



BANGLADESH TECHNICAL EDUCATION BOARD
Agargaon, Dhaka-1207

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

POWER TECHNOLOGY

TECHNOLOGY CODE: **671**

6th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

POWER TECHNOLOGY
6th 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	67161	Engine Testing & Performance	2	6	4	40	60	50	50	200
2	66274	Vehicle Automation & Signaling	2	3	3	40	60	25	25	150
3	66241	Automotive Body Building	2	3	3	40	60	25	25	150
4	67162	Fluid Mechanics & Machineries	3	3	4	60	90	25	25	200
5	66764	Transmission & Distribution of Electrical Power	3	3	4	60	90	25	25	200
6	65852	Industrial Management	2	0	2	40	60	0	0	100
Total			14	18	20	260	390	175	175	1000

67161

Engine Testing & Performance

T P C

2 6 4

AIMS

To provide the students with an opportunity to acquire knowledge, skills and attitude in the area of engine testing and performance with special emphasis on:

- testing different systems of automotive engine
- trouble shooting and diagnosis of automobile engine
- testing engine performance
- measuring air and fuel consumption

SHORT DESCRIPTION

Use of common instruments for engine testing, the trouble shooting and diagnosis of gasoline engine fuel system, the problems and adjustments of carburetor, Trouble diagnosis of diesel fuel system, Testing of cooling system, Testing of lubricating system, Engine tune up, Friction power measurement, Indicated power measurement of IC engine, Brake power measurement, Engine efficiencies, The air and fuel consumption test of IC engine, IC engine performance characteristics..

DETAIL DESCRIPTION

Theory:

1. Understand the use of common instruments for engine testing.

- 1.1 Describe the procedure of cylinder compression test by compression tester.
- 1.2 Describe the procedure of cylinder leakage testing by cylinder leakage tester.
- 1.3 Describe the procedure of engine vacuum test by engine vacuum tester / gage.
- 1.5 Describe the procedure of measuring engine rpm by mechanical, electrical and electronic tachometer.
- 1.6 Describe the procedure of measuring engine dwell angle by tech dwell meter.
- 1.7 Describe the procedure of exhaust gas analysis by exhaust gas analyzer.

2. Understand the trouble shooting and diagnosis of gasoline engine fuel system.

- 2.1 Mention the common problems of gasoline fuel pump.
- 2.2 Describe the process of testing fuel pump i.e. mechanical pump & Electric pump.
- 2.3 Describe the testing procedure of EFI injector.
- 2.4 Describe the cleaning procedure of EFI injector.
- 2.5 Mention the possible causes and remedies of following problems:
 - a) Gasoline pumps not delivering fuel.
 - b) Non-uniform supply of fuel.
 - c) Too high injection pressure.
 - d) Too low injection pressure.
- 2.6 Poor atomization of fuel.
 - e) Electing wiring test of fuel pump.
 - f) Insufficient fuel delivery.
 - g) Fuel pump noisy.
 - h) Fuel pumps pressure high.
 - i) Fuel pumps pressure low.

3. Understand the problems and adjustments of carburetor.

- 3.1 Identify the problems of a carburetor.
- 3.2 Identify the different adjustments of carburetor.
- 3.3 Describe the procedure of choke adjustment.

- 3.4 Describe the procedure of idle adjustment
- 3.5 Describe the procedure of throttle adjustment.
- 3.6 Describe the procedure of flooding adjustment.

4. Understand the trouble shooting and diagnosis of diesel engine fuel system.

- 4.1 Describe the testing procedure of injector for nozzle seat tightness, nozzle pressure and spray pattern.
- 4.2 Describe the phasing and calibration of high pressure pump.
- 4.3 Mention the possible causes and remedies of the following problems:
 - a) Diesel pumps not delivering fuel.
 - b) Insufficient quantity of fuel delivery at every stroke.
 - c) Jammed control rod.
 - d) Non-uniform supply of fuel.
 - e) Too high injection pressure.
 - f) Too low injection pressure.
 - g) Nozzle dribbles.
 - h) Poor atomization of fuel.

5. Understand the testing of engine cooling system.

- 5.1 Describe the process of testing the thermostat.
- 5.2 Describe the process of testing the water pump.
- 5.3 Describe the process of testing the cooling fan.
- 5.4 Describe the process of testing the radiator cap.
- 5.5 Describe the process of engine timing belt-tension and adjust belt tension of engine.

6. Understand the testing of engine lubricating system.

- 6.1 Mention the uses of accurate grade of lubricating oil.
- 6.2 Describe the process of testing the fuel filter.
- 6.3 Describe the process of measuring lub oil by dip stick.
- 6.4 Describe the process of testing the engine oil pump.
- 6.5 Mention the purpose of engine oil cooler used in heavy automobile engine.

7. Understand the tune up of automobile engine.

- 7.1 Define engine tune up.
- 7.2 Name the common instruments used for engine tune up.
- 7.3 Identify the different types of engine noise.
- 7.4 Describe the procedure for engine tune up.
- 7.5 Function of automotive scanner.
- 7.6 Describe the procedure of checking ignition system by automotive scanner.

8. Understand the friction power measurement.

- 8.1 State the meaning of friction power.
- 8.2 Mention the methods to find the friction power.
- 8.3 Describe the methods to find the friction power.
- 8.4 Compare the various methods to be used to find the friction power.

9. Understand the indicated power measurement of IC engine.

- 9.1 State the meaning of indicated power.
- 9.2 Mention the methods to estimate the indicated power.
- 9.3 Describe the methods to estimate the indicated power.
- 9.4 Mention the types of engine indicators to be used to estimate the indicated power.
- 9.5 Describe the working procedure of common engine indicators.

9.6 Express the derivation of formulae to calculate indicated power of four stroke and two stroke engine.

9.7 Describe the indicated power measurement procedure with the help of engine indicator.

9.8 Solve problems relating indicated power.

10. Understand the brake power measurement.

10.1 State the meaning of brake power.

10.2 Mention the classification of dynamometer used to measure engine torque.

10.3 Distinguish between absorption dynamometer and transmission dynamometer.

10.4 Mention the advantages and disadvantages of different types of dynamometer.

10.5 Describe the procedure of brake power measurement with the prony brake, water brake and eddy current dynamometer.

10.6 Describe the procedure of brake power measurement of vehicle engine with the chassis dynamometer.

10.7 Solve problems relating engine power.

11. Understand the aspects of engine efficiencies.

11.1 Define efficiency.

11.2 Mention the different types of efficiency used in IC engine.

11.3 Explain mechanical efficiency, air standard efficiency, indicated thermal efficiency, brake thermal efficiency and relative efficiency.

