



**BANGLADESH TECHNICAL EDUCATION BOARD**  
Agargaon, Dhaka-1207

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

# **AUTOMOBILE TECHNOLOGY**

TECHNOLOGY CODE: **662**

6th SEMESTER

DIPLOMA IN ENGINEERING  
PROBIDHAN-2016

**AUTOMOBILE TECHNOLOGY (662)**

**6<sup>th</sup> 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	66261	Advance Automotive Mechanisms	2	3	3	40	60	25	25	150
2	66262	Vehicle Driving & Fitness Test	1	3	2	20	30	25	25	100
3	66263	Automotive Brake & Steering System	2	3	3	40	60	25	25	150
4	66264	Specialized Vehicles	1	3	2	20	30	25	25	100
5	66265	Automotive Electrical & Electronic System -1	2	6	4	40	60	50	50	200
6	67162	Fluid Mechanics & Machineries	3	3	4	60	90	25	25	200
7	65852	Industrial Management	2	0	2	40	60	0	0	100
<b>Total</b>			<b>13</b>	<b>21</b>	<b>20</b>	<b>260</b>	<b>390</b>	<b>175</b>	<b>175</b>	<b>1000</b>

## AIMS

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of automotive engines and their systems with special emphasis on:

- Construction and operation of EFI system.
- Service procedure of EFI system.
- Gasoline direct injection (GDI) system.
- Hybride vehicle.
- Veriable valve timing mechanism.
- Cruise Control & SRS System.
- Accident prevention system.

## SHORT DESCRIPTION

Electronic fuel injection system, Air induction system of EFI engine, Fuel delivery system of EFI engine, Sensors and actuators of EFI engine, Electronic control system of EFI engine, Service procedure of EFI system, Gasoline direct injection (GDI) system, Hybride vehicle, Veriable valve timing mechanism, Cruise Control, Suplimentry Restrain System (SRS) & Accident prevention systems.

## DETAILS DESCRIPTION

### Theory:

#### **1 Understand the concept of electronic fuel injection (EFI) system.**

- 1.1 State the meaning of EFI system.
- 1.2 Outline the importance of EFI system.
- 1.3 Mention the different types of EFI system.
- 1.4 Explain the operating principle of EFI system
- 1.5 Describe the operation of different types of EFI system.
- 1.6 Compare port fuel injection (PFI) and throttle body fuel injection (TBI) system.
- 1.7 Describe basic construction of EFI system.
- 1.8 Mention the advantages and disadvantages of EFI system with respect to carburetor system.

#### **2 Understand the air induction system of EFI engine.**

- 2.1 State the meaning of air induction system.
- 2.2 List the components of EFI air induction system.
- 2.3 Mention the function of each components of air induction system.
- 2.4 Describe the operation of each components of air induction system.
- 2.5 Explain the acoustic control induction system.

#### **3 Understand the fuel delivery system of EFI engine.**

- 3.1 State the meaning of fuel delivery system of EFI engine.
- 3.2 List the components of fuel delivery system of EFI engine.
- 3.3 Mention the function of each components of fuel delivery system.
- 3.4 Describe the construction & operation of each components of fuel delivery system.
- 3.5 Explain the fuel control circuit of EFI fuel system.
- 3.6 Compare pulsed injection with continuous injection system.
- 3.7 Describe the operation of cold start injector/valve . .

#### **4 Understand the features of sensors & Actuator used in EFI engine.**

- 4.1 Mention the function of sensors used in EFI engine.
- 4.2 Outline the importance of sensors in EFI engine.
- 4.3 List the common sensors used in EFI engine.
- 4.4 Describe the construction of each sensor used in EFI engine.
- 4.5 Describe the operation of each sensor used in EFI engine.
- 4.6 List the common actuators used in EFI engine.

