

6251

AUTOMOTIVE ENGINE SYSTEM – II

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AIMS

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

- valves, valve trains and valve timing
- cooling and lubricating systems
- intake and exhaust systems
- ignition and starting systems

SHORT DESCRIPTION

Valves and valve trains; Valve timing and valve timing diagrams; Cooling systems; Cooling system components; Servicing of cooling systems; Lubricating systems; Lubricating system components; Servicing of lubricating systems; Intake system; Exhaust system; Ignition systems; Starting systems.

DETAIL DESCRIPTION

Theory :

VALVES AND VALVE TRAINS

1 Understand the features of valves.

- 1.1 Mention the purpose of engine valves.
- 1.2 Identify different types of engine valves.
- 1.3 Describe the construction of IC engine valves.
- 1.4 Describe the operation of IC engine valves.

2 Understand the features of valve trains.

- 2.1 State the meaning of valve train.
- 2.2 Describe the tappets or rocker arms valve train.
- 2.3 Describe the camshaft in block with push rods valve train.
- 2.4 Identify the various types of valve arrangement head in IC engines (I-head, L-head, T-head, F-head, etc).
- 2.5 Mention the purpose of tappet clearance.
- 2.6 Describe the construction of hydraulic valve lifters.
- 2.7 Describe the operation of hydraulic valve lifters.

VALVE TIMING AND VALVE TIMING DIAGRAMS

3 Understand the aspects of valve timing.

- 3.1 State the meaning of camshaft timing and valve timing.
- 3.2 Outline the importance of valve timing.
- 3.3 Mention the mechanical and dynamic factors affecting the valve timing.

4 Understand the aspects of valve timing diagrams.

- 4.1 State what is meant by valve timing diagram.
- 4.2 Draw the valve timing diagram for low and high speed 4-stroke SI engines.
- 4.3 Explain the valve timing diagram for low and high speed 4-stroke SI engines.
- 4.4 Explain the 4-stroke petrol engine valve timing diagram in relation to the pressure volume diagram.
- 4.5 Draw the valve timing diagram for a typical 4-stroke CI engine.

4.6 Explain valve timing diagram for a typical 4-stroke CI engine.

COOLING SYSTEMS

5 Understand the aspects of engine cooling system.

- 5.1 State what is meant by engine operating temperature.
- 5.2 Mention the necessity of engine cooling.
- 5.3 Mention the functions of engine cooling system.
- 5.4 Identify different engine cooling systems.
- 5.5 List the advantages and disadvantages of different engine cooling systems.

6 Understand the feature of various engine cooling systems.

- 6.1 Explain the direct air cooling system.
- 6.2 Mention the factors those affect the air cooling system.
- 6.3 Describe the pump assisted water cooling system.
- 6.4 Describe the thermo-syphon type water cooling system.
- 6.5 Describe the steam cooling (evaporative cooling) system.

7 Understand the features of water jacket.

- 7.1 Mention the functions of water jacket.
- 7.2 Describe the construction of water jacket.
- 7.3 Describe the operation of water jacket.

8 Understand the features of water pump.

- 8.1 Mention the functions of water pump.
- 8.2 Describe the construction of water pump.
- 8.3 Describe the operation of water pump.

9 Understand the features of cooling fan.

- 9.1 Mention the functions of cooling fan.
- 9.2 Describe the construction of cooling fan.
- 9.3 Describe the operation of cooling fan.

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10 Understand the features of radiator.

- 10.1 Mention the functions of radiator.
- 10.2 Identify the types of radiator.
- 10.3 Describe the construction of radiators.
- 10.4 Describe the operation of radiators.
- 10.5 Mention the functions of coolant expansion tank and coolant by-pass passage.
- 10.6 Mention the functions of antifreeze solution.

11 Understand the features of thermostat.

- 11.1 Mention the functions of thermostat.
- 11.2 Identify the types of thermostat.
- 11.3 Describe the construction of thermostat.
- 11.4 Describe the operation of thermostat.