11.4 Explain volumetric efficiency and scavenging efficiency.

11.5 Explain charge efficiency and combustion efficiency.

11.6 Solve problems relating efficiencies of internal combustion engine.

12. Understand the air and fuel consumption test of IC engine.

12.1 Mention the methods used for air consumption measurement

12.2 Describe the air box method of air consumption test.

12.3 Describe the viscous flow air meter method of air consumption test.

12.4 Explain the factors which affect the fuel consumption of automobile engine.

12.5 Describe the fuel consumption measurement procedure with the volumetric types flow meters.

12.6 Describe the procedure of gravimeter fuel flow measurement.

12.7 Solve problems relating specific fuel consumption.

13. Understand the IC engine performance characteristics.

13.1 State the meaning of engine performance.

13.2 Mention the factors which are to be considered for evaluating the performance of an engine.

13.3 Mention the parameters of engine performance.

13.4 Explain engine performance characteristics.

13.5 Explain the variable affecting performance characteristics.

13.6 Describe the methods of improving engine performance.

13.7 Solve problems relating engine performance.

Practical:

1. Perform the petrol engine cylinder compression test by compression tester.

1.1 Collect compression tester & engine.

1.2 Set proper tools & instrument in working place.

1.3 Working procedure compression tester in engine.

1.4 Measure pressure data

- 1.5 precaution
- 1.6 Remarks
- 2. Perform the diesel cylinder compression test by compression tester.**
 - 2.1 Collect compression tester & engine
 - 2.2 Set proper tools & instrument in working place.
 - 2.3 Working procedure of compression tester in engine.
 - 2.4 Measure pressure data
 - 2.5 precaution
 - 2.6 Remarks
- 3. Perform the cylinder leakage testing by cylinder leakage tester.**
 - 3.1 Collect leakage tester & engine
 - 3.2 Set proper tools & instrument in working place.
 - 3.3 Working procedure leakage tester in engine.
 - 3.4 Measure leakage data
 - 3.5 precaution
 - 3.6 Remarks
- 4. Perform engine vacuum test by engine vacuum tester / gage.**
 - 4.1 Collect engine vacuum tester & engine
 - 4.2 Set proper tools & instrument in working place.
 - 4.3 Working procedure engine vacuum tester in engine.
 - 4.4 Measure engine vacuum data
 - 4.5 precaution
 - 4.6 Remarks
- 5. Perform engine rpm by mechanical, electrical and electronic tachometer.**
 - 5.1 Collect engine tachometer & engine
 - 5.2 Set proper tools & instrument in working place.
 - 5.3 Working procedure tachometer tester in engine.
 - 5.4 Measure engine tachometer data
 - 5.5 precaution
 - 5.6 Remarks
- 6. Perform the exhaust gas analysis by exhaust gas analyzer.**
 - 6.1 Collect exhaust gas analyzer & engine
 - 6.2 Set proper tools & instrument in working place.
 - 6.3 Working procedure exhaust gas analyzer in engine.
 - 6.4 Measure exhausts gas analyzer data.
 - 6.5 Precaution.
 - 6.6 Remarks.
- 7. Perform testing fuel pump i.e. mechanical pump & Electric pump.**
 - 7.1 Collect fuel pump
 - 7.2 Set proper tools & instrument in working place.
 - 7.3 Working procedure fuel pump.
 - 7.4 Measure fuel pumps data.
 - 7.5 Precaution.
 - 7.6 Remarks.
- 8. Perform the testing procedure of EFI injector.**
 - 8.1 Collect EFI injector.
 - 8.2 Set proper tools & instrument in working place.

8.3 Perform various test procedure of EFI injector.

8.4 Measure EFI injector data.

8.5 Precaution.

8.6 Remarks.

9. Perform the cleaning procedure of EFI injector.

9.1 Collect EFI injector.

9.2 Set proper tools & instrument in working place.

9.3 Perform cleaning procedure of EFI injector.

9.4 Precaution.

9.5 Remarks.

10. Adjustments of carburetor.

10.1 Collect carburetor and engine.

10.2 Set proper tools & instrument in working place.

10.3 Procedure the adjustment of different types of a carburetor.

10.4 Precaution.

10.5 Remarks.

11. Perform the injector tester of Diesel engine

11.1 Collect the injector, injector tester.

11.2 Set proper tools & instrument in working place.

11.3 Procedure the testing of injector pressure and spray pattern.

11.4 Precaution.

11.5 Remarks.

12. Perform the phasing and calibration of high pressure pump.

12.1 Collect the high pressure pump, phasing and calibration test bench .

12.2 Set proper tools & instrument in working place.

12.3 Procedure the testing of high pressure pump for phasing and calibration.

12.4 Precaution.

12.5 Remarks.

13. Perform the engine cooling system.

13.1 Collect the components of cooling system and engine.

13.2 Set proper tools & instrument in working place.

13.3 Procedure the testing of thermostat valve, cooling pump, radiator for cooling systems

13.4 Test the engine timing belt-tension and adjust belt tension of engine.

13.5 Precaution.

13.6 Remarks.

14. Test of engine lubricating system.

14.1 Collect the components of lubricating system of engine.

14.2 Set proper tools & instrument in working place.

14.3 Procedure the testing of lub oil filter, lub oil pump, dip stick test

14.4 Test the quality test using by lub oil tester.

14.5 Precaution.

14.6 Remarks.

15. Perform the checking of ignition system by automotive scanner.

15.1 Collect the engine, automotive scanner.

15.2 Set proper tools & instrument in working place.

15.3 Procedure the testing of ignition system of engine using by automotive scanner.

15.4 Measure ignition wave pattern.

15.5Precaution.

15.6Remarks.

16.Determine the brake horse power.

16.1Collect the engine, Dynamometer

16.2Set proper tools & instrument in working place.

16.3Procedure the testing of the brake horse power

16.4Measure ignition wave pattern.

16.5Precaution.

16.6Remarks.

REFERENCE BOOKS

1. Automotive Mechanics –W H Crouse and Anglin.
2. Auto mechanics –Mitchell.
3. Thermal Engineering –A. S. Sarao.
4. A Course in Internal Combustion Engine –M. L. Mathur & R. P. Sharma.
5. Internal Combustion Engines –V. Ganesan.
6. Audels Automobile Guide -Frederick E. Bricker.
7. Automobile Engineering Volume-1 and volume-2 – Dr. Kripal Shingh
8. Thermal Engineering –R.S Khurmi
9. Thermal Engineering –P.L. Balaney

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of Vehicle Automation & signaling with special emphasis on:

- Intelligent transport system (ITS)
- Vehicle cruise control
- Collision avoidance system's & control both steering and speed autonomously under normal environmental condition of vehicle.
- Traffic signaling

SHORT DESCRIPTION

Vehicle automation, Intelligent transport system (ITS), Vehicle cruise control, Collision avoidance system, Automation control of steering & speed under normal environment condition, Vehicle tracking system, Intelligent parking Assist system (IPAS), Automotive night vision (ANV), Blind spot monitoring, Advance automatic collision notification (AACN) and Traffic signaling.

DETAIL DESCRIPTION

Theory:

1. Understand the Features of Vehicle Automation.

- 1.1 Define of vehicle automation.
- 1.2 State name of the operation mechanism viz Informing and warning functions, Continuously automating functions, Intervening emergency functions (near-accident situations).
- 1.3 Verity of levels of driving automation for on-road vehicles.
- 1.4 Mention the function with levels of driving automation for on-road vehicles.
- 1.5 Identify the challenges of emerging sector for vehicle automation.