4.7 Mention the function of actuators used in EFI engine.

4.8 Describe the construction & operation of Idle speed control (ISC) valve.

**5 Understand the electronic control system of EFI engine.**

5.1 State the meaning of ECU/ECM OF EFI engine.

5.2 Mention the function of ECU/ECM of EFI engine.

5.3 State the meaning of stoichio metric ratio.

5.4 Outline the importance of stoichio metric ratio in EFI engine.

5.5 Mention the function of electronic control system.

5.6 Draw electronic control system with block diagram.

5.7 Describe the air fuel metering system of EFI engine.

**6 Understand the service procedure of EFI system.**

6.1 Describe visual inspection procedure of EFI system.

6.2 Describe the service procedure of throttle body.

6.3 Describe the service procedure of air induction system of EFI engine.

6.4 Describe the service procedure of fuel delivery system of EFI engine.

6.5 Describe the trouble diagnosis procedure of EFI engine with the malfunction indicator light.

6.6 Describe the trouble diagnosis procedure of EFI engine with the scan tool.

6.7 Describe the on board diagnosis system (OBD) procedure of EFI engine.

**7 Understand the concept of gasoline Direct injection (GDI) system.**

7.1 Define GDI system.

7.2 Explain the operating principle of GDI system.

7.3 Compare the GDI system with EFI system.

7.4 Mention the advantages of GDI system.

**8 Understand the concept of hybrid Vehicle.**

8.1 Define hybrid vehicle.

8.2 Mention the type of Hybrid vehicle.

8.3 Explain the operating principle of hybrid vehicle of each type.

8.4 Describe the construction & operation of main components of hybrid mechanism.

8.5 Mention the advantages of hybrid vehicle.

**9 Understand the concept of variable valve Timing mechanism.**

9.1 Define VVT-i system.

9.2 Describe the operation of VVT-i system.

9.3 Mention the advantages of VVT-i system.

9.4 Define variable valve event & lift (VVEL) control system.

9.5 Describe the operation of VVEL control system.

9.6 Mention the advantages of VVEL control system.

9.7 Mention the difference between VVT-i & VVEL control system.

**10 Understand the concept of cruise control system.**

10.1 Define cruise control system.

10.2 Mention the purpose of cruise control system.

10.3 Describe the operation of cruise control system with block diagram.

**11 Understand the concept of traction control system.**

11.1 Define traction control system.

11.2 Describe the operation of traction control system.

11.3 Mention the advantages of traction control system.

**12 Understand the concepts of supplementary restrain system (SRS).**

12.1 Define supplementary restrain system (SRS).

12.2 Describe the operation of air bag system.

12.3 Describe the operation of seat belt mechanism.

12.4 Mention the advantages of SRS.

**13 Understand the concept of accident prevention system.**

13.1 Name the system of accident prevention.

13.2 Explain forward collision warning (FCW) system.

13.3 Explain rear view camera system.

- 13.4 Explain lane departure warning (LDW) system.
- 13.5 Explain lane keeping assistance (LKA) system.
- 13.6 Explain lane auto parking system/ intelligent parking assistance.
- 13.7 Explain tyre pressure monitoring system.
- 13.8 Explain pedestrian detection system.
- 13.9 Explain blind spot monitoring (BSM) system.

## **Practical:**

### **1 Observe the construction of EFI system.**

- 1.1 Identify the components of air induction system.
- 1.2 Identify the components of fuel delivery system.
- 1.3 Identify the sensors.
- 1.4 Identify the actuators.
- 1.5 Identify the ECU/ECM/ ECA.

### **2 Service the throttle body of EFI engine.**

- 2.1 Disconnect the negative cable from the battery.
- 2.2 Disconnect the inlet air duct from the throttle body.
- 2.3 Cover the throttle sensor and idle air control valve with a shop towel.
- 2.4 Plug the air inlet passage with a shop towel.
- 2.5 Block the throttle lever for wide open.
- 2.6 Spray the cleaner (carburetor chock cleaner) around the throttle bore and on the back side of the throttle valves.
- 2.7 Remove heavy deposit by using a nylon parts cleaning brush.
- 2.8 Open and close the throttle lever several time to check for free movement.
- 2.9 Connect the disconnected parts.

### **3 Service the fuel system of EFI engine.**

- 3.1 Make a visual inspection on fuel system.
- 3.2 Relieve fuel line pressure.
- 3.3 Check fuel filter.
- 3.4 Test fuel pump pressure and capacity.
- 3.5 Clean the fuel injectors .
- 3.6 check injection pattern & injection volume.
- 3.7 Check the injector resistance (solenoid winding) for proper value.

### **4 Diagnose the troubles of EFI circuits and devices with malfunction indicator light.**

- 4.1 Identify the diagnostic socket.
- 4.2 Identify the jumper terminals.
- 4.3 Insert a jumper wire in the terminals of diagnostic socket.
- 4.4 Turn the ignition key to on.
- 4.5 Observe and interpret trouble code(S).

### **5 Diagnose EFI system troubles with scantool.**

- 5.1 Identify the diagnostic socket.
- 5.2 Connect the scan tool with the diagnostic socket.
- 5.3 Operate the scan tool.
- 5.4 Read out the trouble codes or scan data from scan tool display.
- 5.5 Compare the scan data with manufacture's service manual to interpret correctly.
- 5.6 Perform road test of the car.

### **6 Observe the construction of the VVT-i system.**

- 6.1 Identify the components of VVTI system.
- 6.2 Disassemble the components.
- 6.3 Test the components.
- 6.4 Assemble the components.

### **7 Observe the construction of the VVEL control system.**

7.1 Identify the components of VVEL control system.

7.2 Disassemble the components.

7.3 Test the components.

7.4 Assemble the components.

**8 Observe the construction of the GDI system.**

8.1 Identify the components of GDI system.

8.2 Disassemble the components.

8.3 Test the components.

8.4 Assemble the components.

**9 Observe the construction of the SRS system.**

9.1 Identify the components of SRS system.

9.2 Disassemble the components.

9.3 Test the components.

9.4 Assemble the components.

**10 Observe the construction of the cruise system.**

10.1 Identify the components of cruise system.

10.2 Disassemble the components.

10.3 Test the components.

10.4 Assemble the components.

**REFERENCE BOOKS**

1. Automotive Mechanics  
-W.H Crouse & Anglin
2. Auto Mechanics  
- Mitchell
3. Auto Repair for Dummies  
- Deana Sclar

## OBJECTIVES

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

- driving technique
- traffic signals and acts
- safety and first aid.
- fitness test

## SHORT DESCRIPTION

Fitness to drive vehicle, Ideal position of driver, Vehicle marching procedure, Technique of gear changing, Braking, stopping, parking, turning, Overtaking, skidding, Emergencies, safety and first aids, Daily maintenance, Traffic signals & acts. Fitness test, Driving regulation, Driving licenses, Vehicle registration, Road permit, fitness certificate, tax-token & insurance certificate.

