



BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

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

ELECTRICAL TECHNOLOGY

TECHNOLOGY CODE: **667**

4th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

ELECTRICAL TECHNOLOGY (667)

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	66741	Electrical Installation Planning & Estimating	3	3	4	60	90	25	25	200
2	66742	DC Machines	3	3	4	60	90	25	25	200
3	66845	Industrial Electronics	2	3	3	40	60	25	25	150
4	67045	Applied Mechanics	2	3	3	40	60	25	25	150
5	66631	Programming Essentials	2	3	3	40	60	25	25	150
6	65841	Business organization & Communication	2	0	2	40	60	0	0	100
Total			14	15	19	280	420	125	125	950

OBJECTIVES

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of planning and estimating of electrical installation with special emphasis on:

- Planning and preparation of estimate for an electrical installation.
- Internal wiring and service connection.
- Installation of electrical machines.
- Electricity act / rules and safety practices.

SHORT DESCRIPTION

Planning and estimating; Measurement book, price sheet, catalogue and schedule of labor rate; Illumination; Conductor size and current carrying capacity; Electricity Acts/Rules; Electrical codes; Internal wiring installation; Distribution line; Installation and winding of electrical machine/equipment; Testing electrical installation.

DETAIL DESCRIPTION

Theory:

1. Understand the concepts of electrical installation.

- 1.1 Explain electrical installation.
- 1.2 List the main types of electrical installations.
- 1.3 Define indoor and outdoor electrical installation.
- 1.4 Distinguish between indoor and outdoor electrical installation.

2. Understand the concept of planning of an electrical installation.

- 2.1 Define the term planning of an electrical installation.
- 2.2 Explain the necessity of planning of an electrical installation.
- 2.3 List the main categories of planning of an electrical installation.
- 2.4 List the factors to be considered for proper planning.
- 2.5 Calculate the electrical load of residential building, college building, student hostel an office building and 20 stored building.

3. Understand the concept of estimating of an electrical installation.

- 3.1 Discuss estimating of an installation.
- 3.2 Explain the necessity of estimating.
- 3.3 List the important steps for costing of an installation.
- 3.4 List the steps to be considered for preparing an estimate.

4. Understand MB writing, Price sheet and Schedule of labor rates.

- 4.1 Describe MB.
- 4.2 Explain the necessity of MB.
- 4.3 Identify the style of maintaining an MB.
- 4.4 Identify proper specifications for the required materials form catalogue.
- 4.5 Describe price sheet and schedule of labor rates.
- 4.6 Explain the necessity of price sheet and labor rates for an estimate.
- 4.7 Prepare a price sheet and a labor rate schedule.

5. Understand the concept of illumination.

- 5.1 Define illumination.
- 5.2 Define the terms Solid angle, Candela, Luminous flux, Luminous intensity, MSCP, MHSCP and different related factors
- 5.3 Explain the laws of illumination.
- 5.4 Calculate illumination required for different purposes.
- 5.5 Prepare a chart of illumination for different lamp system (including CFL, Incandescent, Florescent)
- 5.6 Solve problems related to illumination.

6. Understand the concept of lighting scheme.

- 6.1 Discuss direct lighting, indirect lighting, semi-direct and semi-indirect lighting.
- 6.2 Discuss the level of illumination required for different purposes.
- 6.3 Discuss the factors to be considered for designing a lighting scheme.
- 6.4 Design a lighting scheme.

7. Understand the principle of calculating current carrying capacity and determining the conductor size.

- 7.1 Describe the factors to be considered for determining the conductor size.
- 7.2 Calculate the current carrying capacity of a given circuit and the sub circuits.
- 7.3 Calculate Voltage and Voltage drop of conductor
- 7.4 Find the conductor size from the table.
- 7.5 Explain the meaning and utility of RM, RE and SWG.

8. Understand the electricity Act/Rules and utility of electrical codes.

- 8.1 List the main electricity rules of Bangladesh Electricity Act.
- 8.2 Describe the importance of electricity act/rules.
- 8.3 Explain the need for maintaining safety procedure against electrical hazards.
- 8.4 Explain the safety measures.
- 8.5 List the electrical codes of Bangladesh National Building Code (BNBC) and International Building code.
- 8.6 Explain different electrical codes of National Building Code and International Building code
- 8.7 State the advantages of using the electrical codes.

9. Understand the installation of internal wiring.

- 9.1 Explain internal wiring installation.
- 9.2 Describe the main types of internal wiring.
- 9.3 Prepare schedule of materials for channel, surface conduit, and concealed conduit wiring.
- 9.4 Sketch the layout plan for channel, surface conduit, and concealed conduit of small building.
- 9.5 Calculate the load of main circuit and sub circuits.
- 9.6 Select the sizes of wire, main switch, sub-main switches and switches.
- 9.7 Prepare a detail estimate for necessary materials and labor of installation of internal wiring.
- 9.8 Prepare a summary of the estimate.
- 9.9 Prepare an estimate by point method.

