



BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

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

POWER TECHNOLOGY

TECHNOLOGY CODE: **671**

4th SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

POWER TECHNOLOGY (671)

4th SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	67141	Engine Details	3	3	4	60	90	25	25	200
2	67041	Engineering Mechanics	3	3	4	60	90	25	25	200
3	67142	Automotive Suspension, Brake, Steering & Transmission system	2	6	4	40	60	50	50	200
4	67143	Fuels & Lubricants	2	3	3	40	60	25	25	150
5	66743	Electrical Circuits & Machine	3	3	4	60	90	25	25	200
6	65841	Business Organization & Communication	2	0	2	40	60	0	0	100
Total			15	18	21	300	450	150	150	1050

67141 Engine Details

T P C
3 3 4

AIMS:

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

- Functions of internal combustion (IC) engines.
- Types of internal combustion (IC) engines.
- Dimensions of IC engines.
- Working principle of IC engines.
- Construction and operation of IC engine components.
- Systems of IC engines.
- Supercharging of IC engines.
- Combustion process of IC engines.

SHORT DESCRIPTION

Functions & types of internal combustion (IC) engines; Construction and operation of engine components; Dimensions of IC engines; Working principle of IC engines; Valve trains; Lubricating system; Cooling system; Petrol engine fuel system; Diesel engine fuel system; Supercharging & scavenging; Combustion process of IC engines.

DETAIL DESCRIPTION

Theory:

1. Understand the feature of Dimension of IC engines

- 1.1 Define IC engine.
- 1.2 Classify the IC engine on the basis of different terms.
- 1.3 List the basic terms of IC engine dimensions.
- 1.4 Explain the terms bore and stroke, piston displacement, clearance volume and compression ratio.
- 1.5 Discuss the engine torque and efficiency.
- 1.6 Compute the formula to calculate indicated power (IP), break power (BP) and frictional power (FP).
- 1.7 Solve problems on IP, BP, FP and engine capacity.

2. Understand the construction & functional features of IC engine.

- 2.1 List the moving parts and stationary parts of an IC engine.
- 2.2 Mention the function of stationary and moving parts of an IC engine.
- 2.3 Describe the operation of piston, piston rings, piston pin, connecting rod, camshaft and crankshaft.
- 2.4 Describe the construction of stationary and moving parts of an IC engine

3. Understand the features of IC engines.

- 3.1 State the working principle of 2-stroke and 4-stroke SI & CI engines.
- 3.2 Compare the SI and CI engines.
- 3.3 Compare the 2-stroke and 4-stroke engines.
- 3.4 List the advantages and disadvantages of CI and SI engines.
- 3.5 List the advantages and disadvantages of 2-stroke and 4-stroke engines.

4. Understand the features of valve trains of IC engines.

- 4.1 State the valve mechanism/trains.
- 4.2 Describe the different valve operating mechanism.
- 4.3 Explain the operation of hydraulic valve lifter.
- 4.4 Describe the fixed valve timing & variable valve timing
- 4.5 Outline the importance of valve timing.
- 4.6 Draw valve timing diagram of IC engine.
- 4.7 Explain the methods of valve timing.
- 4.8 State variable valve timing intelligent (VVT-i)
- 4.9 Mention the advantages of VVT-i

5. Understand the engine lubricating system.

- 5.1 Mention the purposes of lubricating system.
- 5.2 Classify lubricating system.
- 5.3 Describe the operation of lubricating systems.
- 5.4 Describe the construction and operation of oil pumps and oil filters.