## DETAIL DESCRIPTION

### THEORY:

#### **1. Understand the fitness & ideal position of a driver.**

- 1.1 Mention the physical fitness of a driver.
- 1.2 Mention the mental fitness of a driver.
- 1.3 Explain color blind, vision error and car sickness.
- 1.4 Identify the causes of fatigue of a driver.
- 1.5 Describe the ideal sitting position of a driver.
- 1.6 Explain the necessity of seat-belt.

#### **2. Understand the vehicle marching procedure.**

- 2.1 Name different types of controlling devices.
- 2.2 Explain the function of controlling devices during driving.
- 2.3 Mention the driver's duties & responsibilities before moving.
- 2.4 Describe the technique of moving vehicle.
- 2.5 Explain the necessity of clutch operation during gear change.
- 2.6 Explain the technique of changing gear position by hand in case of floor gears.

#### **3. Understand the braking, stopping, parking, turning overtaking & skidding.**

- 3.1 Define braking distance.
- 3.2 Explain brake testing before moving off.
- 3.3 Explain parallel parking, angular parking and dead end parking.
- 3.4 Describe the turning procedure at right turn and left turn.
- 3.5 Describe the turning procedure at a blind corner.
- 3.6 Describe the procedure of overtaking.
- 3.7 Explain the safe distance.
- 3.8 Mention the causes of skidding.

#### **4. Understand the daily maintenance emergencies and first aid.**

- 4.1 Describe the necessity for daily maintenance.
- 4.2 Mention the items of daily checking.
- 4.3 Mention the checking items before starting the engine.
- 4.4 Mention the duties of a driver during brake failure.
- 4.5 Mention the duties of a driver during the emergency stopping.
- 4.6 Mention the duties of a driver during towing.

- 4.7 List the emergency aids in the first aid box.
- 4.8 Describe the common first aid procedure such as: burning, cutting & breaking of bone.
- 5. Understand the traffic signals and acts.**
  - 5.1. Define traffic signals.
  - 5.2. Mention the type of traffic signals.
  - 5.3. Explain different road signals recommended by BRTA.
  - 5.4. Explain different road markings.
  - 5.5. Explain the road signals shown by the traffic police / signal light.
  - 5.6. Explain the signal shown by the driver for turning, slowing down, stopping, overtaking etc.
  - 5.7. Explain the signal and signaling devices fitted to a vehicle.
  - 5.8. Describe the vehicle act no 92, 93, 94, 95, 96 97, 98, 99, 100, 101, 102, 103, 138, 139, 144, 145, 148, 150, 152 & 155.
- 6. Understand driving regulation.**
  - 6.1. List the documents and papers that a driver should have during driving.
  - 6.2. Mention the precautions of driving during night, raining and foggy weather.
  - 6.3. Mention the precautions of driving on hilly, sandy and sleepy road.
  - 6.4. Explain the duties of a driver in case of accident and injury of a person.
  - 6.5. Explain what a driver should do and what should not do during driving.
  - 6.6 Describe the process of grant of licence.
  - 6.7 Describe the process of registration.
  - 6.8 Describe the process of transfer of ownership of a vehicle.
- 7. Understand the fitness of vehicle.**
  - 7.1 Define fitness of a vehicle.
  - 7.2 Explain Emission control.
  - 7.3 Explain brake performance test.
  - 7.4 Explain suspension test.
  - 7.5 Explain lighting & signaling device test.
  - 7.6 Define road permit, fitness certificate, tax-token, insurance certificate.
  - 7.7 Mention the necessity of road permit, fitness certificate, tax-token, insurance certificate, PSV badge and conductor's licence.

## **Practical:**

- 1. Practice the idle sitting & pre-inspection before driving.**
  - 1.1. Adjust the seat.
  - 1.2. Set the seat belt.
  - 1.3. Set the eye, body, head, leg at ideal position.
  - 1.4 Check the parking break.
  - 1.5 Check the neutral condition of gear.
  - 1.6 Check the side & other mirror position.
- 2. Practice on marching the vehicle & gear changing.**
  - 2.1. Start the engine.
  - 2.2. Press the clutch pedal.
  - 2.3. Engage 1<sup>st</sup> gear.
  - 2.4. Release the clutch pedal.
  - 2.5. Press the accelerator pedal & control starting.
  - 2.6. Press the clutch pedal.
  - 2.7. Change the gear to next low gear.
  - 2.8. Release the clutch pedal.
- 3. Practice the turning of vehicle towards left or right & stopping.**
  - 3.1. Decrease the speed of vehicle.
  - 3.2. Give the turning signals.



- 3.3. Observe the road condition and make turning.
- 3.4. Press the clutch pedal.
- 3.5. Press the brake pedal.
- 3.6. Neutralize the gear.

**4. Practice the overtaking a vehicle.**

- 4.1. Give the signal for turning.
- 4.2. Increase the speed and complete overtaking.
- 4.3. Turn the vehicle to left side or the right side.

**5. Practice the parking of vehicle.**

- 5.1. Set the back gear.
- 5.2. Release the clutch and press accelerator pedal.
- 5.3. See the view on side mirror.
- 5.4. Control the steering wheel.
- 5.5. Complete the parking.