12 Understand the features of radiator pressure cap.

- 12.1 Mention the functions of radiator pressure cap.
- 12.2 Identify the types of radiator pressure cap.
- 12.3 Describe the construction of radiator pressure cap.
- 12.4 Describe the operation of radiator pressure cap.

13 Understand the features of electric motor cooling fan.

- 13.1 Mention the function of electric motor cooling fan.

13.2 Describe the construction of electric motor cooling fan.

13.3 Describe the operation of electric motor cooling fan.

14 Understand the servicing of cooling system.

14.1 Identify the common faults of cooling system.

14.2 Outline the purpose of cooling system servicing.

14.3 List the radiator servicing procedure.

14.4 Describe the process of cleaning water jackets.

14.5 List the servicing procedure of water pump.

14.6 Mention the causes and remedies of engine overheating.

14.7 Mention the trouble shooting procedure of engine cooling system.

14.8 Identify the problems due to freezing of cooling water.

LUBRICATING SYSTEMS

15 Understand the lubricating systems.

15.1 State the purpose of engine lubrication.

15.2 Name the different lubricating systems.

15.3 Describe the splash lubricating system.

15.4 Describe the full pressure lubricating system.

15.5 Explain the combination of splash and pressure lubricating system with sketch.

15.6 Describe the petro-oil lubricating system.

15.7 Describe the dry-sump lubricating system with sketch.

16 Understand the features of oil pump.

16.1 Mention the function of oil pump.

16.2 Identify the types of oil pump.

16.3 Describe the construction of oil pump.

16.4 Describe the operation of oil pump.

17 Understand the features of oil pressure relief valve.

17.1 Mention the function of oil pressure relief valve.

17.2 Describe the construction of oil pressure relief valve.

17.3 Describe the operation of oil pressure relief valve.

18 Understand the features of gear pump.

18.1 Describe the construction of a gear pump.

18.2 Describe the operation of gear pump.

18.3 Mention the advantages and disadvantages of gear pump.

19 Understand the features of plunger pump.

19.1 Describe the construction of plunger pump.

19.2 Describe the operation of plunger pump.

19.3 Mention the advantages and disadvantages of plunger pump.

20 Understand the features of oil filter.

20.1 Mention the function of oil filter.

20.2 Identify the types of oil filter.

20.3 Describe the construction of oil filters.

20.4 Describe the operation of oil filters.

21 Understand the aspects of crankcase ventilation.

21.1 State the purpose of crankcase ventilation.

21.2 Identify the types of crankcase ventilation.

21.3 Describe the breather pipe crankcase ventilation.

- 21.4 Describe the operation of positive crankcase ventilation.
- 21.5 Mention the causes of sludge formation and its remedies.

22 Understand the servicing of lubricating system.

- 22.1 Describe the servicing of lubricating pump.
- 22.2 Describe the servicing of lubricating filter.
- 22.3 Describe the servicing of oil galleries.
- 22.4 Describe the servicing of oil pump.
- 22.5 List the common faults and remedies of lubricating system.
- 22.6 Mention the trouble shooting procedure of lubricating system.

EXHAUST SYSTEM

23 Understand the features of exhaust system of engine.

- 23.1 State what is meant by the exhaust system of engine.
- 23.2 Identify the different components of exhaust system.
- 23.3 Mention the function of various components of exhaust system.
- 23.4 Describe the construction of various components of exhaust system.
- 23.5 Describe the operation of various components of exhaust system.
- 23.6 Identify the types of muffler.

24 Understand the features of catalytic converter.

- 24.1 Mention the function of catalytic converter.
- 24.2 Mention the classification of catalytic converter.
- 24.3 Describe the construction of catalytic converters.
- 24.4 Describe the operation of catalytic converters.

25 Understand the servicing of exhaust system of automobile.

- 25.1 Outline the purpose of servicing of exhaust system.
- 25.2 Mention the procedure of servicing exhaust system.
- 25.3 Mention the common troubles, causes and remedies of exhaust system.

