joint Stock Company.
- 2.4 State the principles of Co operative & various types of Co operative.
- 2.5 Discuss the role of co-operative society in Bangladesh.

3. Basic idea of Banking system and negotiable instrument.

- 3.1 Define bank.
- 3.2 State the service rendered by bank.
- 3.3 Describe the classification of bank in Bangladesh.
- 3.4 State the functions of Bangladesh Bank in controlling money market.
- 3.5 State the functions of commercial Bank in Bangladesh
- 3.6 Mention different types of account operated in a bank.
- 3.7 Mention how different types of bank accounts are opened and operated.
- 3.8 Define negotiable instrument.
- 3.9 Discuss various types of negotiable instrument.
- 3.10 Describe different types of cheque.

4. Home & foreign trade

- 4.1 Define home trade.
- 4.2 Describe types of home trade.
- 4.3 Define foreign trade.
- 4.4 Mention the advantages and disadvantages of foreign trade.
- 4.5 Discuss the import procedure & exporting procedure.
- 4.6 Define letter of credit.
- 4.7 Discuss the importance of foreign trade in the economy of Bangladesh.

5. Basic concepts of communication

- 5.1 Define communication & business communication.
- 5.2 State the objectives of business communication.
- 5.3 Describe the scope of business communication.
- 5.4 Discuss the essential elements of communication process.

6. Communication model and feedback.

- 6.1 Define communication model.
- 6.2 State the business functions of communication model.
- 6.3 Define feedback.
- 6.4 State the basic principles of effective feedback.

7. Types and Methods of communication.

- 7.1 Explain the different types of communication;-
 - a) Two-way communication
 - b) Formal & informal communication
 - c) Oral & written communication
 - d) Horizontal & vertical communication
 - e) external & internal communication
 - f) Spoken & listening communication.
- 7.2 Define communication method.
- 7.3 Discuss the various methods of communication.
- 7.4 Distinguish between oral and written communication.

8. Essentials of communication.

- 8.1 Discuss the essential feature of good communication.
- 8.2 Describe the barriers of communication.
- 8.3 Discuss the means for overcoming barriers to good communication.

9. Report writing.

- 9.1 Define report, business report & technical report.
- 9.2 State the essential qualities of a good report.
- 9.3 Describe the factors to be considered while drafting a report.
- 9.4 Explain the components of a technical report.
- 9.5 Prepare & present a technical report.

10. Office management.

- 10.1 Define office and office work.
- 10.2 State the characteristics of office work.
- 10.3 Define filing and indexing.

- 10.4 Discuss the methods of filing.
- 10.5 Discuss the methods of indexing.
- 10.6 Distinguish between filing and indexing.

11. Official and semi-official letters.

- 11.1 State the types of correspondence.
- 11.2 State the different parts of a commercial letter.
- 11.3 Define official letter and semi-official letter.
- 11.4 Prepare & present the following letters: Interview letter, appointment letter, joining letter and application for recruitment. Complain letters, tender notice.

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