10. Understand the Service main.

- 10.1 Explain service main.
- 10.2 Prepare a schedule of materials for single phase service main
- 10.3 Prepare a schedule of materials for 3-phase service main.
- 10.4 Sketch the layout of 1-phase service connection required energy meter, DB & SDB
- 10.5 Sketch the layout of 3-phase service connection required energy meter, DB & SDB
- 10.6 Prepare a detail estimate for materials & Labor of 1-phase service connection.
- 10.7 Prepare a detail estimate for materials & Labor of 3-phase service connection

11. Understand the concept of earthing.

- 11.1 Describe earthing.
- 11.2 Explain the necessity of earthing.
- 11.3 Explain the methods of earthing for Single to 20-stored building.
- 11.4 Prepare an estimate for earthing for Single to 20-stored building
- 11.5 Explain the method of testing of an earthing installation.
- 11.6 List the desired value of earth resistance for different installations.

12. Understand wiring layout and schematic diagram of an electrical installation.

- 12.1 Sketch the layout plan for casing wiring of a small workshop showing lighting loads.
- 12.2 Sketch the layout plan for conduit wiring of a small workshop showing lighting loads.
- 12.3 Sketch the layout plan of casing wiring of the same workshop showing power loads.
- 12.4 Sketch the layout plan of conduit wiring of the same workshop showing power loads.

- 12.5 Sketch the layout plan for earth connection.
- 12.6 Calculate power loads and lighting loads respectively of main circuit and sub-circuits
- 12.7 Select the sizes of wire, main switch, sub-main switches, switches and distribution boards to lighting and power line respectively.
- 12.8 Prepare an estimate for the required materials and labour from the schedule.
- 12.9 Prepare an estimate for earth connections and earthing.
- 12.10 Prepare a summary of the estimate.

13. Understand the estimate of LT overhead distribution line.

- 13.1 Sketch the layout plan of a 400V, 3-phase, 4-wire overhead distribution line with street poles, conductors, insulators and other accessories.
- 13.2 Prepare a schedule of materials required for overhead line.
- 13.3 Prepare an estimate for required materials for one kilometer long overhead LT distribution line with the 5th wire for street lighting.
- 13.4 Prepare a schedule of labor for overhead LT distribution line.
- 13.5 Prepare an estimate for overhead LT distribution line.
- 13.6 Prepare a summary of the estimate

14. Understand the principle of installation of electrical machine and equipment.

- 14.1 Sketch the layout plan and single line wiring diagram of a motor connection
- 14.2 Identify the position of motor, main switch, starter and accessories in the diagram.
- 14.3 Calculate the distance of the motor, main switch and starter from the mains.
- 14.4 Determine the sizes of wire, main switch and starter for the installation.
- 14.5 Prepare the material cost.
- 14.6 Estimate labor charge.
- 14.7 Prepare the estimate adding contingencies.

15. Understand the principle of testing of electrical installation.

- 15.1 Describe the tests to be carried out after completion of wiring of a building.
- 15.2 Describe the tests to be performed after installation of a motor.
- 15.3 Describe the tests to be performed after installation of a transformer.
- 15.4 Sketch the developed diagrams of full pitch and fractional pitch winding of a three-phase induction motor.
- 15.5 Sketch the developed winding diagram of a single phase induction motor.
- 15.6 Estimate the required materials and costs for rewinding of a burnt out induction motor.
- 15.7 Describe the methods of testing winding of electrical machine.

PRACTICAL:

1. Measure the illumination level of a surface.

- 1.1 Select the lumen meter.
- 1.2 Measure the illumination level in your wiring lab/ class room.
- 1.3 Compare the obtained reading with the calculated value.

2. Plan and estimate for electrification of a class room.

- 2.1 Sketch the layout plan and single line wiring diagram of a class room.
- 2.2 Sketch the wiring and circuit diagram.
- 2.3 Indicate the positions of electrical fittings in the plan.
- 2.4 Find out the sizes of wire and main switch from the calculated load of main circuit and sub-circuits following electricity rules.
- 2.5 Measure the distances of fittings from the main board & BDB and find out the length of the wire.
- 2.6 List the materials in the schedule and find out the cost.
- 2.7 Add labor charges from the schedule with material cost for the summary of estimate.