INTAKE SYSTEM

26 Understand the intake system of gasoline and diesel engines.

- 26.1 State what is meant by the intake system.
- 26.2 Identify the components of gasoline engine intake system.
- 26.3 Identify the components of diesel engine intake system.
- 26.4 Mention the functions of gasoline engine fuel system.
- 26.5 Mention the functions of diesel fuel system.

27 Understand the features of air cleaner.

- 27.1 Mention the function of air cleaner.
- 27.2 Identify different types of air cleaner.
- 27.3 Mention the functions of oil bath type air cleaner.
- 27.4 Describe the construction of oil bath type air cleaner.
- 27.5 Describe the operation of oil bath type air cleaner.
- 27.6 Mention the functions of thermostatically controlled air cleaner.
- 27.7 Describe the construction of thermostatically controlled air cleaner.
- 27.8 Describe the operation of thermostatically controlled air cleaner.
- 27.9 Describe the servicing procedure of different types of air cleaner.

28 Understand the combustion phenomenon of CI and SI engines.

- 28.1 State the conditions necessary for combustion.
- 28.2 Mention the stages of combustion in SI engine.

- 28.3 Describe the design features of different types of combustion chamber used in SI engine.
- 28.4 List the advantages and disadvantages of different combustion chambers.
- 28.5 Explain the abnormal combustion in SI engine.
- 28.6 Mention the stages of combustion in CI engine.
- 28.7 Describe the design features of different types of combustion chamber used in CI engine.
- 28.8 List the merits and demerits of different types of combustion chamber used in CI engine.
- 28.9 Compare the induction swirl and compression swirl.

IGNITION SYSTEM

29 Understand the features of conventional ignition system.

- 29.1 Outline the purpose of ignition system.
- 29.2 Identify different types of ignition system.
- 29.3 Describe the construction of the battery-coil (contact-point) ignition system.
- 29.4 Describe the operation of the battery-coil (contact-point) ignition system.
- 29.5 Describe the construction of the magneto ignition system.
- 29.6 Describe the operation of the magneto ignition system.
- 29.7 Mention the functions of spark plug.
- 29.8 Describe the construction of spark plug.
- 29.9 Describe the operation of spark plug.
- 29.10 Mention the common troubles, causes and remedies of ignition systems.

STARTING SYSTEM

30 Understand the features of starting system of IC engines.

- 30.1 Outline the purpose of IC engine starting system.
- 30.2 Identify different methods of IC engine starting.
- 30.3 Describe the electric motor starting system.
- 30.4 Describe compressed air starting system.
- 30.5 Describe pilot engine starting system.
- 30.6 Mention the trouble shooting procedure of electric starting system with remedies.

Practical :

1 Study the valve trains arrangement of IC engines.

- 1.1 Identify the L-head (flat head) engine valve train and its components.
- 1.2 Identify the I-head (camshaft in block) engine valve train and its components.
- 1.3 Identify the single overhead camshaft IC engine valve train and its components.
- 1.4 Identify the double over head camshaft IC engine valve train and its components.
- 1.5 Identify the V-type camshaft in block IC engine valve train and its components.

2 Study the camshaft in block with push rods valve trains (I-head).

- 2.1 Disassemble the camshaft in block with push rods valve trains.
- 2.2 Identify different components of the camshaft in block with push rods valve mechanism.
- 2.3 Reassemble the valve train.
- 2.4 Perform the valve timing operation.
- 2.5 Adjust the valve clearance.

3 Study the overhead cam valve train.

- 3.1 Disassemble the overhead cam valve mechanism of an IC engine.
- 3.2 Identify different components of overhead cam valve mechanism.
- 3.3 Reassemble the overhead cam valve mechanism.
- 3.4 Perform the valve timing operation.
- 3.5 Adjust the valve clearance.

4 Study the cooling system of IC engine.

- 4.1 Identify the air cooling system and its components.
- 4.2 Identify the evaporative cooling system and its components.
- 4.3 Identify the thermo-syphonic type water cooling system and its components.
- 4.4 Identify the pump assisted water cooling system and its components.