- 5.5 Outline the importance of crankcase ventilation.
- 5.6 Describe the operation of different types of crankcase ventilation.
- 5.7 State the function of oil mist detector and oil pressure relief valve.
- 5.8 Mention the lubricating system troubles, possible causes and remedies.
- 6. Understand the features of cooling system.**
 - 6.1 Mention the necessity of engine cooling.
 - 6.2 Classify cooling system.
 - 6.3 Describe cooling system components.
 - 6.4 Describe the operation of various cooling system.
 - 6.5 Describe the construction of cooling water pump & radiator.
 - 6.6 Explain the use of antifreeze solution.
 - 6.7 Describe the cooling system (Radiator and water jacket) flushing procedure.
 - 6.8 Mention the cooling system troubles and their remedies.
- 7. Understand the features of carbureted gasoline engine fuel system.**
 - 7.1 List the components of gasoline engine fuel system.
 - 7.2 Draw the flow diagram of SI engine fuel system.
 - 7.3 State the basic principle of carburetion.
 - 7.4 Explain the functions of a carburetor.
 - 7.5 List the different circuits of a carburetor.
 - 7.6 Explain the air fuel ratio requirements with different carburetor Circuit operation at different speeds.
- 8. Understand the features of advance fuel systems.**
 - 8.1 Define the gasoline injection system.
 - 8.2 8.5List the advantages of gasoline injection system.
 - 8.3 8.4Describe the construction of electronic fuel injection (EFI) system.
 - 8.4 8.3Describe the operation of electronic fuel injection system.
 - 8.5 8.2State the onboard diagnosis system (OBD) of EFI engine.
 - 8.6 Describe the operation of CNG fuel system.
 - 8.7 Describe the operation of LPG fuel system.
 - 8.8 Compare the EFI and Carburetor system.
- 9. Understand the features of diesel engine fuel systems.**
 - 9.1 State the meaning of diesel fuel injection.
 - 9.2 Classify of the diesel engine injection systems.
 - 9.3 List the components of diesel engine fuel systems.
 - 9.4 Explain the diesel engine injection systems.
 - 9.5 Describe the operation of low and high-pressure pumps.
 - 9.6 Describe the construction and operation of fuel injectors and nozzles.
 - 9.7 Explain governing system in diesel engine
 - 9.8 State the meaning of phasing and calibration.
- 10. Understand the aspects of supercharging & scavenging.**
 - 10.1 State the purpose of supercharging.
 - 10.2 Outline the necessity of scavenging in SI. & CI engines.
 - 10.3 Explain the effect of supercharging on SI & CI engines performance.
 - 10.4 Classify the superchargers and turbochargers.
 - 10.5 Describe the construction of superchargers and turbochargers.
 - 10.6 Describe the operation of superchargers and turbochargers.
 - 10.7 List the advantages and disadvantages of superchargers and turbochargers.
- 11. Understand the combustion process of SI engine.**
 - 11.1 Mention the stages of Combusion in SI engine.
 - 11.2 State the meaning of normal and abnormal combustion.
 - 11.3 Describe the effect of engine variables on flame propagation.
 - 11.4 Mention the classification of the SI engine combustion chambers.
 - 11.5 List the advantages and disadvantage of various combustion chambers.
 - 11.6 State the SI engine detonation.
 - 11.7 Mention the causes & effect of SI engine detonation and their remedies.
- 12. Understand the combustion process of CI engine.**
 - 12.1 State the combustion Process in CI engine.
 - 12.2 Identify the delay period.
 - 12.3 Explain the variables affecting delay period.
 - 12.4 Describe the knock in CI engine.
 - 12.5 Describe the methods of knock controlling in CI engine.
 - 12.6 Explain the design features of CI engine combustion chambers.
 - 12.7 List the advantages and disadvantage of various combustion chambers.

PRACTICAL:

- 1. Demonstrate the IC engine components.**
 - 1.1 Identify the engine cylinder block, crankcase & cylinder head with all parts connected their in.
 - 1.2 Identify the piston and connecting rod assembly.
- 2. Show the valve trains.**
 - 2.1 Identify the valve train components of an IC engine.
 - 2.2 Adjust the valve clearance of a typical IC engine.
- 3. Demonstrate the lubricating system of IC engine.**
 - 3.1 Identify the pressure feed lubricating system and its components.
 - 3.2 Change the crankcase oil and re-fill with proper grade of lub oil.
 - 3.3 Remove the oil filter and replace it.
 - 3.4 Diagnose and correct lubricating system troubles.
- 4. Show the cooling system of IC engine.**
 - 4.1 Identify the air and liquid cooling system components.
 - 4.2 Isolate the fan belt and replace it after proper inspection.
 - 4.3 Remove the thermostat from the system and fix up it after servicing.
- 5. Demonstrate the petrol fuel pump.**
 - 5.1 Disassemble a fuel pump.
 - 5.2 Assemble a fuel pump after necessary servicing.
 - 5.3 Test the fuel pump.
 - 5.4 Fix up the fuel pump in the system.
- 6. Demonstrate the operation of carburetor.**
 - 6.1 Disassemble the carburetor.
 - 6.2 Assemble the carburetor in sequential order.
 - 6.3 Adjust the carburetor to run on idle speed
- 7. Demonstrate the CI engine injection system.**
 - 7.1 Identify the different components of CI engine fuel injection system.
 - 7.2 Remove and replace a high-pressure pump from engine.
- 8. Show the operation of injector**
 - 8.1 Disassemble and assemble the injector.
 - 8.2 Test the injector.
- 9. Perform phasing & calibration of high-pressure diesel fuel pumps.**
- 10. Set valve timing operation of an IC engine.**

REFERENCE BOOKS:

1. Automotive Fundamentals — Fredric C. Nash
2. Vehicle and Engine Technology— Heinz Heisler
3. Automotive Mechanics — Crouse-Anglin
4. Automobile Engineering — Dr. Kirpal Singh
5. The Automobile — Harbans Singh Reyat
6. A Course in Internal Combustion Engines — M. L. Mather; R. P. Sharma
7. Automobile Engineering — R.B. Gupta.
8. Automobile Engineering — K.K. Ramalingan
9. Automobile Engineering — N.K. Giri

67142 Automotive Suspension, Brake, Steering & Transmission System

T P C
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AIMS:

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

- Suspension systems
- Manual and automatic transmission systems
- Drive shafts & universal joints
- Differentials & drive axles
- Steering systems
- Brake systems

SHORT DESCRIPTION

Suspension systems; Clutches; Power transmission system; Manual transmissions; Automatic transmissions; Gear box; Fluid coupling & Torque converter Drive axles; Universal joints & Slip joints; Differentials: Steering systems & Brake systems.

DETAIL DESCRIPTION

Theory:

1. Understand the features of suspension systems.

- 1.1 Define suspension system.
- 1.2 State the purpose of suspension systems.
- 1.3 Identify the components of suspension systems.
- 1.4 Mention the classification of the various suspension systems.
- 1.5 Describe the construction and operation of various suspension systems.
- 1.6 Describe the construction and operation of shock absorber and springs used in automobile suspension systems.
- 1.7 Describe the construction and operation of sensor-controlled shock absorber.
- 1.8 Describe the basic suspension movements, viz. bouncing, pitching, rolling, etc.

2. Understand the features of power transmission system.

- 2.1 Define power transmission system.
- 2.2 Classify power transmission system
- 2.3 List the components of power transmission system
- 2.4 Describe the power drive system of front engine front wheel drive (including trans axle system), front engine rear wheel drive, rear engine rear wheel drive, four-wheel drive (4WD), all wheel drive (AWD) system.
- 2.5 Describe the operation of different types of power drive system of two & three wheeler.
- 2.6 Distinguish between four-wheel drive and all wheel drive.

3. Understand the features of automotive clutches.

- 3.1 State the purpose of a clutch.
- 3.2 Mention the classification of the automotive clutches.
- 3.3 Describe the construction and operation of a coil spring & diaphragm spring clutch.
- 3.4 Explain the operating principle of different types of multi plate clutch.
- 3.5 Explain the operating principle of centrifugal clutch, semi-centrifugal clutch and crown spring type clutch.
- 3.6 Explain the operating principle of hydraulic clutch and electromagnetic clutch.
- 3.7 Explain different adjustments of clutch, floor board clearance adjustment, clutch free play adjustment, clutch pedal travel adjustment and clutch release lever adjustment.

4. Understand the features of gear boxes.

- 4.1 State the necessity of a gear box.
- 4.2 Mention the principle of gearing.
- 4.3 Classify gear transmission.
- 4.4 Describe the construction and operation of sliding mesh & constant mesh (dog clutch type & synchromesh type) gear boxes.
- 4.5 Describe the power drive system in gear box at different gear position.
- 4.6 List the advantages and disadvantages of sliding mesh gear, constant mesh gear and synchromesh gear.
- 4.7 State the importance of over drive in power transmission system.

5. Understand the features of automatic transmissions.

- 5.1 Define fluid coupling and torque converter.
- 5.2 Describe the construction and operation of fluid coupling.
- 5.3 Describe the advantage and disadvantage of fluid coupling
- 5.4 Describe construction & operation of torque converter.
- 5.5 Compare between the fluid coupling & torque converter
- 5.6 Describe the operation of planetary gear mechanism.
- 5.7 Describe the construction and operation of automatic transmissions.
- 5.8 Explain the automatic transmission control system.
- 5.9 Describe the operation of electronic control Transmission (ECT) system.

6. Understand the features of drive shafts and universal joints.

- 6.1 Define the drive lines.
- 6.2 Mention the function of propeller shaft.
- 6.3 Mention the classification of the propeller shafts.
- 6.4 Describe the function of universal joints, slip joints and CV (Constant velocity) joints.
- 6.5 Mention the construction of universal joints, slip joints and CV joints.
- 6.6 Describe the operation of universal joints, slip joints and CV joints.
- 6.7 Explain the principle of resisting rear end torque by Hotchkiss drive and torque tube drive.

7. Understand the features of differential.

- 7.1 State the function of differential.
- 7.2 Mention the types of differential.
- 7.3 Describe the construction and operation of conventional differential.
- 7.4 Describe the construction & operation of limited slip differentials.
- 7.5 Describe the construction & operation of double reduction differential.