**6. Practical driving with auto gear.**

- 6.1 Select proper shifting lever of auto gear.
- 6.2 Control accelerating pedal for proper speed.
- 6.3 Drive using O/D.

<b>66263</b>	<b>Automotive Brake &amp; Steering System</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>3</b>	<b>3</b>

## AIMS

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

- construction and operation of brake system
- construction & operation of ABS, EBD & SBC system
- construction and operation of conventional steering system
- construction and operation of power steering system

## SHORT DESCRIPTION

Features of mechanical, hydraulic, servo, servo-assisted hydraulic, air brake, anti lock brake system (ABS), electronic brake force distribution (EBD) sensor brake control (SBC) system and their components, such as: master cylinder, wheel cylinder, disc brake, drum brake, hydraulic modulator, air compressor, air valves etc. and servicing of brake system: Mechanical, hydraulic & electrical power steering and its components, steering geometry & servicing of steering system.

## DETAIL DESCRIPTION

### Theory:

#### 1. Understand the features of brake system.

- 1.1 Mention the purposes of brake system.
- 1.2 Explain the principle of braking.
- 1.3 Mention the classification of automotive brake system.

#### 2. Understand the features of mechanical brake (parking) system.

- 2.1 Define mechanical brake system.
- 2.2 List the components of mechanical brake system.
- 2.3 Describe the operation of mechanical brake system

#### 3. Understand the features of hydraulic brake system.

- 3.1 Define hydraulic brake system.
- 3.2 Mention the characteristics of different type of brake fluid & its use.
- 3.3 List the components of hydraulic brake system.
- 3.4 Describe the construction of wheel cylinder, brake shoe, brake shoe lining and brake drum & calipers.
- 3.5 Describe the operation of hydraulic brake system (drum brake).
- 3.6 Describe the operation of hydraulic brake system (disc brake).
- 3.7 Compare disc brake with drum brake.
- 3.8 Mention the advantages & disadvantages of disc brake mechanism.

#### 4. Understand the features of brake master cylinder.

- 4.1 Mention the function of brake master cylinder.
- 4.2 Describe the operation of brake master cylinder.
- 4.3 Mention the function of check valve, feeling hole and compensation port.
- 4.4 Describe operation of tandem master cylinder.
- 4.5 List the advantages of tandem master cylinder.

#### 5. Understand the vacuum assisted hydraulic brake.

- 5.1 Define vacuum assisted hydraulic brake.
- 5.2 List the components of vacuum assisted hydraulic brake.
- 5.3 Describe operation of vacuum assisted hydraulic brake.
- 5.4 Describe the operation of servo unit (Brake Booster).
- 5.5 Mention the uses of vacuum pump.
- 5.6 Mention the advantages of vacuum assisted hydraulic brake system.

**6. Understand the air assisted hydraulic brake.**

- 6.1 Define air assisted hydraulic brake.
- 6.2 List the components of air assisted hydraulic brake.
- 6.3 Describe the operation of air assisted hydraulic brake.
- 6.4 Mention the advantages of air assisted hydraulic brake.

**7. Understand the air brake.**

- 7.1 Define air brake.
- 7.2 Mention the purposes of air brake.
- 7.3 Describe the construction of air brake.
- 7.4 Describe the operation of air brake.
- 7.5 Explain the importance of air compressor, unloaded valve, air regulator valve, brake chamber and brake valve.
- 7.6 Mention the advantages of air brake.
- 7.7 Mention the difference between conventional air brake system and self locking air brake system.

**8. Understand the feature of electronically controlled brake system.**

- 8.1 State the meaning of ABS, EBD & SBC.
- 8.2 Describe the operation of anti lock brake (ABS) system.
- 8.3 Describe the operation of electronic brake force distribution (EBD) system.
- 8.4 Describe the operation of sensotronic brake control (SBC) system.
- 8.5 Mention the difference among ABS, EBD & SBC.
- 8.6 Mention the advantages of ABS, EBD & SBC.

**9. Understand the features of brake system servicing.**

- 9.1 Define the terms: brake shoe clearance, brake pedal free play, spongy brake, brake bleeding, brake system flashing.
- 9.2 Describe the adjusting procedure of brake shoe clearance and brake pedal free play.
- 9.3 Describe the brake bleeding process.
- 9.4 Describe the process of brake system flashing.
- 9.5 Describe the process of master cylinder servicing.
- 9.6 Describe the process of brake disc and drum servicing.
- 9.7 Describe the process of trouble shooting and diagnosis.
- 9.8 Describe the self adjusting brake mechanism.

**10. Understand the features of steering system.**

- 10.1 Mention the purpose of steering system.
- 10.2 Mention the types of steering system.
- 10.3 Describe the operation of conventional (mechanical) steering system.
- 10.4 Name the different types of steering gear box.
  - 10.5 Describe the operation of steering gear box of each type.
  - 10.6 Describe the construction of steering linkage of different types.
  - 10.7 Describe the operation of telescopic steering wheel.
  - 10.8 Describe the operation of collapsible steering column.
  - 10.9 Describe the operation of four wheel steering system.

**11 Understand the features of hydraulic power steering system.**

- 11.1 State the meaning of power steering system.
- 11.2 Classify the different types of power steering system.
- 11.3 Describe the operation of integral power steering system.
- 11.4 Describe the operation of linkage booster power steering system.
- 11.5 Describe the construction & operation of rack & pinion power steering system.
- 11.6 Name the types of power steering pump.
- 11.7 Describe the operation of vane type power steering pump.