3. Plan and estimate for electrification of a single storied residential building.

- 3.1 Sketch the layout plan of a single storied residential building of about 1250 square feet plinth area in a five decimal land with boundary wall and gate showing the position of electric pole for service connection.
- 3.2 Sketch the wiring and circuit diagrams and show the service connection.
- 3.3 Show the positions of electrical fittings in the plan.
- 3.4 Find out the size of wire, main switch, BDB, fuse or MCB from the calculated load of circuit and sub circuit.
- 3.5 Measure the distance of the fittings from the board to find out the length of wires.
- 3.6 List the materials in the schedule of materials and find out the cost.
- 3.7 Add labor charge from the schedule with the material cost for the summary of the estimate.

4. Plan and estimate for electrification of a multistoried building.

- 4.1 Sketch the elevation and floor plan of the building.
- 4.2 Sketch the wiring and circuit diagrams of a flat.
- 4.3 Show the positions of the fittings in a flat.
- 4.4 Find out the size of wires, main switch, fuse or MCB.
- 4.5 Measure the distance of the fittings from the board to find out the length of wire.
- 4.6 Identify the rising main and power distribution system.
- 4.7 Prepare the estimate for electrification of the building.

5. Plan and estimate for electrification of an electrical machine shop.

- 5.1 Sketch the layout plan and single line wiring diagram of the shop.
- 5.2 Sketch the wiring and circuit diagrams.
- 5.3 Indicate the positions of the fittings in the plan.
- 5.4 Find out the size of wires, main switch, fuse or MCB.
- 5.5 Measure the distance of the fittings from the board to find out the length of wire.
- 5.6 List the materials in the schedule of materials and find out the cost.
- 5.7 Add labor charge with the cost of material for the summary of estimate.

6. Perform Channel wiring.

- 6.1 Sketch the layout plan.
- 6.2 Sketch the wiring and circuit diagrams.
- 6.3 Indicate the positions of the fittings.
- 6.4 Find out the size of wire, main switch, fuse/MCB.
- 6.5 Measure the distance of the fittings from the main switch.
- 6.6 Estimate the cost including labour charges.
- 6.7 Mark the position of the fittings.
- 6.8 Fix up the rowel plugs on the wall.
- 6.9 Fix up boards and casing on wall.
- 6.10 Fasten wires.
- 6.11 Fix up switches and outlets.
- 6.12 Fix up the energy meter, cut-out MCB and main switch.
- 6.13 Connect power supply.

7. Determine cable size from cable catalogue.

- 7.1 Calculate the load of main circuits and sub-circuits of different installations.
- 7.2 Find out the corresponding suitable cable size from the catalogue allowing safety factor.
- 7.3 Find out the size of the cables by using SWG
- 7.4 Find out the size of the cables in respect of RM & RE

8. Install a single phase/three phase service connection.

- 8.1 Sketch the layout plan showing single line service connection from the nearest pole to the service entrance of the building.
- 8.2 Determine the total electrical load of the installation.
- 8.3 Measure the distance from the meter at premises to the nearest electric pole.

- 8.4 Prepare the material cost.
- 8.5 Add labor charges.
- 8.6 Add contingencies
- 8.7 Add lump sum for petty stores like cement, bricks and sand etc.
- 8.8 Prepare the summary of estimate.
- 8.9 Procure the materials and hand tools.
- 8.10 Fix up brackets, service pipe and insulators.
- 8.11 Draw two GI guard wires with carlings (use draw vice).
- 8.12 Draw the single core PVC wires through the pipe up to the meter inside the premises.
- 8.13 Connect one aerial fuse with the phase.

9. Perform the installation of three phase induction motor.

- 9.1 Sketch the layout plan and single line wiring diagram of the motor connection.
- 9.2 Indicate the position of the motor, main switch and starter.
- 9.3 Measure the distance of the motor, starter and main switch from the supply main.
- 9.4 Find out the sizes of wires, main switch and starter.
- 9.5 Prepare the material cost.
- 9.6 Add labor charges with the cost of materials for the summary estimate.
- 9.7 Add contingencies.
- 9.8 Following electricity rules connect the mains and operate the motor.
- 9.9 Install the components and connect to the power source and observe the performance.

10. Re-wind of a single phase induction motor

- 10.1 Calculate the size of conductor, number of coils and number of turns in a coil.
- 10.2 Sketch the developed winding diagram of the induction motor.
- 10.3 Make necessary grouping on the basis of the layout plan for winding.
- 10.4 Find out the types and sizes of wire required for the winding.
- 10.5 Determine the number of turns required on the basis of the coil grouping per phase and layer of winding.
- 10.6 Estimate the cost involved to rewind the motor.
- 10.7 Collect required tools and materials to rewind the motor.
- 10.8 Rewind the motor.
- 10.9 Energize the motor after performing necessary tests.
- 10.10 Measure the RPM of the motor.