5 Service the pump assisted water cooling system.

- 5.1 Clean the cooling system (reverse flushing the radiator and engine water jackets).
- 5.2 Check the hoses and connections.
- 5.3 Bleed the cooling system.
- 5.4 Service the water pump.
- 5.5 Check the water pump drive belt for wear.
- 5.6 Test drive belt tension manually.
- 5.7 Adjust the drive belt tension, if necessary.

6 Check and test the cooling system.

- 6.1 Check cooling level.
- 6.2 Test workability of the thermostat.
- 6.3 Check the cooling system for leaks using the cooling system pressure tester.
- 6.4 Perform the pressure test of the radiator pressure cap using the cooling system pressure tester.
- 6.5 Test the workability (strength) of antifreeze solution.
- 6.6 Test and adjust pump drive belt tension using a belt tension gage.

7 Study the lubricating system of IC engine.

- 7.1 Identify the splash lubricating system and its components.
- 7.2 Identify the full pressure lubricating system and its components.
- 7.3 Identify the combination of splash and pressure lubricating system and its components.
- 7.4 Identify the petrol oil lubricating system and its components.
- 7.5 Identify the dry sump lubricating system and its components.

8 Service the lubricating system of IC engine.

- 8.1 Perform the oil change operation of an IC engine.
- 8.2 Replace the oil filter of an IC engine.
- 8.3 Service the oil pan.
- 8.4 Service the oil pump and pressure relief valve.
- 8.5 Diagnose and rectify troubles of lubricating system.

9 Study the intake system of IC engine.

- 9.1 Disassemble the intake system of an IC engine.
- 9.2 Identify the components of intake system.
- 9.3 Clean the air cleaner filtering element.
- 9.4 Check the oil contamination of an oil bath air cleaner and change oil, if necessary.
- 9.5 Check the oil level of an oil bath air cleaner and top up, if necessary.
- 9.6 Check intake manifold for wear, leakage and damage.

9.7 Reassemble the intake system.

10 Study the exhaust system of an IC engine.

- 10.1 Disassemble the exhaust system of an engine.
- 10.2 Identify the components of exhaust system.
- 10.3 Clean the exhaust system components.
- 10.4 Inspect the exhaust system components for damage.
- 10.5 Reassemble the exhaust system components.

11 Study the magneto ignition system.

- 11.1 Identify the components of magneto ignition system.
- 11.2 Inspect the circuit diagram of magneto ignition system.
- 11.3 Check the performance of magneto ignition system (spark method).

12 Study the battery-coil (contact-point) ignition system.

- 12.1 Identify the components of battery coil ignition system.
- 12.2 Inspect the circuit diagram of battery coil ignition system.
- 12.3 Check the performance of battery coil ignition system (spark method)

13 Study the spark plug

- 13.1 Identify the components of spark plug.
- 13.2 Perform the spark plug gap adjustments.
- 13.3 Perform the CB point gap adjustments.
- 13.4 Diagnose and correct ignition system troubles.

14 Study the starting system of an automobile engine.

- 14.1 Identify the components of electric starting system.
- 14.2 Identify the components of bendix and overrunning clutch drive mechanism.
- 14.3 Check the performance of an electric starting system.
- 14.4 Perform the starting system voltage drop test.
- 14.5 Identify the terminals of solenoid switch.
- 14.6 Check the performance of solenoid switch.

REFERENCE BOOKS

- 1 Automotive Mechanics – Crouse-Anglin
- 2 Automechanics – Mitchell
- 3 Diesel Mechanics – Schulz/Evridge
- 4 Automechanics – Harold T. Glenn
- 5 The Automobile Engine – William Weistein

6252 ENGINE OVERHAULING AND INSPECTION

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AIMS

To provide the student with an opportunity to acquire knowledge, skill and attitude in the area of automobile engine overhauling and inspection with special emphasis on:

SHORT DESCRIPTION

Fundamentals of overhauling and inspection; Test required for overhauling; Engine removal and cleaning; Engine overhauling; Overhauling of cylinder, piston and connecting rod assembly; Overhauling camshaft, crankshaft & timing gear; Gasket; Lubricating system overhauling; Fuel system overhauling.