**12 Understand the features of electric power steering system**

- 12.1 State the meaning of electric motor power steering (EMPS) system.
- 12.2 List the components of EMPS.
- 12.3 Describe the operation of EMPS system.

12.4 Mention the advantages EMPS.

**13 Understand the features of front end geometry (Steering geometry/wheel alignment).**

13.1 Define the term front end geometry (steering geometry/wheel alignment).

13.2 List the factor which affects the front end geometry.

13.3 List the advantages of accurate front end alignment or wheel alignment.

13.4 Describe the terms: camber angle, castor angle, king pin inclination, included angle, toe-in and Toe-out on turn.

13.5 Mention the necessity of camber angle, caster angle, king pin inclination, Toe- in and Toe-out on turn.

13.6 Mention the approximate range of camber angle, caster angle, king pin inclination, Toe- in and Toe-out on turn.

13.7 Describe the adjusting procedure of camber angle, caster angle, Toe- in and Toe-out on turn.

**Practical:**

**1 Observe the operation mechanical brake system & test.**

1.1 Identify the components of mechanical brake system.

1.2 Disassemble the mechanical brake system.

1.3 Assemble the mechanical brake system.

1.4 Adjust the mechanical brake system.

1.5 Test the mechanical brake system.

**2 Observe the construction of hydraulic brake system & test.**

2.1 Remove master cylinder, wheel cylinder, brake shoe, brake drum, brake disc, etc.

2.2 Clean and install the components.

2.3 Bleed the brake system.

2.4 Adjust the brake shoe clearance.

2.5 Test the performance of brake system.

**3 Observe the construction of master cylinder (conventional type).**

3.1 Disassemble the master cylinder.

3.2 Clean and test the workability of each component.

3.3 Assemble the master cylinder.

**4 Observe the construction of tandem master cylinder.**

4.1 Disassemble the tandem master cylinder.

4.2 Clean and test the workability of each component.

4.3 Assemble the tandem master cylinder.

**5 Observe the construction of servo unit & test.**

5.1 Disassemble the servo unit.

5.2 Identify the components.

5.3 Assemble the servo unit.

5.4 Test the performance of servo unit.

**6 Observe the construction of air brake system & test.**

6.1 Identify the components of air brake system.

6.2 Disassemble the system.

6.3 Assemble the components.

6.4 Test the performance.

**7 Observe the construction of steering system & test.**

7.1 Identify the components of steering system.

7.2 Disassemble the system.

7.3 Clean and assemble the system.

7.4 Test the performance of steering system.

**8 Observe the construction of steering gearbox.**

8.1 Disassemble the steering gearbox.

8.2 Clean and test the each component of steering gearbox.

8.3 Assemble the gearbox.

8.4 Adjust the steering gear box

**9 Observe the construction of power steering system & test.**

- 9.1 Identify the components.
- 10.2 Disassemble the components and clean.
- 9.3 Assemble the system.
- 9.4 Test the performance.

**10 Observe the front end geometry/wheel alignment.**

- 10.1 Check and adjust the toe-in & toe-out.
- 10.2 Check and adjust the comber angle.
- 10.3 Check and adjust the castor angle.

## **REFERENCE BOOKS**

1. Automotive Mechanics.  
– W. H. Crouse and Anglin.
2. Automobile Engineering  
– Dr. Kripal Singh.
3. Automobile Engineering  
– G. B. S Narang
4. Automobile Engineering  
- R.B. Gupta
5. Automobile Engineering  
- K.K. Ramalingam
6. Automobile Engineering  
- N.K. Gir

## AIMS

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

- Function, construction and operation of specialized vehicle.
- Uses of specialize vehicle.
- Trouble-diagnosis of specialized vehicle.

## SHORT DESCRIPTION

Uses and dimension code of specialized vehicle; Farm tractor; Trouble-diagnosis of tractor; Trailers; Power tiller; Dozer; Hydraulic excavators; Road roller.

## DETAIL DESCRIPTION

### THEORY

- 1. Understand the uses and dimension code of specialized vehicle.**
  - 1.1 State the meaning of specialized vehicle.
  - 1.2 Mention the purpose of specialized vehicle.
  - 1.3 List the different specialized vehicle.
  - 1.4 Describe the uses of different specialized vehicle.
  - 1.5 Illustrate the vehicle dimension code.
- 2. Understand the features of farm tractors.**
  - 2.1 Define farm tractor.
  - 2.2 Mention the difference between wheel tractor and crawler tractor.
  - 2.3 Name different systems of tractors.
  - 2.4 Describe the clutch mechanism of tractors.
  - 2.5 Describe the transmission / gear mechanism of tractors.
  - 2.6 Describe the final drive / differential mechanism.
  - 2.7 Describe the hydraulic control mechanism.
  - 2.8 Describe the operation of steering system of tractor.
  - 2.9 Describe the maintenance procedure of a tractor.
- 3. Understand the features of trailers.**
  - 3.1 State the meaning of trailer.
  - 3.2 Mention the purpose of trailer.
  - 3.3 Mention different types of trailer.
  - 3.4 Explain the features of full trailer, semi trailer, balance trailer converter dolly and pole trailer.
  - 3.5 Mention the difference between full trailer and a semi trailer.
  - 3.6 Describe the construction of trailer.
  - 3.7 Mention the troubles, possible causes and remedies of trailer.
- 4. Understand the features of power tiller.**
  - 4.1 State the meaning of power tiller.
  - 4.2 Mention the uses of power tiller.
  - 4.3 Name the major components of power tiller.
  - 4.4 Describe the operating mechanism of power tiller.
  - 4.5 Describe the turning process of power tiller.
  - 4.6 Describe the power transmission system of power tiller.
  - 4.7 Describe the plow depth adjustment system of power tiller.