2. Understand the Feature of Vehicle Intelligent transport system (ITS).

- 2.1 State the vehicle intelligent transport system.
- 2.2 Classify the primary category of intelligent transport system application viz Advanced traveler information systems (ATIS), Advanced transportation management systems (ATMS), ITS-Enabled transportation pricing systems, Advanced public transportation systems, Vehicle to infrastructure (VII) integration and vehicle to vehicle integration (V2V).
- 2.3 Mention the specific ITS application of each category.
- 2.4 Describe the primary category of intelligent transport system application.
- 2.5 Mention the key underlying technology used in ITS.
- 2.6 Identify the component of vehicle intelligent transport system.
- 2.7 Explain the benefits of ITS.
- 2.8 Apply the policy measure of vehicle intelligent transport system in urban transportation.

3. Under the Feature of Vehicle Cruise Control.

- 3.1 List of Component of Cruise Control.
- 3.2 Mention the Function of cruise control component.
- 3.3 Operate each component of cruise control system.
- 3.4 Advantages and disadvantages of cruise control system.

4. Understand the Feature of Vehicle Collision Avoidance System.

- 4.1 Give the automobile collision avoidance system operation principle.
- 4.2 Point out the variety of sensor used in collision avoidance system.
- 4.3 Mention the function of collision avoidance system.
- 4.4 Perform the automobile collision avoidance system.

5. Understand the Feature of Automate Vehicle Steering and Speed Control.

- 5.1 List the component of hardware system of automate vehicle.
- 5.2 Mention the function of hardware system component of automate vehicle.
- 5.3 Name of the sensor used in automate vehicle steering and speed control.
- 5.4 Draw the systematic diagram of steering control system.
- 5.5 Illustrate the hardware configuration of steering control system.

6. Understand the feature of vehicle tracking system.

- 6.1 State the vehicle tracking system.
- 6.2 Identify the component of vehicle tracking system.
- 6.3 Discuss the GPS technology vehicle tracking system.
- 6.4 Write possible benefit of using GPS tracking system.
- 6.5 Find the application of vehicle tracking system.
- 6.6 Explain the function of vehicle tracking system.
- 6.7 Define the intelligent parking assist system.

7. Understand the Feature of Automotive Night Vision (ANV).

- 7.1 state what is meant by automotive night vision.
- 7.2 Mention the major function of automotive night vision viz Adaptive night vision, Road sing detection and recognition, Spot light projection, Scene zooming.
- 7.3 Describe the function of automotive night vision.
- 7.4 Write possible benefit of automotive night vision.

8. Understand the feature of Blind Spot Monitoring.

- 8.1 Define the automotive blind spot monitoring.
- 8.2 Types of automotive blind spot monitoring viz Active and Passive blind spot monitor.
- 8.3 Function of automotive blind spot monitoring.

9. Understand the Feature of Advance Automatic Collision Notification (AACN).

- 9.1 State the Advance Automatic Collision Notification (AACN).

10. Understand the Feature of Traffic Signaling.

- 10.1 State the traffic signaling.

Practical: (Field trip should be included to relevant workshop).

1. Study the automobile body parts.

- 1.1 Identify the panels and crown.

Ref:

Kiino, Ron. "The Kiinote: Blinded by the Spot." Motor Trend. (April 17, 2012)

http://www.motortrend.com/features/editorial/1202_the_kiinote_blinded_by_the_spot/

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of automobile body building and repair with special emphasis on:

- Automobile body construction and effect of collision on automobile body
- Tools and equipment required for collision damage works and repairing
- Welding and soldering process
- Automobile body painting.

SHORT DESCRIPTION

Automobile body; Construction of automobile body; Manufacturing process; Effect of collision; Tools and equipment required for auto-body repair; Fasteners; Sheet metal damage repair; Welding process; Fitting methods; Materials for automobile body; Surface preparation; Features of primer; Plastic fillers; Fiber glass repair; Refinishing methods and spray painting equipment.

DETAIL DESCRIPTION

Theory:

1. Understand the features of automobile body.

- 1.1 Define the automobile body.
- 1.2 Mention the function of automobile body.
- 1.3 Name the various designs of automobile body with sketch.
- 1.4 Identify the major body panels of a car with net sketch.

2. Understand the construction of automobile body.

- 2.1 Explain the automobile body construction viz. Body & frame construction and unibody construction.
- 2.2 Describe the method of manufacturing automobile body.
- 2.3 Explain the effects of overhangs.
- 2.4 List the materials required for automobile body making.
- 2.5 Describe the process of rust protection of automobile body.

3. Understand the feature of automobile frame.

- 3.1 Define automobile frame.
- 3.2 List the different type of frame used in automobile.
- 3.3 Explain the forming of metal frame to provide strength crown, angles and flanges, u-channels and box section rail pillars.
- 3.4 Explain stamping body parts.

4. Understand the feature of collision of the automobile body.

- 4.1 Mention the effects of collision of the automobile body.
- 4.2 Define metal bumping & dinging, buckle & roll of sheet metal.
- 4.3 Explain the low and high spot damage of body.
- 4.4 Mention the uses of fittings, denting, straightening and alignment of automobile body.

5. Understand the tools and equipment required for collision damage work.

5.1 Identify the hand tools for collision work.

5.2 List some necessary hand bumping tools for the automobile body repair.

5.3 Mention the function of

- b. Hammer
- c. Dolly blocks
- d. Spoons
- e. Files and Files holders
- f. Mechanical and hydraulic jacks

Understand the fasteners used in the assembly of the automobile body.

5.4 Mention the uses of various types of bolts, viz cap screw, carriage bolt, bumper bolt, studs and machine bolt and stove bolt.

5.5 Mention the uses of different types of nuts used with the various fasteners.

5.6 Mention the use of different types of clips and washers.

5.7 Mention the uses of other mechanical fasteners.

6. Understand the procedure of sheet metal damage repairing.

6.1 Mention the factors to be considered to determine the types of damage.

6.2 Explain the methods of choosing the right type of hammer.

6.3 Explain the principle of using the hammer of dolly method.

6.4 Describe the method of detecting high and low spots.

6.5 Describe the process of picking up the low spots.

6.6 Mention basic use of the disc grinder.

6.7 Describe the repairing procedure of the damage by using mechanical and hydraulic body jacks.

6.8 Describe the repairing procedure of crowned panel.

7. Understand the welding processes and their application.

7.1 Define gas welding.

7.2 Mention the use of gas welding.

7.3 Explain the different types of gas flame and their uses.

7.4 Define the different types of welding position and various types of welding joints with sketches.

7.5 Describe the process of sheet metal welding.

7.6 Mention the uses of arc welding.

7.7 Describe the process of striking the arc.

7.8 Describe the process of running beat.

7.9 State the safety Precautions when using welding equipment around automobile.

7.10 Define spot welding.

7.11 Mention the use of spot welding.

7.12 Compare soldering, brazing & welding.

8. Understand the fitting methods of deck lid, hood and door.

8.1 Describe the process of bending or straightening of metallic steel.

8.2 Describe the process of deck lid fitting.

8.3 Describe the process of hood fitting.

8.4 Describe the process of door fitting.

8.5 Describe the process of correcting missaligned door.

8.6 Describe the frame straightening methods.

9. Understand the plastic fillers and fiberglass repair.

- 9.1 Mention the purposes of filler.
- 9.2 Mention the use of plastic filler.
- 9.3 Name the types of filler.
- 9.4 Describe the procedure of preparing plastic filler.
- 9.5 Describe the application procedure of filler.
- 9.6 Describe the method of fiber glass repairing.