8. Understand the features of drive axles.

- 8.1 State the function of axles.
- 8.2 Mention the classification of axles.
- 8.3 Describe the construction and operation of different types of drive axles.
- 8.4 Mention the causes of axle failure.

9. Understand the features of automotive steering systems.

- 9.1 State the purpose of steering system.
- 9.2 Mention the types of steering system.
- 9.3 Describe the operation of typical manual steering system.
- 9.4 Mention the function of each component of steering system.
- 9.5 Describe the operation of different type of steering gear box.
- 9.6 Describe the operation of integral & linkage booster type hydraulic power steering system.
- 9.7 State the meaning of electric motor power steering (EMPS) system.
- 9.8 Describe the construction and operation of electrical power steering system.
- 9.9 Mention the advantages EMPS.

10. Understand the features of front end geometry (Steering geometry).

- 10.1 Define the term front end geometry (steering geometry).
- 10.2 List the advantages of accurate front end alignment.
- 10.3 Describe the terms: camber angle, castor angle, king pin inclination, included angle, toe-in and Toe-out on turn.
- 10.4 Identify the types of camber angle, castor angle, king pin inclination.
- 10.5 Mention the necessity of camber angle, caster angle, king pin inclination, Toe- in and Toe-out on turn.
- 10.6 Mention the approximate range of camber angle, caster angle, king pin inclination, Toe- in and Toe-out on turn.

11. Understand the features of automotive brakes.

- 11.1 State the purpose of brake systems used in automobile.
- 11.2 Mention the classification of the brake systems.
- 11.3 Define brake fluid.
- 11.4 Mention the types and characteristics of brake fluid.
- 11.5 Describe disk brake system
- 11.6 Describe the construction & operation of mechanical brake systems used in automobile.
- 11.7 Describe the construction and operation of hydraulic (drum and disk) brake systems used in automobile.
- 11.8 Distinguish between disk and drum brake system
- 11.9 Describe the construction and operation of conventional master cylinder and tandem master cylinder.
- 11.10 Describe the construction and operation of vacuum servo brake system.
- 11.11 Describe the construction and operation of air brake system.
- 11.12 Explain the different brake adjustments.

12. Understand the feature of electronically controlled brake system.

- 12.1 State the meaning of ABS, EBD & SBC.
- 12.2 Describe the operation of anti lock brake (ABS) system.
- 12.3 Describe the operation of Electronic brake Distribution (EBD) system.
- 12.4 Describe the operation of sensotronic brake control (SBC) system.
- 12.5 Mention the difference among ABC, EBD & SBC.
- 12.6 Mention the advantages of ABC, EBD & SBC.

PRACTICAL:

1. Show the automotive suspension systems.

- 1.1 Identify the components of suspension systems.
- 1.2 Select appropriate tools.
- 1.3 Disassemble the components of suspension system.
- 1.4 Inspect the components of suspension system.
- 1.5 Assemble the components of suspension system.

2. Demonstrate the automotive clutches.

- 2.1 Identify the components of clutch assembly.
- 2.2 Select appropriate tools.
- 2.3 Disassemble the clutch.
- 2.4 inspect each components of clutch.
- 2.5 Assemble the clutch.

3. Show skill in automotive gear boxes.

- 3.1 Identify each component of gear box.
- 3.2 Select appropriate tools.
- 3.3 Disassemble the gearbox.
- 3.4 Clean and assemble the gearbox.
- 3.5 Perform the power flow in gear box at different gear position.

4. Demonstrate the automatic transmission systems.

- 4.1 Identify the components of automatic transmission systems.
- 4.2 Observe the operation of torque converter and planetary gear by using model.

5. Show the automotive drive shaft.

- 5.1 Identify the components of drive shaft.
- 5.2 Select appropriate tools.
- 5.3 Disassemble the components such as propeller shaft, universal joint and slip joint of drive shaft.
- 5.4 Assemble the components such as propeller shaft, universal joint and slip joint of drive shaft.

6. Show skill in automotive differential unit.

- 6.1 Identify each component of differential unit
- 6.2 Select appropriate tools
- 6.3 Disassemble differential unit.
- 6.4 Clean and assemble of differential unit.
- 6.5 Observe the mode of differential.

7. Show the automotive drive axle.

- 7.1 Identify each component of drive axle
- 7.2 Select appropriate tools
- 7.3 Disassemble drive axle.
- 7.4 Clean and assemble of drive axle.