11. Re-wind a three phase induction motor.

- 11.1 Calculate the number of coils, size of conductor and number of turns in a coil of the motor.
- 11.2 Sketch the developed diagram for winding of the induction motor.
- 11.3 Make necessary grouping of coils.
- 11.4 Find out the types and sizes of wire required for the windings.
- 11.5 Determine the number of turns required on the basis of the coil grouping per phase and layer of winding.
- 11.6 Estimate the cost involved to rewind the motor.
- 11.7 Collect required tools and materials to rewind the motor.
- 11.8 Rewind the motor performing all the steps sequentially.
- 11.9 Energize the motor after performing necessary tests.
- 11.10 Measure the RPM of the motor.

12. Perform Installation of an earthing.

- 12.1 Select earth electrode, earth continuity conductor & other necessary materials.
- 12.2 Place the earth electrode into the ground after digging hole.
- 12.3 Put coal & salt into the hole.
- 12.4 Take out the continuity conductor from the earth electrode.

13. Prepare plan and estimate of a short distribution line.

- 13.1 Take the measurements of the route of the proposed distribution line.
- 13.2 Sketch the route showing substation, pole and consumer.
- 13.3 Prepare estimate.

14. Test an electrical installation (machine/equipment) before commissioning.

- 14.1 Select the machine/equipment to be tested.
- 14.2 Test continuity of the winding of the machine/equipment by AVO meter.
- 14.3 Test the insulation resistance within the coils by Megger.
- 14.4 Test the insulation resistance with the coils and body of the machine/equipment by Megger.
- 14.5 Measure the resistance of the earth point which will be connected to the body of the machine/equipment.

REFERENCE BOOKS:

- 1. Electrical Installation Planning & Estimating – J. B. Gupta.
- 2. Electrical Installing Planning and Costing – Uppal.
- 3. National Building Code.
- 4. PWD Rate Schedule.

OBJECTIVES:

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

- Promote knowledge and skill on Cell & Battery and the process of electroplating.
- Provide understanding on DC generator.
- Develop knowledge and skill on DC motor.
- Maintain knowledge on characteristics of DC generator.
- Develop knowledge on electric traction.

SHORT DESCRIPTION

Cell and Battery: Principle, construction, uses and maintenance; Electroplating; DC Generator: Principle, construction, winding, losses, efficiency, characteristics and parallel operation; DC Motor: Principle, construction, torque/speed curves, efficiency, speed control, starting and tests; Electric traction.

DETAIL DESCRIPTION**Theory:****1. Understand the construction of different types of cell and battery.**

- 1.1 Describe the construction of dry cell and its chemical reaction.
- 1.2 Illustrate the construction of alkaline batteries.
- 1.3 Describe the construction of lead acid battery and its chemical reaction.

2. Understand the features of battery charging.

- 2.1 Name the types of battery charging system.
- 2.2 Describe the charging procedure of battery by 220-230VAC source.
- 2.3 Explain the procedure of slow charging.
- 2.4 Describe the procedure of quick charging.
- 2.5 Describe the procedure of preparing electrolyte.
- 2.6 Outline the construction of dry charged battery.
- 2.7 Explain the charging procedure of sulfated battery.
- 2.8 Describe the process of charging more than one battery at a time.

3. Understand the efficiency and testing of batteries.

- 3.1 Describe the internal resistance and efficiency of a battery.
- 3.2 Explain ampere – hour (A - H) rating of battery.
- 3.3 Solve problems related with internal resistance affecting terminal voltage.
- 3.4 List factors on which the capacity of a battery depends.
- 3.5 Describe the procedures of testing a storage battery by hydrometer, voltmeter and ammeter.
- 3.6 State the maintenance and routine inspection procedure of a battery.

4. Understand the process of electroplating.

- 4.1 State fundamental principles of electroplating.
- 4.2 State Faraday's laws of electrolysis.
- 4.3 Describe briefly the process of extraction and refining of metals.
- 4.4 State a simple method of producing copper plating upon a carbon brush.
- 4.5 Describe electro-deposition process.
- 4.6 Identify power supply for electrolytic process adopted in electroplating.

5. Understand the working principle of DC generator.

- 5.1 State generator principle.