- 4.8 Describe the servicing procedure of power tiller.
- 4.9 Discuss different brand of power tiller used in Bangladesh.
- 4.10 Mention the troubles, possible causes and remedies of power tiller.
- 5. Understand the features of dozer.**
- 5.1 State the meaning of dozer.
- 5.2 Mention the types of dozer.
- 5.3 Name the major components of dozer.
- 5.4 Describe the uses of dozer.
- 5.5 Describe the operation of dozer.
- 5.6 Mention the troubles, possible causes and remedies of dozer.
- 6 Understand the features of hydraulic excavators.**
- 6.1 State the meaning of hydraulic excavators.
- 6.2. Mention the types of hydraulic excavator.
- 6.3 Name the major components of hydraulic excavator.
- 6.4 Describe the uses of hydraulic excavator.
- 6.5 Describe the operation of hydraulic excavator.
- 6.6 Mention the troubles, possible causes and remedies of hydraulic excavator.
- 7. Understand the features of road roller**
- 7.1 State the meaning of road roller.
- 7.2 Name different components of road roller.
- 7.3 Describe the uses of road roller.
- 7.4 Describe the operation of road roller.
- 7.5 Mention the troubles, possible causes and remedies of road roller.

## **Practical:**

- 1. Observe the construction of farm tractor.**
- 1.1. Identify different types of farm tractors.
- 1.2. Identify different systems of farm tractor.
- 1.3. Identify different components of farm tractor.
- 2. Observe the construction of clutch of farm tractor.**
- 2.1. Remove the clutch assembly.
- 2.2. Inspect the components of clutch assembly.
- 2.3. Install the clutch assembly.
- 3. Observe the construction of transmission of farm tractor.**
- 3.1. Remove the transmission assembly.
- 3.2. Inspect the components of transmission assembly.
- 3.3. Install the transmission assembly.
- 4. Observe the construction of final drive / differential of farm tractor.**
- 4.1. Remove the final drive of farm tractor/differential of farm tractor.
- 4.2. Inspect the components of final drive.
- 4.3. Install the final drive of farm tractor.
- 5. Observe the construction of hydraulic control mechanism of farm tractor.**
- 5.1. Identify the hydraulic control mechanism of farm tractor.
- 5.2. Inspect the components of hydraulic control mechanism.
- 5.3. Observe the operation of hydraulic control mechanism.
- 6. Observe the operation of power tiller.**
- 6.1. Identify the different systems of power tiller.
- 6.2. Identify the components of power tiller.
- 6.3. Observe operation of power tiller.
- 6.4 Diagnose and rectify the troubles of power tiller.
- 7 Observe the construction of dozer.**

- 7.1 Identify the different systems of dozer.
- 7.2. Identify the components of dozer.
- 7.3. Observe the operation of dozer.
- 8 Observe the construction of hydraulic excavators.**
  - 8.1. Identify the different systems of excavators.
  - 8.2. Identify the components of excavator.
  - 8.3. Observe the operation of excavators.
- 9 Observe the construction of road roller.**
  - 9.1 Identify the different systems of road roller.
  - 9.2. Identify the components of road roller.
  - 9.3. Observe the operation of road roller.
- 10. Visit some industry in where maximum specialized vehicles are available.**

## **REFERENCE BOOKS**

- 1. Diesel equipment  
-Enich J. Schulz
- 2. Automotive technology  
- K.K.Ramalingam



## AIMS

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

- function, construction and operation of electrical and electronic devices used in automobile
- trouble shooting and diagnosis of electrical and electronic devices used in automobile
- color coding and selection of wire for wiring of automobiles

## SHORT DESCRIPTION

Features of automotive battery, Battery testing, Battery charging, Battery maintenance, Conventional ignition system, Ignition distributor, Spark plug, Magneto ignition system, Magnetic pick up ignition system, Capacitor discharge ignition system, Distributor less ignition system, Direct ignition system, Electric motor starting system, Charging system, Automobile wiring.