10. Understand the surface preparation.

- 10.1 Mention the meaning of surface preparation.
- 10.2 Mention the purpose of surface preparation.
- 10.3 Describe the steps of surface preparation.
- 10.4 Mention the use of putties and sealers.
- 10.5 Describe the methods of surface preparation using abrasive papers (wet & dry type) sanding operation.

11. Understand the features of primer.

- 11.1 State the meaning of term primer.
- 11.2 Mention the use of primer.
- 11.3 Name the different types of primer.
- 11.4 Mention the uses of primer-sealer.
- 11.5 Describe the process of primer application.

12. Understand the refinishing method of automobile body.

- 12.1 Mention the importance of painting.
- 12.2 List the basic ingredients of painting.
- 12.3 Mention the uses of pigment, binder & solvent.
- 12.4 Mention the uses of top coat, under coat and guide coat.
- 12.5 Describe the method of application of synthetic enamel and lacquers.
- 12.6 Explain the uses of thinners and reducers. .
- 12.7 Describe manual painting process.
- 12.8 List the steps of painting a automobile body.
- 12.9 List the safety steps in the paint shop.

13. Understand the spray painting equipment.

- 13.1 List the name of principle parts of a spray gun.
- 13.2 Name the different types of spray gun.
- 13.3 Describe the process of spray gun adjustment.
- 13.4 State the operating principle of spray gun.
- 13.5 Describe the process of painting by using the spray gun.
- 13.6 Describe the method of refinishing the complete automobile.

PRACTICAL: (Field trip should be included to relevant workshop).

1. Familiar with the automobile body parts.

- 1.1 Identify the panels and crown.
- 1.2 Identify the floor panel assembly and front cowl assembly.
- 1.3 Identify the quarter panel, roof assembly and front end assembly.
- 1.4 Identify the radiator, bumper and hood.

- 1.5 Identify door glass, interior hardware and trim.
- 1.6 Identify different types of seats of automobile.
- 1.7 Identify glass and wind shield and rear window glass mountings.

2. Familiar with the hand tools of body bumping of automobile.

- 2.1 Identify the bumping, dinging and pick hammers.
- 2.2 Identify dollies, spoons, pry bars, body files, file holders and reveal file handle and file blade set.

3. Familiar with the fasteners of automobile.

- 3.1 Identify bolts and their types: such as cap screw, carriage bolts, bumper bolts, studs machine bolts and stove bolts.
- 3.2 Identify the common types of nuts used with the various fasteners viz: castle, acorn, squire, hex, slotted hex, retainer nuts, flanged hex nuts, etc.
- 3.3 Identify the labeler types speed clips and metal screws.
- 3.4 Practice the selecting bolt and screw sizes, head and nut sizes.
- 3.5 Identify the washers and hollow rivets.
- 3.6 Identify the different types of rivets.
- 3.7 Practice riveting to build up an automobile body.

4. Practice the oxy-acetylene welding.

- 4.1 Identify the components of oxy-acetylene welding equipment.
- 4.2 Turn the welding units.
- 4.3 Light the welding torch and prepare the three types of flame.
- 4.4 Shut off the flame.
- 4.5 Practice the welding work on various welding positions; viz; flat; vertical; overheat and horizontal.
- 4.6 Practice welding a sheet metal.
- 4.7 Practice braze welding in vertical and horizontal position.
- 4.8 Practice oxygen cutting by cutting attachments.
- 4.9 Practice cutting plate and cutting sheet metal.

5. Perform electric welding.

- 5.1 Identify the components of electric arc equipment.
- 5.2 Select the electrodes and their sizes.
- 5.3 Set the current of the machine.
- 5.4 Practice in striking the Arc.
- 5.5 Practice on running a bead.
- 5.6 Practice welding in various positions.

6. Perform the sheet metal damage repair.

- 6.1 Practice the hammering techniques.
- 6.2 Practice denting with hammer and dolly.
- 6.3 Apply basic hammer and dolly methods in straightening damage area.
- 6.4 Apply techniques of body filing cross and x filing.
- 6.5 Practice in picking up low spots.
- 6.6 Practice in using disc sander or grinder to remove paint and to provide scratch pattern.

7. Perform straightening typical damage.

- 7.1 Practice in selecting hinge buckle, roll buckle, direct damage and indirect damage.
- 7.2 Practice in straightening damage by using jacks.

7.3 Practice in straightening metal without damaging the point.

7.4 Practice repairing a double high crowned area.

7.5 Practice repairing a low crowned area.

7.6 Practice in straightening a reverse crowned area.

8. Perform soldering.

8.1 Identify the components of soldering unit.

8.2 Practice the process of using solder.

8.3 Apply the solder filling techniques.

8.4 Show tinning steps for using tinning flux.

8.5 Practice the application of soldering puddles.

8.6 Practice the soldering on the surface.

9. Practice on fitting methods.

9.1 Remove & Replace radiator.

9.2 Adjust front & rear bumper.

9.3 Remove & fit the wind shield and window glass.

9.4 Practice door fitting, raising and lowering the door, forward and back ward adjustment, missaligned door correction, adjustment of door locks.

10. Perform refinishing.

10.1 Identify the pigment binder and solvent.

10.2 Practice the top coats and under coats.

10.3 Apply synthetic enamel, lacquers, metallic top coats, primary putties, sealers and reducers.

10.4 Apply wax and grease removers.

10.5 Apply polisher application and metal conditioner.

11. Practice surface preparation.

11.1 Use abrasive papers.

11.2 Feather edging, block sanding and masking.

11.3 Perform the refinishing procedure.

12. Use spray equipment.

12.1 Identify the principal parts of a spray gun.

12.2 Adjust the spray gun.

12.3 Operate the spray gun.

12.4 Reduce the paint.

12.5 Regulate the air pressure in using the spray gun.

12.6 Keep the proper distance from the work and the technique of the triggering gun.

12.7 Practice spraying.

12.8 Practice spot spraying.

12.9 Practice waxing, polishing and clearing of the exterior of the automobile.

12.10 Practice interior cleaning of the vehicle.

REFERENCE BOOKS

1. Auto Body Repairing and Repainting - Bill Tobledt.
2. Automotive Body Repair and Refinishing - W. H Crouse and D. L. Anglin.
3. Automobile Engineering - J.B.S. Narang.

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of fluid mechanics and machineries with special emphasis on:

- Properties of fluids
- Fluid pressure measurement
- Bernoulli's equation
- Orifice and mouthpieces
- Impact of jet
- Water pumps & turbines
- Hydraulic devices
- Compressors

SHORT DESCRIPTION

Scope of fluid mechanics, Properties of fluid, Fluid pressure measurement, Flow of fluids through pipes, Bernoulli's equation, Flow through orifices, Flow through mouthpieces, Viscous flow, Impact of jets, Water turbine, Pumps, Hydraulic devices, Reciprocating air compressor, Rotary air compressor.

DETAIL DESCRIPTION**Theory:****1. Understand the scope of fluid mechanics and machineries.**

- 1.1 Define fluid mechanics and fluid machineries.
- 1.2 Outline the importance of fluid mechanics and machineries
- 1.3 Mention the branches of fluid mechanics.
- 1.4 Identify different application of fluid mechanics and fluid machineries in engineering field.