DETAIL DESCRIPTION

Theory:

1 Understand the fundamentals of overhauling and inspection.

- 1.1 Define overhauling and inspection.
- 1.2 Mention different types of overhauling.
- 1.3 Compare the top overhauling with major overhauling.
- 1.4 List the symptoms of overhauling.
- 1.5 Outline the importance of inspection.
- 1.6 Mention different types of inspection.
- 1.7 Mention the causes of top overhauling.
- 1.8 Mention the causes of major overhauling.
- 1.9 Mention the steps of overhauling.

2 Understand the test required for overhauling.

- 2.1 Describe the procedure of cylinder compression test.
- 2.2 Describe the procedure of cylinder leakage test.
- 2.3 Describe the procedure of Engine vacuum test.

3 Understand the features of engine removal and cleaning.

- 3.1 Mention the steps of preparation for engine removing.
- 3.2 Describe the procedure of engine removing from chassis.
- 3.3 List the steps of precaution during engine removal from chassis.
- 3.4 Describe the methods of cleaning engine parts by steam, kerosene, gasoline, compressed air and various chemical solutions.

4 Understand the engine overhauling.

- 4.1 Describe the procedure of removing cylinder head from engine block.
- 4.2 Describe removal of valves and rocker arm mechanism.
- 4.3 Describe the procedure of removal of carbon or de-carbonizing.
- 4.4 Describe the inspection procedure of cylinder head.
- 4.5 Describe the inspection of valve guide.
- 4.6 Describe the removing and replacing valve guide.
- 4.7 Describe the procedure of inspection and testing of valve springs.
- 4.8 Describe the procedure of replacing a valve spring.
- 4.9 Describe the replacing valve seat insert and install new inserts.
- 4.10 Describe the procedure for adjusting tappet clearance of I-head, L-head, T-head and F-head engine.
- 4.11 Describe the procedure of inspecting hydraulic valve lifter.

5 Understand overhauling of cylinder, piston and connecting rod assembly.

- 5.1 Describe the procedure for removal of oil pan.
- 5.2 Explain cylinder ridge.
- 5.3 Describe the procedure of removing cylinder ridge.
- 5.4 Describe the procedure of removing connecting rod assembly.

- 5.5 Describe the procedure of measuring a cylinder and determining taper and out of round wear.
 - 5.6 Explain cylinder glaze and its effect on piston ring sealing.
 - 5.7 Describe the inspection procedure of the piston and connecting rod assembly.
 - 5.8 Describe the removal and replacement of piston pin.
 - 5.9 Describe the removal of piston rings and cleaning the ring grooves and piston head.
 - 5.10 Describe the procedure for clearance for piston rings and installing piston rings.
 - 5.11 Describe the procedure for checking alignment bend, twist and offset of connecting rod.
 - 5.12 Describe the procedure for replacing connecting rod and piston.
 - 5.13 Describe the procedure for inspecting bearing clearance and adjusting connecting rod bearing in various methods.
- 6 Understand the overhauling of cam shafts, crank shaft and timing gear assembly.**
- 6.1 Describe the procedure of removing can shaft and inspect of cam shaft bearings.
 - 6.2 Describe the check procedure of timing gear backlash.
 - 6.3 Describe the procedure of installing timing chain.
 - 6.4 Describe the procedure of replacing and setting a timing gear.
 - 6.5 Describe the procedure of checking valve timing of in-Line engine with out dismantling the engine.
 - 6.6 Describe the procedure of removing and replacing crank shaft from engine block.
 - 6.7 Describe the testing procedure of crank shaft.
 - 6.8 Describe the inspection of a worn bearing.
 - 6.9 Describe the procedure of checking fly wheel run out.
- 7 Understand the features of gasket.**
- 7.1 Mention the uses of gasket in an automobile.
 - 7.2 Identify the types of gasket used in automobile.
 - 7.3 Name the materials used in gasket making.
 - 7.4 Describe replacement procedure of a gasket.
 - 7.5 Describe preparation of a gasket.
 - 7.6 Mention the use of paste gasket.
- 8 Understand the features of lubricating system overhauling.**
- 8.1 Describe replacing procedure of oil filter.
 - 8.2 Describe the procedure of overhauling gear type, rotor type and plunger type oil pump.
- 9 Understand the features of cooling system overhauling.**
- 9.1 Describe the procedure of inspecting and adjusting fan belt.
 - 9.2 Describe replacing and testing thermostat.
 - 9.3 Describe the procedure of replacing a core plug.
 - 9.4 Describe the inspection procedure of leaks in the cooling system.
 - 9.5 Describe the procedure of overhauling water pump.
 - 9.6 Describe the procedure of checking and replacing pressure cap.
 - 9.7 Describe the process of cleaning radiator and water jacket.
- 10 Understand the features of fuel system overhauling.**
- 10.1 Describe the procedure of disassembling and reassembling of conventional carburetor to find out faults with remedies.
 - 10.2 Describe inspection of pressure and vacuum of gasoline fuel pump.
 - 10.3 Describe the procedure of disassembling and reassembling of inline type high pressure fuel pump and find out the faults with remedies.
 - 10.4 Describe the procedure of disassembling and reassembling of distributor type high pressure fuel pump.
 - 10.5 Describe the procedure of disassembling and reassembling of unit injector type high pressure fuel pump.
 - 10.6 Describe the procedure of disassembling and reassembling of injector and find out the faults with pump.
 - 10.7 Describe the testing procedure of EFI injectors.