## DETAIL DESCRIPTION

### THEORY

- 1 Understand the features of automotive battery.**
  - 1.1 Define battery cell and battery.
  - 1.2 Mention the function of battery in automobile.
  - 1.3 Describe the constructions of lead acid battery.
  - 1.4 Describe the construction of each component of lead acid battery.
  - 1.5 Explain the chemical reaction happens in battery cell during charging and discharging period.
  - 1.6 Explain battery efficiency, battery capacity and battery ratings.
  - 1.7 Explain the effect of temperature on battery characteristics and electrolyte gravity.
  - 1.8 Explain self discharge characteristics of a lead acid battery.
- 2 Understand the features of battery charging.**
  - 2.1 Define battery charging.
  - 2.2 Name the different types of battery charging system.
  - 2.3 Draw a charging circuit diagram from AC 220V.
  - 2.4 Describe the procedure of slow charging.
  - 2.5 Describe the procedure of quick charging.
  - 2.6 Describe the procedure of trickle charging.
  - 2.7 Describe the procedure of preparing electrolyte.
  - 2.8 Explain the charging sulfated battery.
  - 2.9 Describe the process of charging more than one battery at a time.
- 3 Understand the battery testing and maintenance.**
  - 3.1 Name the different testing procedure of battery.
  - 3.2 Describe the testing procedure of specific gravity of the electrolyte.
  - 3.3 Describe the high discharge testing procedure.
  - 3.4 Describe the battery testing procedure by electronic tester.
  - 3.5 Mention the steps of battery maintenance.
  - 3.6 Explain over charging failure, sulphation failure, cycling failure & internal short circuit failure.
  - 3.7 Describe the process of storing of dry and wet lead acid battery.
  - 3.8 Mention the advantages of maintenance free battery.
- 4 Understand the features of conventional ignition system.**

- 4.1 Mention the purposes of ignition system.
- 4.2 Mention the classification of the ignition system.
- 4.3 Describe the operation of battery coil ignition system.
- 4.4 Mention the function of each component of battery coil ignition system.
- 4.5 Describe the construction of ignition switch, ignition coil, blast resistor, condenser, C.B.Point and spark plug.
- 4.6 Mention the classification of spark plug.
- 4.7 Mention the specification of spark plug.
- 5 Understand the features of ignition distributor.**
  - 5.1 Mention purposes of ignition distributor.
  - 5.2 Name the different types of ignition distributor.
  - 5.3 Describe the operation of conventional ignition distributor.
  - 5.4 Explain the role of dwell angle in ignition system.
  - 5.5 Mention the purposes of CB point gap adjusting.
  - 5.6 Explain the importance of spark advance.
- 6 Understand the features of magneto ignition system.**
  - 6.1 Mention the purposes of magneto ignition system.
  - 6.2 Name the different types of magneto ignition system.
  - 6.3 Describe the operation of magneto ignition system.
  - 6.4 Mention the advantages of magneto ignition system.
- 7 Understand the features of capacitor discharge ignition (CDI) system.**
  - 7.1 Mention the function of diode, zenor diode, SCR (Thyristor), Transistor & IC.
  - 7.2 Mention the purposes of CDI system.
  - 7.3 Mention the different types of CDI system.
  - 7.4 Describe the operation of Magneto & Battery CDI system.
  - 7.5 Mention the function of each component of CDI systems.
  - 7.6 Explain Hall Effect principle.
- 8 Understand the features of Magnetic pulse/pickup distributor or integrated ignition assembly (IIA).**
  - 8.1 State the meaning of integrated ignition assemblies (IIA).
  - 8.2 Mention the types of integrated ignition assemble (IIA).
  - 8.3 Mention the function of each components of magnetic pulse distributor or IIA.
  - 8.4 Describe the operation of magnetic pulse distributor ignition system or IIA (without ECU & with ECU).
  - 8.5 Mention the advantages of magnetic pulse distributor or IIA system.
- 9 Understand distributor less ignition (DLI) system.**
  - 9.1 Mention the purposes of distributor less ignition system.
  - 9.2 Mention the function of each component of DLI system.
  - 9.3 Describe the operation of DLI system.
  - 9.4 Mention the advantages & disadvantages of DLI system.
- 10 Understand the feature of direct ignition system (DIS).**
  - 10.1 Define DIS.
  - 10.2 Mention the components of DIS.
  - 10.3 Describe the operation of DIS.
  - 10.4 Compare DIS with DLI system.
  - 10.5 Mention the advantages of DIS.
- 11 Understand the starting system.**
  - 11.1 Mention the necessity of starting system.
  - 11.2 Classify the starting system.
  - 11.3 Describe the operation of manual starting system.
  - 11.4 Describe the operation of electric motor starting system with circuit diagram.
  - 11.5 Describe the construction of armature, commutator, pole shoe, field coil, carbon brush, etc.
  - 11.6 Describe the operation of over running clutch and bendix mechanism.
  - 11.7 Describe the construction & operation of solenoid switch.
  - 11.8 Explain the starter motor drive mechanism & planetary gear set for gear reduction.