2. Understand the properties of fluids.

- 2.1 Define fluid.
- 2.2 Mention the classification of fluids.
- 2.3 Compare the liquid, vapor and gas.
- 2.4 Describe various properties of fluids.
- 2.5 Solve problems on properties of fluids.

3. Understand the concept of fluid pressure.

- 3.1 Define pressure and intensity of pressure.
- 3.2 State the formula for finding pressure and pressure head of fluids.
- 3.3 Mention the significance of fluid pressure.
- 3.4 State Pascal's law of fluid pressure.
- 3.5 Define atmospheric pressure, gage pressure and absolute pressure.
- 3.6 Mention the relation among atmospheric pressure, gage pressure and absolute pressure.
- 3.7 Express the derivation of the formulae for finding total pressure on immersed surface at horizontal, inclined and vertical position.
- 3.8 Calculate the total pressure on the bottom and walls of a tank filled with liquid.
- 3.9 Solve problems on the static fluid pressure.

4. Understand the features of fluid pressure gages.

- 4.1 State the meaning of pressure gage.
- 4.2 Mention the classification of pressure gages.
- 4.3 Define manometer.
- 4.4 Distinguish between simple manometer and differential manometer.
- 4.5 Mention the working principle of different types of pressure gages.
- 4.6 Mention the specific application of different pressure gages.
- 4.7 Solve problems relating to the measurement of fluid pressure by different manometer.

5. Understand the concept of flow of fluid through pipes.

- 5.1 Identify different types of flow of fluid in pipe.
- 5.2 Mention different types of flow lines.
- 5.3 Express the mathematical deduction of stream function.
- 5.4 State the equation of continuity of flow.
- 5.5 State what is meant by flow rate or discharge.
- 5.6 Compute the formula of flow through pipes.

- 5.7 Describe the operation of Rotameter to measure flow rate of liquid.
- 5.8 Solve problems on flow of fluid through pipes.
- 6. Understand the concept of Bernoulli's equation.**
 - 6.1 Define head, pressure head, velocity head, datum head and total head.
 - 6.2 Identify the form of energy existence of liquid in motion.
 - 6.3 Mention the total energy of a liquid in motion.
 - 6.4 State the Bernoulli's equation for flowing liquid.
 - 6.5 Express the proof of Bernoulli's equation.
 - 6.6 Mention the limitation of Bernoulli's equation.
 - 6.7 Solve problems on Bernoulli's equation.
- 7. Understand the application of Bernoulli's equation.**
 - 7.1 Mention the functions of venturi meter, orifice meter and pitot tube.
 - 7.2 Describe the construction of venturi meter, orifice meter and pitot tube.
 - 7.3 Describe the operations of venturi meter, orifice meter and pitot tube.
 - 7.4 Express the derivation of formula to measure the quantity of liquid flowing through venture meter.
 - 7.5 Compare venturi meter and orifice meter.
 - 7.6 Solve the problems on venturi meter, orifice meter and pitot tube.
- 8. Understand the concept of flow through orifices.**
 - 8.1 Define orifice.
 - 8.2 Mention the classification of orifices.
 - 8.3 State what is meant by hydraulic coefficient.
 - 8.4 Define jet of water, vena contracta, coefficient of contraction (CC), coefficient of velocity (Cv), coefficient of discharge (Cd) and coefficient of resistance.
 - 8.5 Relate the CC, Cv and Cd.
 - 8.6 Calculate the coefficient of velocity from laboratory data.
 - 8.7 Express the deduction of formulae for finding the discharge of liquid through various orifices.
 - 8.8 Express the deduction of formulae to calculate the time of emptying rectangular and hemispherical tanks.
 - 8.9 Solve problems relating orifices.
- 9. Understand the concept of flow through mouthpieces.**
 - 9.1 State what is meant by mouthpiece.
 - 9.2 Mention the classification of mouthpieces.
 - 9.3 Express the deduction of formulae to calculate discharge through different types of mouthpieces.
 - 9.4 List the causes of head loss of flowing liquid.
 - 9.5 Express the deduction of formulae to calculate loss of head due to sudden enlargement, sudden contraction and obstruction in pipe.
 - 9.6 Express the deduction of formulae to calculate loss of head due to friction (Darcy's and Cheay's formulae).
 - 9.7 Solve problems relating head losses and discharge through mouthpieces.
- 10. Understand the concept of viscous flow.**
 - 10.1 Define viscosity with units.
 - 10.2 Define ideal fluid, real fluid, Newtonian fluid and non-Newtonian fluids.
 - 10.3 Distinguish between the laminar flow and turbulent flow.
 - 10.4 State what is meant by Reynolds number.
 - 10.5 Describe Reynolds experiment of viscous flow.
 - 10.6 Solve problems relating viscous flow.
- 11. Understand the aspect of impact of jets.**
 - 11.1 State what is meant by impact of jet.
 - 11.2 Express the deduction of formulae to calculate the force of a jet impinging on a fixed vertical flat plate and an inclined flat plate.
 - 11.3 Express the deduction of formula to calculate the force of a jet impinging on a fixed curve vane.
 - 11.4 Express the deduction of formula to calculate the force of a jet impinging on the moving curve vane.
 - 11.5 Solve problems on impact of jets.

12. Understand the features of water turbines.

- 12.1 State the meaning of water turbine.
- 12.2 Mention the classification of water turbine.
- 12.3 Describe the principle of impulse and reaction water turbine.
- 12.4 Compare the impulse and reaction turbines.
- 12.5 Describe the components of impulse and reaction turbines.
- 12.6 Describe the operation of Pelton, Kaplan and Francis water turbine.
- 12.7 State what is meant by specific speed of turbine.
- 12.8 Describe the governing system of impulse and reaction turbines.

13. Understand the features of pumps.

- 13.1 Define pumps.
- 13.2 Mention the classification of pumps.
- 13.3 State what is meant by positive displacement and Rotodynamic pumps
- 13.4 Describe the construction and operation of different types of positive displacement and Rotodynamic pumps
- 13.5 Compare centrifugal and reciprocating pumps.
- 13.6 Mention the function of air vessel in single acting reciprocating pump.
- 13.7 Express the deduction of formulae to calculate the discharge, Manometric head, specific speed, Net Positive Suction Head (NPSH), efficiency, and power required to drive the centrifugal pump.
- 13.8 Express the deduction of formulae to calculate the discharge, Cd, Slip and power required to drive the centrifugal pump.
- 13.9 Mention specific application of different types of pumps.
- 13.10 Solve problems relating to centrifugal and reciprocating pumps.

14. Understand the features of hydraulic devices.

- 14.1 State what is meant by hydraulic devices.
- 14.2 Mention the function of hydraulic devices viz. hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift, fluid coupling, etc.
- 14.3 Describe the constructions of various hydraulic devices.
- 14.4 Describe the operation of different types of hydraulic devices.
- 14.5 Solve problems on hydraulic devices.

15. Understand the features of reciprocating air compressor.

- 15.1 State what is meant by air compressor.
- 15.2 Mention the classification of air compressor.
- 15.3 Describe working principle of single stage reciprocating air compressor.
- 15.4 Mention the advantages of multistage air compressor.
- 15.5 Mention the function of inter cooler and after cooler of a multistage air compressor.