8. Demonstrate the automotive steering system.

- 8.1 Identify the components of steering system.
- 8.2 Select appropriate tools.
- 8.3 Disassemble the system.
- 8.4 Clean and assemble the system.
- 8.5 Adjust the steering system.

9. Show the front end geometry.

- 9.1 Identify the front end geometry.
- 9.2 Select appropriate tools
- 9.3 Check front wheel alignment angles.
- 9.4 Adjust caster, camber and toe on tern.

10. Demonstrate the disc and drum brakes.

- 10.1 Identify disc brake components.
- 10.2 Identify drum brake components.
- 10.3 Select appropriate tools
- 10.4 Disassemble disc and drum brake components
- 10.5 Inspect disc and drum brake components.
- 10.6 Assemble and adjust disc and drum brake.

11. Practice on brake systems.

- 11.1 Identify the components of brake systems.
- 11.2 Select appropriate tools
- 11.3 Perform bleeding the brake system.
- 11.4 Check the performance of brake systems.
- 11.5 Adjust the brake system.

REFERENCE BOOKS

- 1. Automotive Fundamentals — Fredric C. Nash
- 2. Vehicle and Engine Technology — Heinz Heisler
- 3. Automotive Mechanics — W. H Crouse-Anglin
- 4. Automobile Engineering — Dr. Kirpal Singh
- 5. The Automobile — Harbans Singh Reyat
- 6. Auto Mechanics — Mitchell
- 7. Automobile Engineering — R.B. Gupta
- 8. Automobile Engineering — G. B. S Narang

AIMS:

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

- Solid fuel
- Gaseous fuel
- LPG, LNG and CNG fuels
- Crude oil and crude oil refining
- Gasoline, diesel, kerosene, alternative fuels and fuel oil
- Solid, semi-solid and liquid lubricants

SHORT DESCRIPTION

Concept of fuels; Solid fuels; Analysis of coal; Gaseous fuels; LPG fuels; LNG fuel and CNG fuel; Crude oil; Hydrocarbon; Refining of crude petroleum; Gasoline fuel; Test and additives of gasoline; Diesel fuel; Solid lubricants; Grease; Lubricating oil.

DETAIL DESCRIPTION**Theory:****1. Understand the basic concept of fuels.**

- 1.1 State the meaning of fuel.
- 1.2 Mention the modern concept of fuels.
- 1.3 Mention the classification of fuels.
- 1.4 State the meaning of fossil fuels.
- 1.5 Mention the alternatives of fossil fuels.
- 1.6 State the meaning of solid fuels.
- 1.7 Mention the properties of solid fuels.
- 1.8 Mention the composition and properties of natural solid fuels.
- 1.9 Compare among of solid, liquid and gaseous fuel.

2. Understand the aspect of coal.

- 2.1 Describe the formation of coal.
- 2.2 Mention the classification of coal.
- 2.3 Explain the properties of coal.
- 2.4 Explain the role of sulphur and ash in coal.
- 2.5 Describe sources of coal in Bangladesh.
- 2.6 Explain higher calorific value (HCV) and lower calorific value (LCV).
- 2.7 Mention the Dulong's formula and Davies formula to determine calorific value of coal.
- 2.8 Describe the procedure of determination of heating value by bomb Junkers gas calorimeters.

3. Understand the concept of gaseous fuels.

- 3.1 State the meaning of gaseous fuels.
- 3.2 Mention the classification of gaseous fuels.
- 3.3 Mention the composition of different gaseous fuels.
- 3.4 Mention the advantages and disadvantages of gaseous fuels.
- 3.5 Describe storing and handling procedure of gaseous fuels.
- 3.6 Describe the heating value determination procedures of gaseous fuel.
- 3.7 Mention the present scenario of natural gas in Bangladesh.

4. Understand the concept of Alternative fuel.

- 4.1 Define Alternative fuel.
- 4.2 Describe the importance of alternative fuel.
- 4.3 Mention the Alternative fuels used in SI & CI engines.
- 4.4 Mention the alternative energy sources.
- 4.5 Explain the composition different alternative fuels.
- 4.6 Mention the advantages & disadvantages of alternative fuel

5. Understand the concept of CNG, LNG and LPG fuel.

- 5.1 State the meaning of CNG, LNG and LPG fuel.
- 5.2 Mention the composition of CNG, LNG and LPG fuel.
- 5.3 Mention the characteristic of CNG, LNG and LPG fuel.
- 5.4 State the static condition pressure and filling condition pressure in Bar of a CNG, LNG and LPG fuel station.
- 5.5 Describe storage and handling procedure of CNG, LNG and LPG fuel.
- 5.6 Mention the uses of CNG, LNG and LPG fuel.
- 5.7 Compare among CNG, LNG and LPG fuel
- 5.8 Explain of safety aspects of CNG, LNG and LPG fuel.