- 5.2 Mention the types or Classification of DC generator.
- 5.3 Mention the conditions for generation of emf in a single coil generator.
- 5.4 Describe the constructional details of a DC generator.
- 5.5 Explain the functions of different parts/components of a DC generator.
- 5.6 Sketch the magnetic circuit of a DC generator.
- 5.7 Express the deduction of the emf equation of a DC generator.
- 5.8 List the various losses in a DC generator.
- 5.9 Explain power stages of a DC generator.
- 5.10 Express the condition for maximum efficiency.
- 5.11 Solve problems relating to DC generator.
- 6. Understand the principle of winding of DC generator.**
- 6.1 Define the terms pole pitch, coil pitch, front pitch, back pitch, average pitch and commutation pitch.
- 6.2 Describe lap and wave winding.
- 6.3 Sketch the developed diagram of simplex and duplex (lap and wave) winding.
- 6.4 Name at least four major differences between the lap and wave windings.
- 7. Understand the armature reaction and commutation of DC generator.**
- 7.1 Explain armature reaction.
- 7.2 Describe the effect of armature reaction.
- 7.3 State de-magnetizing and cross magnetizing.
- 7.4 Explain the action of commutation.
- 7.5 Identify the value of reactance voltage.
- 7.6 Mention the methods of improving commutation.
- 7.7 Explain the necessity of interpoles and compensating winding.
- 7.8 State the need for equalizing bar and rings.
- 8. Understand the principle of excitation.**
- 8.1 Explain the excitation of DC generator.
- 8.2 Explain the necessity of excitation.
- 8.3 Mention self excited and separately excited generator.
- 8.4 Describe the condition for excitation.
- 9. Understand the characteristics of DC generator.**
- 9.1 Explain the process of building up voltage of shunt generator.
- 9.2 State the critical resistance and critical speed for shunt generator.
- 9.3 Plot the terminal voltage Vs load current characteristic curve of shunt generator.
- 9.4 State the reasons for decreasing terminal voltage with increasing load.
- 9.5 Plot the internal and external characteristic curve of DC shunt, series and compound generator.
- 9.6 Solve related problems relating to shunt generator
- 10. Understand the concept of voltage regulation and efficiency of a DC generator.**
- 10.1 Explain the formula for voltage regulation of a DC generator.
- 10.2 Discuss the importance of voltage regulation of DC generator.
- 10.3 Solve problems relating to voltage regulation of DC generator.
- 10.4 Express the formula for efficiency of a DC generator.
- 10.5 Solve problems relating to efficiency of a DC generator.
- 11. Understand the principle of parallel operation of DC generator.**
- 11.1 State the need for parallel operation of DC generator (shunt, series and compound)
- 11.2 List the conditions for parallel operation of DC generator.
- 11.3 Discuss the condition of sharing loads in DC generators operating in parallel.
- 11.4 Draw the circuit diagram of two long shunt compound generators connected in parallel.
- 11.5 Calculate the load shared by individual machine at the time of parallel operation.
- 12. Understand the working principle of DC motor.**
- 12.1 Explain the working principle of DC motor.
- 12.2 Mention the types or Classification of DC Motor.

- 12.3 Explain generator action of motor.
- 12.4 Explain the significance of the back emf.
- 12.5 Express the deduction of voltage equation of motor.
- 12.6 Define the term torque (mentioning its unit), running torque and break down torque.
- 12.7 Express the deduction of equation for speed of DC motor (for series and shunt motors).
- 12.8 Plot the torque/speed curve of series, shunt and compound motors.

13. Understand losses and efficiency.

- 13.1 State the losses in DC motor.
- 13.2 Calculate the efficiency of DC motor from a given data.
- 13.3 Explain the power stages of DC motor.

14. Understand the starting methods and speed control of DC motor.

- 14.1 Describe the factors controlling the speed of DC motor.
- 14.2 Discuss the general methods of speed control of DC motor.
- 14.3 Explain speed control of shunt, series and compound motor.
- 14.4 Mention the merits and demerits of rheostat control method.
- 14.5 Describe electric braking of shunt and series motor.
- 14.6 Explain the necessity of a starter for DC motor.
- 14.7 Describe three point and four point starter used in DC motor.
- 14.8 Explain the heating and cooling of DC machine.
- 14.9 Explain brake test and no-load test of DC motor.

15. Understand the system of electric traction.

- 15.1 State the meaning of electric traction.
- 15.2 Describe the system of electric traction.
- 15.3 List the characteristics of an ideal traction system.
- 15.4 Describe the feeding and distribution system for tram ways and trolley buses.
- 15.5 Explain the diesel electric drive, battery electric drive and electric drive of locomotives.
- 15.6 Explain the working principle of tram ways and trolley buses.
- 15.7 Explain the DC system used in traction.
- 15.8 Explain the reasons for using DC series motor for traction purpose.

16. Understand the concept of speed control of traction motors.

- 16.1 Explain different methods of speed control of DC traction motors.
- 16.2 Explain starting methods and speed control of DC series motor.
- 16.3 Explain starting method of 3-phase induction motor used in traction.
- 16.4 Explain speed control system of 3-phase induction motor used in traction.
- 16.5 Explain different braking systems.
- 16.6 Explain the systems of supplying power in electric traction.