16. Understand the features of rotary air compressor.

- 16.1 State what is meant by rotary air compressor.
- 16.2 Distinguish between reciprocating and rotary air compressors.
- 16.3 Mention types of rotary air compressors.
- 16.4 Describe the operation of different types of rotary air compressor.
- 16.5 State what is meant by efficiency of air compressor.
- 16.6 Solve problem related to efficiency of air compressor.

PRACTICAL:**1. Calibrate a bourdon tube pressure gage with a dead weight gage.**

- 1.1 Collect bourdon tube pressure gage & dead weight gage.
- 1.2 Set proper tools & instrument in working place.
- 1.3 Working procedure for calibration of bourdon tube pressure gage dead weight gage.
- 1.4 Measure data.
- 1.5 Precautions.
- 1.6 Remarks.

2. Verify Bernoulli's equation by Bernoulli's apparatus equipped with Hydraulic test bench.

- 2.1 Collect Bernoulli's apparatus equipped with Hydraulic test bench.
- 2.2 Set proper tools & instrument in working place.
- 2.3 Working procedure for verifying Bernoulli's apparatus equipped with Hydraulic test bench.
- 2.4 Measure data.
- 2.5 Precautions.
- 2.6 Remarks.

3. Determine CC, CV, and Cd by orifice apparatus equipped with Hydraulic test bench.

- 3.1 Collect Orifice apparatus equipped with Hydraulic test bench.
- 3.2 Set proper tools & instrument in working place.
- 3.3 Working procedure for verifying Bernoulli's apparatus equipped with hydraulic test bench.
- 3.4 Determine CC, CV, and Cd using by measuring data.
- 3.5 Precautions.
- 3.6 Remarks.

4. Determine the discharge of water through a pipe by the Venturi meter or Orifice meter equipped with Hydraulic test bench.

- 4.1 Collect Venturi meter Orifice apparatus equipped with Hydraulic test bench.
- 4.2 Set proper tools & instrument in working place.
- 4.3 Working procedure for verifying Bernoulli's apparatus equipped with hydraulic test bench.
- 4.4 Determine the discharge of water using by measuring data.
- 4.5 Precautions.
- 4.6 Remarks.

5. Determine the loss of head due to sudden enlargement of pipe by the manometer.

- 5.1 Collect Friction apparatus.
- 5.2 Set proper tools & instrument in working place.
- 5.3 Working procedure for determining the loss of head due to sudden enlargement of pipe by the manometer.
- 5.4 Determine the loss of different head loss due to sudden enlargement of pipe by using measuring data.
- 5.5 Precautions.
- 5.6 Remarks.

6. Determine the loss of head due to friction by fluid friction apparatus.

- 6.1 Collect Friction apparatus.
- 6.2 Set proper tools & instrument in working place.
- 6.3 Working procedure for determining the loss of head due to sudden enlargement of pipe by the manometer.
- 6.4 Determine the loss of different head loss due to sudden enlargement of pipe by using measuring data.
- 6.5 Precautions.
- 6.6 Remarks.

7. Determine the loss of fluid energy through various fittings (elbows, bends and valves).

- 7.1 Collect Friction apparatus.
- 7.2 Set proper tools & instrument in working place.
- 7.3 Working procedure for determining the loss of fluid energy through various fittings (elbows, bends and valves).
- 7.4 Determine the loss of fluid energy through various fittings (elbows, bends and valves) by using measuring data.
- 7.5 Precautions.
- 7.6 Remarks.

8. Test the performance of a reciprocating pump with the reciprocating pump test rig.

8.1 Collect a reciprocating pump with the reciprocating pump test rig.

8.2 Set proper tools & instrument in working place.

8.3 Working procedure for determining the performance of a reciprocating pump with the reciprocating pump test rig.

8.4 Determine the performance of a reciprocating pump with the reciprocating pump test rig.

8.5 Precautions.

8.6 Remarks.

9. Test the performance of a centrifugal pump with the centrifugal pump test rig.

9.1 Collect centrifugal pump with the centrifugal pump test rig.

9.2 Set proper tools & instrument in working place.

9.3 Working procedure for determining the performance of a centrifugal pump with the centrifugal pump test rig.

9.4 Determine the performance of a centrifugal pump with the centrifugal pump test rig. using measuring data.

9.5 Precautions.

9.6 Remarks.

10. Test the performance of an impulse turbine with the impulse (Pelton wheel) turbine test rig.

10.1 Collect impulse turbine with the impulse (Pelton wheel) turbine test rig.

10.2 Set proper tools & instrument in working place.

10.3 Working procedure for determining the performance of impulse turbine with the impulse (Pelton wheel) turbine test rig.

10.4 Determine the performance of impulse turbine with the impulse (Pelton wheel) turbine test rig using measuring data.

10.5 Precautions.

10.6 Remarks.

11. Test the performance of a Francis turbine with the Francis turbine test rig.

11.1 Collect Francis turbine with the Francis turbine test rig.

11.2 Set proper tools & instrument in working place.

11.3 Working procedure for determining the performance of Francis turbine with the Francis turbine test rig.

11.4 Determine the performance of impulse turbine with the impulse (Pelton wheel) turbine test rig using measuring data.

11.5 Precautions.

11.6 Remarks.

12. Determine the leverage and mechanical advantage of a hydraulic press.

12.1 Collect the leverage and mechanical advantage of a hydraulic press.

12.2 Set proper tools & instrument in working place.

12.3 Working procedure for determining the leverage and mechanical advantage of a hydraulic press.

12.4 Determine the leverage and mechanical advantage of a hydraulic press by using measuring data.

12.5 Precautions.

12.6 Remarks.

13. Identify the components of hydraulic crane and operate a hydraulic crane.

13.1 Collect the the components of hydraulic crane

13.2 Set proper tools & instrument in working place.

13.3 Working procedure for operation hydraulic crane.

13.4 Precautions.

13.5 Remarks.

14. Identify the different components of a two-stage reciprocating air compressor and operate the compressor.

14.1 Collect the the components a two-stage reciprocating air compressor.

14.2 Set proper tools & instrument in working place.

14.3 Working procedure for operation a two-stage reciprocating air compressor.

14.4 Precautions.

14.5 Remarks.

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1. A text book of fluid mechanics and Hydraulic Machineries - R.K RAJPUT
2. Fluid mechanics and Machineries - K. AGRAWAL
3. A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines - R. S. Khurmi
4. Fluid Mechanics Hydraulics and Hydraulic Machines - K. R. Arora
5. Hydraulics, Fluid Mechanics, and Fluid Machines - S. Ramamrutham
6. Fluid Mechanics including Hydraulics Machines - K. Subramanya

AIMS

To provide the students with opportunities to acquire knowledge, skills and attitude in the area of transmission and distribution of electrical power with special emphasis on:

- Different types of transmission and distribution systems of electrical power.
- Comparison of different types of transmission and distribution systems.
- Electrical and Mechanical design of overhead lines.
- Survey of transmission and distribution line routes.
- Underground cables and its faults.

SHORT DESCRIPTION

Different systems of transmission; supply system & D.C. distribution system; Kelvin's law & system losses Grid network; comparison of supply systems; copper comparison; Mechanical design of overhead lines: support of overhead lines; conductors & conductor materials; Insulators; Sag and its effect; methods for survey of transmission/distribution line route; Voltage distribution of suspension insulator; Corona; Erection of poles and drawing of conductors of overhead lines; Electrical design of overhead line; Resistance of the line conductor; Understand corona & Skin effect of transmission line; Underground cables; types; laying and joining; cable faults; operation and maintenance of distribution line.