6. Understand the concept of crude petroleum/ oil.

- 6.1 State the meaning of crude petroleum/oil.
- 6.2 Mention the classification of crude petroleum/oil.
- 6.3 Mention the composition of crude oil.
- 6.4 Describe the origin of crude petroleum/oil.
- 6.5 Describe the region of various oil field of the world.
- 6.6 Describe the determination procedure of crude petroleum/oil reserve.

7. Understand the concept of hydrocarbon family and refining of crude petroleum/ oil.

- 7.1 Mention the types of hydrocarbon classification of hydrocarbon family.
- 7.2 Explain the properties of different types of hydrocarbon.
- 7.3 State the purpose of crude oil refining.
- 7.4 Mention the classification of the various treatments performs on the crude oil to obtain the desired product.
- 7.5 Describe the separation process of distillation, absorption, adsorption, filtration, solvent extraction.
- 7.6 Describe the most common methods of break down processes.
- 7.7 Describe the rebuilding processes of reforming, alkylation, isomerization, and polymerization.
- 7.8 Describe the purification process of petroleum product.
- 7.9 Explain the refining process with flow chart.

8. Understand the concept of gasoline fuel.

- 8.1 State the meaning of gasoline fuel.
- 8.2 Mention the uses of gasoline fuel.
- 8.3 Describe the characteristics of gasoline fuel.
- 8.4 Mention the specification of gasoline fuel.
- 8.5 Describe the blending of gasoline.
- 8.6 Describe the treatment procedure of gasoline fuel.
- 8.7 Explain volatility of gasoline fuel and its effect on the engine.
- 8.8 Explain the effect of gasoline fuel on the engine performance.
- 8.9 Explain the abnormal combustion phenomena of gasoline fuel.

9. Understand the concept of test and additives of gasoline fuel.

- 9.1 Describe the distillation test of gasoline fuel.
- 9.2 Describe the reid vapor pressure test procedure of gasoline.
- 9.3 Describe the procedure of equilibrium air distillation test.
- 9.4 State the meaning of octane number.
- 9.5 Describe the octane number determination procedure with CRF engine and knock meter.
- 9.6 Mention the knock ratings methods.
- 9.7 Describe the octane ratings methods.
- 9.8 State the meaning of anti knock agents.
- 9.9 Mention the additives used in gasoline.

10. Understand the concept of diesel fuel.

- 10.1 State the meaning of diesel fuel.
- 10.2 Explain important characteristics of diesel fuel.
- 10.3 Mention the specification for diesel fuel.
- 10.4 Describe the distillate and residual fuel used for diesel engine.
- 10.5 State the significance of cetane number.
- 10.6 Describe the cetane number determination procedure of diesel fuel.
- 10.7 Explain the significance of diesel fuel viscosity on the engine performance.
- 10.8 Describe the flash point and fire point determination procedure of diesel fuel.
- 10.9 Mention the composition, purification and properties of kerosene.

11. Understand the concept of kerosene fuel.

- 11.1 Mention the uses of kerosene.
- 11.2 Mention the composition of kerosene.
- 11.3 Explain the properties of kerosene.
- 11.4 Mention the specifications of kerosene.
- 11.5 Explain the purification process of kerosene.

12. Understand the concept of lubricants.

- 12.1 Define lubricants.
- 12.2 Mention the different types of lubricants.
- 12.3 List the most common solid lubricants.
- 12.4 Mention the field of application of solid lubricants.
- 12.5 Mention the classification of grease.
- 12.6 Explain the properties of grease.
- 12.7 Explain the constituents of grease.
- 12.8 Explain the grease additives.
- 12.9 Describe manufacturing process of grease.
- 12.10 Mention the advantages and disadvantages of grease over solid and liquid lubricants.

13. Understand the concept of lubricating oil.

- 13.1 State the purpose of lubricating oil in the engine.
- 13.2 Mention the classification of lubricating oil.
- 13.3 Explain the various properties of lubricating oil.
- 13.4 Mention the various additives used in lubricating oil.
- 13.5 Mention the significance of viscosity index.
- 13.6 Explain the viscosity rating and service rating of lubricating oil.
- 13.7 State the meaning of synthetic lubricating oil.
- 13.8 Name some synthetic lubricating oil.

PRACTICAL:

1. Demonstrate the different types of fuels and lubricants.

- 1.1 Identify various types of solid fuels.
- 1.2 Identify various types of liquid fuel.
- 1.3 Identify various types of solid lubricants.
- 1.4 Identify various types of semi solid lubricants.
- 1.5 Identify various types of liquid lubricants.