PRACTICAL:

1. Charge a lead acid battery.

- 1.1 Sketch the connection diagram for constant potential/Constant current method of charging.
- 1.2 Identify the equipment and materials for charging a lead acid battery.
- 1.3 Record the readings by measuring the terminal voltage of the discharged battery and specific gravity of electrolytes.
- 1.4 Connect the positive and negative terminal of the battery to the positive and negative terminals of the charger respectively.
- 1.5 Set the charging voltage and switch on the charger.
- 1.6 Record the readings by measuring the specific gravity of electrolyte and the terminal voltage of the battery.

2. Measure the internal resistance of a battery.

- 2.1 Sketch necessary circuit diagram.
- 2.2 Connect a resistance (known value) with the battery.
- 2.3 Record the readings by measuring the voltage and current of the battery.
- 2.4 Calculate the internal resistance of a battery

3. De-assemble and re-assemble the parts of a DC generator/ DC motor.

- 3.1 Select the necessary tools required for de-assembling and re-assembling the parts of DC generator/ DC motor.
- 3.2 Identify at least ten main parts of the generator/motor.
- 3.3 Sketch at least ten main parts of the generator/motor.
- 3.4 Re-assemble the parts of the generator/motor.
- 3.5 Connect the generator/motor to the proper power source.
- 3.6 Start the generator/motor.

4. Develop 4 poles, 24 slots; double layer lap winding (simplex & duplex) of a DC generator.

- 4.1 Select pole pitch, back pitch, front pitch and commutator pitch for the generator.
- 4.2 Sketch the developed winding diagram (simplex and duplex) showing the position of carbon brushes.
- 4.3 Select the coil turns, coil number and coil grouping for the winding.
- 4.4 Select the sizes and types of wires required for the winding.
- 4.5 Construct required number of coils.
- 4.6 Insert the coils into the slot using the proper insulation.
- 4.7 Connect the coils in proper way.
- 4.8 Test the winding step by step.
- 4.9 Note down the observations.

5. Develop a 4 poles, 16 slots, double layer wave winding (simplex & duplex) of a DC generator.

- 5.1 Identify pole pitch, back pitch, front pitch, commutator pitch.
- 5.2 Sketch the developed winding diagram (simplex & duplex) showing the position of carbon brushes.
- 5.3 Determine the number of turns required on the basis of coil grouping and layer of winding.
- 5.4 Determine the size and type of wires required for the winding.
- 5.5 Perform winding.

6. Determine generated emf of a DC shunt generator.

- 6.1 Sketch the required diagram of the shunt generator.
- 6.2 Set the experiment as per diagram.
- 6.3 Start the generating set and build up the voltage.
- 6.4 Measure the developed emf by starting the generator.
- 6.5 Record the required data.
- 6.6 Plot the I_f versus V_g curve from the data.

7. 8. Plot the V_L - I_L characteristic curves of a shunt generator.

- 7.1 Sketch the required diagram for the experiment.
- 7.2 List the materials, meters and equipment required for the experiment.
- 7.3 Connect all the meters and equipment as per diagram.
- 7.4 Record the necessary readings from the meters.
- 7.5 Plot the V_L - I_L curve from the data.

8. Plot the V_L - I_L characteristic curve of a series generator.

- 8.1 Sketch the required diagram for the experiment.
- 8.2 List the required instruments & materials.
- 8.3 Connect all the meters and equipment as per diagram.
- 8.4 Record the necessary readings from the meters.
- 8.5 Plot the V_L - I_L curve from the data.

9. Plot the V_L - I_L characteristic curve of a compound generator.

- 9.1 Sketch the required diagram for the experiment.
- 9.2 List the required instruments & materials.
- 9.3 Connect all the meters and equipment as per diagram.
- 9.4 Record the necessary readings from the meters.
- 9.5 Plot the V_L - I_L curve from the data.

10. Run the two DC shunt generators in parallel.

- 10.1 Sketch the required diagram.
- 10.2 List tools and materials required for the experiment.
- 10.3 Connect the machines as per diagram.
- 10.4 Check connection and start incoming machine.
- 10.5 Observe the voltage of incoming machine and compare this with bus bar voltage.
- 10.6 Switch on the incoming machine with the bus bar when it is ready.

11. Run a small size DC shunt motor and control its speed.

- 11.1 Sketch the required diagram.
- 11.2 List tools and materials required.
- 11.3 Connect the machine as per diagram.
- 11.4 Start the machine.
- 11.5 Regulate speed of the motor.

12. Start a DC compound motor by a four point starter.

- 12.1 Sketch the required diagram for the experiment.
- 12.2 List the tools and materials required.
- 12.3 Connect the machine as per diagram.
- 12.4 Start the motor with the help of four point starter.

REFERENCE BOOKS:

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

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-shorter 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 facilitate understanding the fundamental of units and their conversions.
- To provide the understanding of force, effect of the force, composition and resolution of forces and computing the resultant force & couple
- To provide the understanding of parallel forces
- To provide understanding the centroid and enable to computing the center of gravity & the moment of inertia.
- To enable to understand the laws of friction and the coefficient of friction & the ability of computing frictional forces of reactions of surfaces.
- To provide to understanding of deriving support reactions and types of loading of beam and trusses.
- To facilitate the understanding of work, power, energy.