DETAIL DESCRIPTION

Theory:

1. Understand different systems of transmission of electrical power.

- 1.1 Define the transmission and distribution system of electrical power.
- 1.2 Categories various systems of transmission and distribution of electrical power.
- 1.3 Define Feeder and Distributor.
- 1.4 Compare between Feeder & Distributor.
- 1.5 Explain the advantages of high voltage transmission over low voltage transmission.
- 1.6 Compare the cost of conductor of different overhead systems.
- 1.7 Compare the cost of conductor of underground system with overhead system.
- 1.8 Describe the process of choosing the working voltage for transmission and distribution system.
- 1.9 Calculate the most economic working voltage for transmission of electrical power.

2. Understand the supply systems and D.C. distribution systems

- 2.1 Explain supply systems
- 2.2 Compare between A.C. and D.C. transmission
- 2.3 Compare between overhead and underground transmission and distribution system.
- 2.4 Describe D.C. distribution
- 2.5 Describe D.C. distributor fed at one end
- 2.6 Describe D.C. distributor fed at one end
- 2.7 Describe Ring distributor
- 2.8 Solve problems on D.C. distributor fed at one end, fed at both end, & Ring distributor.

3. Perceive different aspects of transmission system.

- 3.1 Express the equation for the most economic size of conductor using Kelvin's law.
- 3.2 Describe the limitations of the application of Kelvin's law to find out the economic size of the conductor.
- 3.3 Solve problems on Kelvin's law.
- 3.4 Explain the term system losses.
- 3.5 List the factors involved in system loss.
- 3.6 Explain how the system losses can be minimized.
- 3.7 Discuss the most economic power factor.
- 3.8 Derive the equation for most economic power factor.
- 3.9 Solve problems on most economic power factor.

4. Understand the Grid network

- 4.1 State grid networking of power system.
- 4.2 Explain in brief the prerequisites of grid system
- 4.3 List the different types of grid system.
- 4.4 Mention the advantages of grid system
- 4.5 Outline the grid system of Bangladesh.

5. Recognize the supports of overhead lines.

- 5.1 Mention the main components of overhead lines.
- 5.2 Categorize the line supports.
- 5.3 Describe different types of line supports.
- 5.4 Mention the characteristics of line supports.

6. Interpret the conductors and conductor materials.

- 6.1 List different types of line conductors used in overhead transmission and distribution lines.
- 6.2 Mention at least five properties of conductor materials.
- 6.3 Compare the properties of Copper, Aluminum and ACSR conductors.

7. Realize the line insulators and their characteristics.

- 7.1 List different types of insulators.
- 7.2 Specify various types of insulating materials.
- 7.3 Describe the properties of insulating materials.
- 7.4 Explain the Pin and Suspension type insulators.
- 7.5 Compare the advantages and disadvantages of Pin and Suspension type insulator.
- 7.6 Mention the uses of different types of insulators.
- 7.7 List the causes of failure of insulators.
- 7.8 Explain different types of test of insulators.

8. Understand sag and its effect.

- 8.1 Explain the sag of transmission line.
- 8.2 List the factors affecting the sag.
- 8.3 Explain the spacing between conductors and span length.
- 8.4 Derive the formula to calculate the sag of a conductor between two poles of equal height.
- 8.5 Express the formula to calculate the sag of a conductor between two poles of unequal heights considering effect of ice and wind pressure.
- 8.6 Solve problems on sag of transmission lines.

9. Perceive the methods for survey of transmission / distribution line route.

- 9.1 List the Surveying Instruments required to survey of transmission / distribution lines.
- 9.2 Explain the uses, errors and accuracy of surveying instruments.
- 9.3 Describe the process of measuring the angles by compass, level and Theodolite.
- 9.4 Enumerate leveling, alignment, surveying and pegging of the route.
- 9.5 Explain the methods of measuring vertical and horizontal heights of T/D.
- 9.6 List the principle factors in routing overhead energy lines.

10. Understand the voltage distribution of a string of suspension insulator.

- 10.1 Explain string efficiency.
- 10.2 Describe the methods of improving string efficiency.
- 10.3 Solve problems on string efficiency.
- 10.4 Deduce the equation of voltage distribution across each unit of a string of suspension insulators.
- 10.5 Describe the methods of voltage grading in suspension insulators.
- 10.6 Illustrate the methods of equalization of voltage of suspension insulators by guard ring.
- 10.7 Solve problems on voltage distribution and voltage grading.

11. Understand the phenomenon of corona.

- 11.1 Define corona of overhead transmission line.
- 11.2 Discuss the effect of corona.
- 11.3 Explain at least four factors that affect corona.
- 11.4 Describe the advantages and disadvantages of corona.
- 11.5 Express the derivation of the relation for disruptive critical voltage, visual critical voltage and energy loss due to corona.
- 11.6 Discuss the methods for minimizing corona.

12. Recognize the erection of poles / towers and drawing of conductors of overhead line.

- 12.1 Describe the procedure of erection of poles of overhead transmission / distribution line.
- 12.2 Explain the procedure of erection of towers of overhead transmission line.
- 12.3 Describe the procedure of fixing cross arm and insulator.
- 12.4 Interpret the drawing of conductors of overhead lines.
- 12.5 Narrate the erection of stay / guy wire.

13. Understand the line constants of transmission line conductor & skin effect

- 13.1 Describe the line constants of a transmission line.
- 13.2 Express the deduction of the equation for calculating resistance of the line conductor.
- 13.3 Solve problems on the resistance of the line conductor.
- 13.4 Explain the skin effect of transmission line.
- 13.5 Express the equation for calculating skin effect.
- 13.6 Explain the transposition of line conductors.

14. Understand the constructional features and types of underground cables.

- 14.1 Describe about the under underground cable.
- 14.2 Name the advantages and disadvantages of underground cables.
- 14.3 List different types of underground cables.
- 14.4 List the insulating materials of underground cables.
- 14.5 Describe the constructional features of low voltage, high voltage and super high voltage underground cables.
- 14.6 List the different types of cable faults
- 14.7 Explain the causes of cable faults.
- 14.8 List the different methods of locating cable faults.

15. Understand operation and maintenance of distribution line.

- 15.1 Sketch the circuit diagram of a distribution system
- 15.2 Describe load dispatch of a substation.

- 15.3 List the faults generally occurred in the distribution line.
- 15.4 Discuss the procedure of repairing the damage and faults on the line.
- 15.5 Describe the safety procedures for repair and maintenance of distribution line.