2. Show the petroleum refinery flow chart.

- 2.1 Draw the schematic diagram of a typical modern petroleum refinery showing main units and products.
- 2.2 Draw a simplified flow diagram for automated refinery showing main quality analysis for process units and blending areas.

3. Analyze the composition of coal.

- 3.1 Determine the percentage of moisture, ash, volatile matter and fixed carbon of a sample coal by proximate analysis.
- 3.2 Determine the percentage of carbon, hydrogen, nitrogen, sulphur, oxygen and ash of a sample coal by ultimate analysis.

4. Determine the heating value of fuels.

- 4.1 Find the heating value of a coal sample by bomb calorimeter.
- 4.2 Find the heating value of a sample of diesel fuel by bomb calorimeter.
- 4.3 Find the heating value of a natural gas by continuous flow Junker's gas calorimeter.

5. Determine the volatility of fuel.

- 5.1 Find the volatility of gasoline, naphtha, Kerosene, or similar petroleum product by ASTM distillation test apparatus.
- 5.2 Find the vapor lock tendency of a gasoline by the Reid vapor pressure test.

6. Determine the viscosity of lubricating oil by a viscometer.

7. Determine the pour point and cloud point of lubricating oil by pour point test apparatus.

8. Determine the octane number of gasoline by CRF research method/Motor method.
9. Determine the cetane number of diesel fuel by the CRF engine.
10. Make a typical soap grease by cold set method.
11. Perform the consistency test of grease by the penetrometer.
12. Determine the drop point of grease by the drop point apparatus.

REFERENCE BOOKS:

1. Fuels and Petroleum Processing - B. K SHARMA
2. Advanced Petroleum Refining - G. N. SARKAR
3. Outlines of Chemical Technology - M. GOPALA RAO MARSHALL SITTIG
4. A Course in Internal Combustion Engine - M. L. Mathur R. P Sharma.
5. Thermal Engineering - P.L. Balancy
6. Thermal Engineering - R.S. Kharmi

OBJECTIVES:

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

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

SHORT DESCRIPTION

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

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

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

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

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

3 Understand the application of complex algebra for power calculation.

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

4 Understand the concept of poly-phase system.

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

5 Apply the concept of poly phase for interconnection.

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

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

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

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

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

8 Understand the principle of operation of transformer.

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

9 Understand the principle of DC motor.

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

10 Understand the principle of induction motor.

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

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

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

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

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

PRACTICAL:

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

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

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

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

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

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

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

- 4.1 Sketch the circuit diagram for 3-phase delta connected load.
- 4.2 Select equipment, tools & materials for the experiment.
- 4.3 Connect the circuit according to the circuit diagram.
- 4.4 Check all connection points before connecting power supply.
- 4.5 Record the readings of the instruments.
- 4.6 Compare the recorded values with calculated values.
- 4.7 Note down the observations.

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

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

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

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

7 Find the transformation ratio of a transformer.

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

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

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

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

- 9.1 Prepare a list of the parts of a 3-phase induction motor.
- 9.2 Dismantle the components/parts of the motor.
- 9.3 Develop sketches of each part.
- 9.4 Sketch the developed diagram of the windings of the motor.
- 9.5 Assemble the dismantled parts.
- 9.6 Note down the observations.

10 Operate a 3-phase induction motor.

- 10.1 Sketch the circuit diagram.
- 10.2 Select required, equipment, tools and materials.
- 10.3 Connect starter with motor.
- 10.4 Connect power supply to the circuit.
- 10.5 Observe the operation.
- 10.6 Measure the speed of the rotor.
- 10.7 Note down the observations.

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

- 11.1 Select the equipment and tools required for the experiment.
- 11.2 Sketch a working diagram.
- 11.3 Identify the two sets of coils.
- 11.4 Connect the capacitor with the proper set of coil.
- 11.5 Connect power supply to the fan motor.
- 11.6 Test the rotation of the motor opposite direction by changing the capacitor connection.
- 11.7 Note down the observations.

REFERENCE BOOKS:

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

AIMS:

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

SHORT DESCRIPTION

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

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

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

2. Understand the composition and resolution of forces.

- 2.1. State the effect and characteristics of a force.
- 2.2. Describe different system of forces.
- 2.3. Describe resultant force and composition of forces.
- 2.4. Find the resultant force graphically and analytically.
- 2.5. State the laws of forces.
- 2.6. Define resolution of a force.
- 2.7. Deduce the formula for finding the rectangular components.
- 2.8. Find the magnitude and position of the resultant force graphically and analytically
- 2.9. Solve problems related to resultant force.