11.9 Describe the procedure of testing, fault finding and repair of starting motor and its components.

**12 Understand the charging system.**

12.1 Mention the purpose of automobile charging system.

12.2 Describe the operation of automobile charging system with circuit diagram.

12.3 Describe the construction of alternator.

12.4 Describe the operation of alternator.

12.5 Mention the function of alternator rectifier, heat sink, rotor, stator, slip ring, carbon brush, etc.

12.6 Describe the operation of alternator regulator.

12.7 Explain the field excitation, self excitation and battery excitation type alternator.

12.8 Describe the warning light control operating mechanism.

12.9 Describe the procedure of testing, servicing and repairing of alternator and its components.

**13 Understand the features of automobile wiring.**

13.1 Explain cable color coding and cable size selection.

13.2 State the meaning of wiring harness.

13.3 List the typical cable connectors for auto-electrical equipment.

13.4 Explain uses of fuses, fusible link, circuit breakers and various relays used in automobile.

13.5 Explain a simplified wiring diagram of automobile.

13.6 Explain the printed circuit board and its use in automobile.

13.7 Mention the electrical load for a passenger car.

13.8 Draw the symbols used in automotive electrical diagram.

**PRACTICAL:**

**1 Observe the construction of battery.**

1.1 Identify the external parts of a lead acid battery.

1.2 Cut and disassemble an old (rejected) lead acid battery.

1.3 Identify each component of battery.

**2 Perform specific gravity test of lead acid battery.**

2.1 Open all vent plugs.

2.2 Topping up the battery.

2.3 Measure specific gravity of all cells by hydrometer and record the readings.

2.4 Compare the readings and find out the problem.

**3 Perform high discharge test of a lead acid battery.**

3.1 Before load testing be sure that the battery has at least three fourth charged.

3.2 Press the two legs of high discharge tester on each cell terminals for 5 seconds only.

3.3 Record the reading from voltmeter of tester.

3.4 Compare the readings and find out the problem.

**4 Practice charging a lead acid battery.**

4.1 Clean the post terminals and topping up the battery.

4.2 Connect the battery with charger.

4.3 Set the voltage and current for slow charging.

4.4 Set the voltage and current for quick charging.

4.5 Set the voltage and current for trickle charging.

4.6 Set the voltage and current for charging more than one battery at a time.

**5 Perform maintenance of a lead acid battery.**

5.1 Clean the battery.

5.2 Remove the white corrosion and dirt from post terminals.

5.3 Topping up the battery.

5.4 Clean the vent plug holes.

5.5 Test the battery to find out the problem.

- 6 Practice the preparation of electrolyte.**
  - 6.1 Take some distilled water in a beaker.
  - 6.2 Pour the sulfuric acid slowly in the beaker with distilled water and stir.
  - 6.3 Measure the specific gravity for required value.
- 7 Perform the battery coil ignition system circuit connection & observe operation.**
  - 7.1 Identify the components of battery coil ignition system.
  - 7.2 Connect the component and complete the wiring on a circuit board.
  - 7.3 Test the operating condition of the circuit.
- 8 Observe the construction of ignition distributor.**
  - 8.1 Disassemble the distributor.
  - 8.2 Identify the components of distributor.
  - 8.3 Assemble the distributor.
- 9 Service the spark plug.**
  - 9.1 Clean the spark plug perfectly.
  - 9.2 Check the insulation for cracking.
  - 9.3 File the tip of center electrode.
  - 9.4 Adjust the gap accurately.
  - 9.5 Check the intensity of spark.
- 10 Observe the magneto ignition system.**
  - 10.1 Identify the components of magneto ignition system.
  - 10.2 Connect and complete the wiring of the system.
  - 10.3 Test the performance of the system.
- 11 Observe the CDI system of motor cycle.**
  - 11.1 Identify the components of CDI system.
  - 11.2 Connect and complete the wiring circuit of the system.
  - 11.3 Test the inverter, rectifier, thyristor and capacitor.
  - 11.4 Test the operation of the system.
- 12 Observe the operation of magnetic pick up distributor type ignition system.**
  - 12.1 Identify the component of magnetic pick up distributor.
  - 12.2 Connect & complete the wiring circuit of magnetic pick up distribution ignition system.
  - 12.3 Test the operation of the system.
- 13 Observe the operation of distributor less ignition (DLI) system & test.**
  - 13.1 Identify the components of DLI system.
  - 13.2 Connect and complete the wiring of DLI system.
  - 13.3 Test the operation of the system.
- 14 Observe the operation of Direct system (DIS) & test.**
  - 14.1 Identify the components of DIS.
  - 14.2 Connect & complete the wiring of DIS.
  - 14.3 Test the operation the system.
- 15 Observe the operation of starter motor circuit & test.**
  - 15.1 Identify the components of starting motor circuit.
  - 15.2 Remove the starting motor from the engine.
  - 15.3 Clean and reinstall the motor.
  - 15.4 Complete the starting circuit.
  - 15.5 Test the operation.
- 16 Observe the construction of starter motor.**
  - 16.1 Disassemble the starter motor.
  - 16.2 Test each component for workability.
  - 16.3 Assemble the starter motor.
  - 16.4 Test the starter motor with load and no-load condition.
- 17 Observe the operation of solenoid switch of starter motor & test.**
  - 17.1 Disassemble the solenoid switch (if possible).
  - 17.2 Test its contact points and disc.
  - 17.3 Test its pull-in-coil and hold in coil.
  - 17.4 Assemble the solenoid switch.

- 18 Observe the operation of alternator & test.**
- 18.1 Disassemble the alternator.
  - 18.2 Test each component for workability.
  - 18.3 Assemble the alternator.
  - 18.4 Run the engine and measure the output of alternator.
- 19 Observe the wiring and insulation of automobile.**
- 19.1 Identify the color code for each circuit.
  - 19.2 Select proper size of wire for each circuit.
  - 19.3 Identify different fuses and relays used in automobile.
  - 19.4 Test the continuity of each circuit.
  - 19.5 Test for short circuit of wiring.

## **BOOK REFERENCE**

- 1 Automotive Electrical Equipment
  - by W. H Crouse.
- 2 Automobile Electrical and Electronic System
  - by A. Tranter.
- 3 Automotive Electronic System
  - by Trevor Mellard.
- 4 Automobile Electrical Equipment
  - by P. L. Kohli

**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 venturi 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 Chey'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.

**REFERENCE BOOKS**

- 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 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

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