PRACTICAL:

- 1. Make a table for cost of conductor by considering same distance and voltage level.**
 - 1.1 Select different types of conductor.
 - 1.2 Fix up distance and voltage level.
 - 1.3 Collect price list of conductors.
 - 1.4 Prepare a table.
- 2. Survey and estimate the electrical loads of an area.**
 - 2.1 Select the area / section of which the electrical loads are to be surveyed.
 - 2.2 Observe and record the load of each point of the area.
 - 2.3 Calculate the average load of a specific area and the sub-area.
 - 2.4 Calculate the load of main circuit and sub-circuits.
- 3. Perform the calculation of most economical Power factor (graphically).**
 - 3.1 Select the formula to calculate the most economical Power factor.
 - 3.2 Collect the data from a typical mathematical problem.
 - 3.3 Calculate the most economical power factor.
- 4. Sketch the lay out plan of an Electrical Project.**
 - 4.1 Sketch the layout diagram of the selected electrical project.
 - 4.2 Sketch the complete wiring diagram of the electrical project showing transmission line, distribution line and service mains.
 - 4.3 Specify required materials.
 - 4.4 Indicate the energy source.
- 5. Perform the identification of different components of LT and HT over head lines.**
 - 5.1 Identify the components of LT over head lines.
 - 5.2 Specify the components of HT over head line.
 - 5.3 Follow safety practices.
 - 5.4 Prepare a report.
- 6. Perform the measurement of the horizontal distance between poles.**
 - 6.1 Collect the instruments/ equipment commonly used in surveying.
 - 6.2 Measure the horizontal distance between poles over different ground conditions using tape and chain.
 - 6.3 Record the measurement of distance.
 - 6.4 Plot the line route showing the measurements.
- 7. Perform the measurement of the angles and heights of poles / towers.**
 - 7.1 Select the instruments for measuring angles and heights of poles.
 - 7.2 Measure horizontal angles.
 - 7.3 Measure vertical angles.
 - 7.4 Measure vertical heights of poles / towers.

8. Perform the measurement of sag of a transmission / distribution line.

- 8.1 Set the Theodolite/Total station in first position and measure the angle.
- 8.2 Set the Theodolite/Total station in second position and measure the angle.
- 8.3 Calculate the sag of a transmission / distribution line using Theodolite.
- 8.4 Prepare a report.

9. Identify different types of Insulator

- 9.1 Voltage grading
- 9.2 Its uses

10. Identify different types of cable and their uses

- 10.1 Voltage grading
- 10.2 Types of insulator used at different layers.
- 10.3 Types of protector used in opposition to mechanical damage.

11. Visit your nearest Sub Station or Power Station and know how the different sections work

- 11.1 Submit a report

REFERENCE BOOKS

1. A Course in Electrical Energy - J B Gupta.
2. Principles of Energy System - V K Mehta.
3. Transmission & Distribution of Electrical Power - H. Cotton.
4. Electrical Energy system 3rd Revised Edition - Ashfaq Husain

AIMS

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

Course Outline

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

1 Basic concepts & principles of management.

- 1.1 Define management and industrial management.
- 1.2 State the objectives of modern management.
- 1.3 Describe the scope and functions of management.
- 1.4 State the principles of management.
- 1.5 State the activity level of industrial management from top personnel to workmen.
- 1.6 Describe the relation among administration, organization & management.

2. Concept of Planning

- 2.1 Define Planning
- 2.2 Discuss the importance of Planning
- 2.3 Discuss the Types of Planning.
- 2.4 Discuss the steps in Planning

3 . Concepts of organization and organization structure.

- 3.1 Define management organization.
- 3.2 State the elements of management organization.
- 3.3 Describe different forms of organization structure.
- 3.4 Distinguish between line organization and line & staff organization.
- 3.5 Distinguish between line organization and functional organization.
- 3.6 Describe the features, advantages and disadvantages of different organization structure.

4. Concept of scientific management.

- 4.1 Define scientific management.
- 4.2 Discuss the basic principles of scientific management.
- 4.3 Explain the different aspects of scientific management.
- 4.4 Discuss the advantages and disadvantages of scientific management.
- 4.5 Describe the difference between scientific management and traditional management..

5. Concept of span of supervision.

- 5.1 Define span of supervision and optimum span of supervision.
- 5.2 Discuss the considering factors of optimum span of supervision.
- 5.3 Discuss advantages and disadvantages of optimum span of supervision.
- 5.4 Define delegation of authority.
- 5.5 Explain the principles of delegation of authority.
- 5.6 Explain the terms: authority, responsibility and duties.

6 . Concept of motivation.

- 6.1 Define motivation.
- 6.2 Discuss the importance of motivation.
- 6.3 Describe financial and non-financial factors of motivation.
- 6.4 **Special Motivational Techniques.**
- 6.5 Discuss the motivation theory of Maslow and Herzberg.
- 6.6 Differentiate between theory-X and theory-Y.

7. Concept of leadership.

- 7.1 Define leadership.
- 7.2 Discuss the importance and necessity of leadership.
- 7.3 Discuss the functions of leadership.
- 7.4 Describe the qualities of a leader.

8. Basic concepts and techniques of decision making.

- 8.1 Define decision making.
- 8.2 Discuss the importance and necessity of decision making.
- 8.3 Discuss different types of decision making .
- 8.4 Describe the steps in decision making.

9. Concept of personnel management and human relation.

- .9.1 Define personnel management.
- .9.2 Discuss the functions of personnel management.
- 9.3 Define staffing.
- 9.4 Define recruitment and selection of employees.
- 9.5 Describe various sources of recruitment of employees.
- 9.6 Describe the methods of selection of employees.
- 9.7 Define training and orientation of employee.
- 9.8 Discuss the importance and necessity of training.
- 9.9 Discuss the various methods of training of workmen, technicians and executive personnel.

10. Concept of inventory control & Economic lot size

- 10.1 Define inventory.& inventory control.
- 10.2 Describe the function of inventory control.
- 10.3 Define Economic lot size and the Method of determination of economic lot size.
- 10.4 Discuss the effects of over supply and under supply.
- 10.5 Explain the following terms :
 - Bin card or Bin tag.
 - Purchase requisition.
 - Store requisition.
 - Material transfer note.
 - First in first out (FIFO).
 - Last in first out(LIFO).
 - Safety stock
 - Lead time

11. Concept of Break Even Point(BEP)

- 11.1 Define Break Even Point and Break Even Chart.
- 11.2 Describe the method of determination of BEP
- 11.3 Explain the terms :
 - Break even analysis.
 - Fixed cost.
 - Variable cost

12 . Concept of Marketing

- 12.1 Define marketing.
- 12.2 Discuss the function of marketing.
- 12.3 State the objectives of marketing.
- 12.4 Explain the terms :
 - Purchase
 - Brand
 - Producer
 - Consumer
 - Customer
 - Copyright
 - Trade mark
- 12.5 Discuss product life -cycle and marketing strategies in different stages of a product life-cycle

13. Concept of trade union and industrial dispute

- 13.1 Define trade union.
- 13.2 Mention the objectives of trade union.
- 13.3 Discuss the function of trade union.
- 13.4 Describe different types of trade union.
- 13.5 Define industrial dispute

13.6 Discuss different type of industrial dispute

REFERENCE BOOKS

1. Dr. Md. Mainul Islam and Dr. Abdul Awal Khan-Principles of Management, Bangladesh Open University. 2. Mohammad Mohiuddin-Personnel Management and Industrial Relation, NIDS Publication Co. Dhaka. 3. সুফিয়া বেগম, মো: জাহেদুল হক ও সুপ্রিয়া ভট্টাচার্য-ব্যবস্থাপনা এর মৌলিক ধারণা, ব্যতিক্রম প্রকাশনী ঢাকা। Matz Usry-Cost Accounting: Planning & Control.