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

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

4. Understand the aspects of equilibrium of forces.

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

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

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

6. Understand the application of moment of inertia.

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

7. Understand the principles and application of friction

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

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

- 8.1. Define support and support reactions.
- 8.2. Identify types of beam.
- 8.3. Explain the types of loading on beams.

- 8.4. Determine the support reactions of simple, overhanging and cantilever beam with different loading conditions.
- 8.5. Define frame.
- 8.6. Identify the frames and trusses with their end supports.
- 8.7. State the method of finding support reactions and forces on the member of the frame.
- 8.8. Identify the nature of force on the members of trusses.
- 8.9. Calculate the support reactions and forces on different end support of simple truss by joint method and section method.

9. Understand the features and principle of projectile.

- 9.1. Describe projectiles with example.
- 9.2. Describe the term relating to projectiles.
- 9.3. Identify the motion of a body thrown horizontally in the air.
- 9.4. Describe the motion of a projectile.
- 9.5. Derivation of the equation of the path of a projectile.
- 9.6. Derivation of the time of flight of a projectile on a horizontal plane.
- 9.7. Derivation of horizontal range of a projectile.
- 9.8. Derivation of the equation of maximum height of a projectile on a horizontal plane.
- 9.9. Derivation of velocity and direction of motion of a projectile after a given interval of time.
- 9.10. Solve problems related to projectiles.

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

- 10.1. Define work, power and energy.
- 10.2. State the units of work, power and energy.
- 10.3. Explain the work done in rotation.
- 10.4. Mention the types of engine power.
- 10.5. Define and classify engine efficiency.
- 10.6. Mention types of energy.
- 10.7. Explain the derivation of the equation of kinetic & potential energy.
- 10.8. State the law of conservation of energy.
- 10.9. Solve problems related to work, power and energy.

11. Understand the simple lifting machines.

- 11.1. Define lifting machine.
- 11.2. State Mechanical advantage, velocity ratio, input of a machine, output of a machine, efficiency of a machine.
- 11.3. Explain the relation between efficiency, mechanical advantage and velocity ratio of a lifting machine.
- 11.4. Explain the maximum mechanical advantage of a lifting machine by using the equation of law's of machine.
- 11.5. Describe lifting machine such as simple wheel & axel, differential wheel & axel, Weston's differential pulley block and geared pulley block.
- 11.6. Solve the problems related to above specific objects.

12. Understand the various aspects of gear trains.

- 12.1. State what is meant by gear.
- 12.2. Identify the types of gears.
- 12.3. Identify the simple gear drive.
- 12.4. Express the derivation of the equation of velocity ratio of simple gear drive.
- 12.5. Identify the compound gear drive and gear train.

- 12.6. Identify the equation of power transmitted by simple and compound train.
- 12.7. Identify the epicyclical gear train.
- 12.8. Express the derivation of the velocity ratio of an epicyclical gear train.
- 12.9. Solve problems related to gear trains.

PRACTICAL:

1. Determine the resultant force by using force board.

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

2 Determine the compression load using crane boom.

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

3 Determine the equilibrium force by using Kennon force table.

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

4 Determine the center of a triangular lamina.

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

5 Determine the center of gravity of solid body.

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

6 Determine the co-efficient of friction.

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

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

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

8 Determine the torque of engine by prony brake.

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

9 Determine the BHP of an engine by chassis dynamometer.

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

10 Determine the velocity ratios among the driver and driven gears.

- 10.1 Set a simple train of gears.
- 10.2 Compare the velocity ratios of the same.
- 10.3 Set a compound train of gears.
- 10.4 Compare the velocity ratios of the same.

REFERENCE BOOKS

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

65841 Business Organization & Communication

T P C

2 0 2

AIMS:

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

SHORT DESCRIPTION:

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

DETAIL DESCRIPTION:

Theory:

1 Concept of Business organization.

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

2 Formation of Business organization.

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

3 Basic idea of Banking system and negotiable instrument.

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

4 Home & foreign trade

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

5 Basic concepts of communication

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

6 Communication model and feedback.

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

7 Types and Methods of communication.

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

8 Essentials of communication.

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

9 Report writing.

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

10 Office management.

- 10.1 Define office and office work.
- 10.2 State the characteristics of office work.
- 10.3 Define filing and indexing.
- 10.4 Discuss the methods of filing.
- 10.5 Discuss the methods of indexing.
- 10.6 Distinguish between filing and indexing.

11 Official and semi-official letters.

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

REFERENCE BOOK:

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