SHORT DESCRIPTION

Applied mechanics and unit conversion, Composition and resolution of forces. Moment and their applications. Equilibrium of force and couples, centroid, center of gravity and moment of inertia. Friction, support reactions, frame and truss, projectiles, work, power and energy.

Theory:**1. Understand Fundamental of Mechanics.**

- 1.1. Define mechanics.
- 1.2. Classify applied mechanics.
- 1.3. Importance of units in the engineering field.
- 1.4. Discuss the conversion of units.
- 1.5. Illustrate the fundamental mathematics (algebra, trigonometry & calculus) used in mechanics.

2. Understand the composition and resolution of forces.

- 2.1. State the effect and characteristics of a force.
- 2.2. Mention different system of forces.
- 2.3. Define resultant force and composition of forces.
- 2.4. Find the resultant force graphically and analytically.
- 2.5. State the laws of forces.
- 2.6. Define resolution of a force.
- 2.7. State the principle of resolution of force.
- 2.8. Express the deduction of the formula for finding the resolved part of a component.
- 2.9. Find the magnitude and position of the resultant force graphically and analytically
- 2.10. Solve problems related to resultant force.

3. Understand the aspects of moment of forces and couples.

- 3.1. Define moment of force and mention the units of moment.
- 3.2. Identify the clockwise and anticlockwise moment.
- 3.3. State the Varignon's principle of moments.
- 3.4. State the laws of moments.
- 3.5. Define and classify the lever.
- 3.6. State and classify parallel force.
- 3.7. Define and classify a couple.
- 3.8. Solve problems related to moment of forces and couple.

4. Understand the aspects of equilibrium of forces.

- 4.1. State the principles of equilibrium of forces.
- 4.2. State the Lame's theorem.
- 4.3. Express the derivation of Lame's theorem.
- 4.4. Describe different methods of the equilibrium of coplanar forces and non-coplanar forces.
- 4.5. Explain the conditions of equilibrium.
- 4.6. Mention the various types of equilibrium of forces.
- 4.7. Solve problems related to equilibrium of forces.

5. Understand the concept of centroid and center of gravity.

- 5.1. Define center of gravity and centroid.
- 5.2. Distinguish between center of gravity and centroid.
- 5.3. Explain the methods of finding out centroid of simple geometrical figure.
- 5.4. Identify the axis of reference and axis of symmetry.
- 5.5. Determine the centroid of rectangle, triangle, semicircle, geometrically and by integration.
- 5.6. Determine the centroid of plain geometrical figure by principle of first moments.
- 5.7. Calculate the centroid of various composite areas.
- 5.8. Calculate the center of gravity of solid bodies.

6. Understand the application of moment of inertia.

- 6.1. Explain the term moment of inertia and the units of moment of inertia.
- 6.2. Express the derivation of the formulae for moment of inertia of an area.
- 6.3. Describe the methods for finding out the moment of inertia.
- 6.4. Find the moment of inertia of simple areas by the method of integration.
- 6.5. State and proof of the theorem of perpendicular axis as applied to moment of inertia.
- 6.6. State the parallel axis theorem in the determination of moment of inertia of areas.
- 6.7. Explain the radius of gyration and section modulus.
- 6.8. Calculate the moment of inertia and section modulus of composite sections and simple solid bodies.

7. Understand the principles and application of friction

- 7.1. Define friction.
- 7.2. Identify the types of friction.
- 7.3. Advantage and disadvantage of friction.
- 7.4. State the laws of static and dynamic friction.
- 7.5. Explain the angle of friction.
- 7.6. Explain coefficient of friction.
- 7.7. Explain free body diagrams of a body lying on horizontal, inclined and vertical surfaces.
- 7.8. Determine the frictional force of a body lying on horizontal and inclined surfaces.

8. Understand the fundamentals of support reaction on beams and Truss

- 8.1. Explain support reactions.
- 8.2. Identify types of beam.
- 8.3. Explain the types of loading on beams.
- 8.4. Determine the support reactions of simple and cantilever beam with different loading condition.
- 8.5. Define the support reactions of roller supported beam.
- 8.6. Define frame.
- 8.7. Identify the frames and trusses with their end supports.
- 8.8. State the method of finding support reactions and forces on the member of the frame.
- 8.9. Calculate the support reactions and forces on different end support of simple truss by joint method and section method.

9. Understand the aspects of work, power and energy.

- 9.1. Define work, power and energy.
- 9.2. State the units of work, power and energy.

- 9.3. Explain the work done in rotation.
- 9.4. Mention the types of engine power.
- 9.5. Define and classify engine efficiency.
- 9.6. Mention types of energy.
- 9.7. Explain the derivation of the equation of kinetic & potential energy.
- 9.8. Solve problems related to work, power and energy.

10. Understand the aspect of stress and strain.

- 10.1 Define stress, strain, modulus of elasticity, Poisson's ratio and principle of shear stress.
- 10.1. Explain the stress in composite bar, stress in nuts and bolts, stress due to change in temperature.
- 10.2. Describe the linear and lateral strain.
- 10.3. Explain the stress strain diagram.
- 10.4. Solve problems on stress and strain.

PRACTICAL:

1. Determine the resultant force by using force board.

- 1.1 Set up the force board.
- 1.2 Set up the accessories on the force board.
- 1.3 Find the resultant force.
- 1.4 Calculate the magnitude of resultant force.
- 1.5 Compare the calculated values with experimental values.

2. Determine the compression load using crane boom.

- 2.1 Set up the crane boom.
- 2.2 Set up the accessories on the crane boom.
- 2.3 Find the compression load on the jib.
- 2.4 Calculate the compression analytically.
- 2.5 Compare the experimental values with analytical values.

3. Determine the equilibrium force by using Kennon force table.

- 3.1 Set up the Kennon force table.
- 3.2 Set up the accessories on the Kennon force table.
- 3.3 Find the magnitude and direction of a force establishing equilibrium.
- 3.4 Calculate the magnitude and direction of equilibrium force.
- 3.5 Compare the calculated values with experimental values.

4. Determine the center of a triangular lamina.

- 4.1 Select a triangular lamina and a plumb bob.
- 4.2 Set up the plumb bob.
- 4.3 Find the center point of the triangular lamina.

5. Determine the center of gravity of solid body.

- 5.1 Select solid bodies such as solid rod, step rod and body with cut out holes.
- 5.2 Select a fulcrum.
- 5.3 Set up the fulcrum.
- 5.4 Find the center point.
- 5.5 Compare the analytical values with experimental values.

6. Determine the co-efficient of friction.

- 6.1 Set up the friction apparatus.
- 6.2 Select the materials of which coefficient of friction are to be determined.
- 6.3 Place the materials over each other.
- 6.4 Raise one end of the body until the other body slides down.
- 6.5 Find the angle of friction.
- 6.6 Find the co-efficient of friction.

7. Determine the action of load on the member of simple frame or truss.

- 7.1 Select two members of which one end roller and other end pin point.
- 7.2 Select a tension spring.
- 7.3 Make a unit as a simple frame or truss.
- 7.4 Apply the load.
- 7.5 Read the tension load on spring.

8. Determine the torque of engine by prony brake.

- 8.1 Set up the prony brake with the engine flywheel.
- 8.2 Tighten the hand wheel of prony brake.
- 8.3 Measure the length of torque arm.
- 8.4 Start the engine.
- 8.5 Take the reading of spring scale.
- 8.6 Find the torque of engine.
- 8.7 Compare the calculated values with the manufacturers' recommended values.

9. Determine the BHP of an engine by chassis dynamometer.

- 9.1 Place the vehicle on chassis dynamometer.
- 9.2 Start the vehicle engine.
- 9.3 Transmit power at different gear position.
- 9.4 Find the B. H. P. of the engine by chassis dynamometer at different speeds.
- 9.5 Compare the experimental value with the manufactures' recommended value.

REFERENCE BOOKS

- 1 Applied Mechanics – R. S. Khurmi
- 2 Applied Mechanics – R. K. Jain
- 3 Applied Mechanics – Fairries
- 4 Analytical Mechanics – Faires& Nash
- 5 Mechanics of Materials – Morgan

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.

REFERENCE BOOK:

1. উচ্চ মাধ্যমিক ব্যবসায়নীতি ও প্রয়োগ -মোহাম্মদ খালেকুজ্জামান
2. উচ্চ মাধ্যমিক ব্যাংকিং ও বীমা -প্রফেসর কাজী নুরুল ইসলাম ফারুকী
3. আধুনিক কারবার পদ্ধতি -লতিফুর রহমান
4. কারবার যোগাযোগ ও সচিবের কার্যপদ্ধতি -প্রফেসর লতিফুর রহমান ও প্রফেসর কাজী নুরুল ইসলাম ফারুকী
5. ব্যবসায়িক যোগাযোগ এবং অফিসের কর্মপ্রণালী -ড. এম, এ, মান্নান
6. ব্যবসায় যোগাযোগ – মোহাম্মদ খালেকুজ্জামান ও মোঃ মুশাররফ হোসেন চৌধুরী
7. Business organization & management- M.C. Shukla
8. Business organization & management- R.N. Gupta