Practical : (Visit to workshop)

- 1 Perform removing engine from the chassis.**
 - 1.1 Disconnect the all external connections to the engine.
 - 1.2 Take out the coolant and lubricants of the engine.
 - 1.3 Remove all external accessories of the engine.
 - 1.4 Remove engine form the chassis with the help of hydraulic floor jack or portable crane.
 - 1.5 Clean the removed engine by steam cleaner or by other cleaner.
- 2 Perform top overhauling.**
 - 2.1 Remove cylinder head cover or tapet cover.
 - 2.2 Measure the tightening torque of head bolts.
 - 2.3 Remove the head bolts as per prescribed rule or sequence and remove the cylinder head.
 - 2.4 Disassemble the components of cylinder head and clean.
 - 2.5 Inspect cylinder head and other components viz: valve, valve spring, valve guide, rocker arm, rocker arm shaft, etc for their workability.
 - 2.6 Assemble the cylinder head components and keep it in safe side.
 - 2.7 Follow safe and systematic procedure.
- 3 Perform the removing oil pan accessories.**
 - 3.1 Remove the oil pan and keep the bolts in it.
 - 3.2 Remove oil pump with strainer.
 - 3.3 Remove timing chain / gear cover and other accessories.
- 4 Perform removing piston and connecting rod assembly.**
 - 4.1 Inspect cylinder for cylinder ring ridge.
 - 4.2 Remove cylinder ring ridge (if any) by a ridge remover.
 - 4.3 Measure the tightening torque to big end bearing cap and mark the piston.
 - 4.4 Loosen the connecting rod nut bolt and remove bearing cap with bearing.
 - 4.5 Remove the piston with connecting rod.
 - 4.6 Dismantle the piston, connecting rod and piston rings.
 - 4.7 Clean and inspect those for their workability.
- 5 Perform removing and inspecting crankshaft assembly.**
 - 5.1 Remove fly wheel.
 - 5.2 Remove timing chain or gear cover and remove timing chain (if any).
 - 5.3 Measure the tightening torque of main journal bearing cap and remove the bearing caps with marking.
 - 5.4 Remove the crankshaft.
 - 5.5 Clean and inspect its workability.
 - 5.6 Follow safe and systematic procedure.
- 6 Perform removing and inspecting camshaft and bearings assembly.**
 - 6.1 Remove camshaft.
 - 6.2 Remove camshaft bearing.
 - 6.3 Clean and inspect those for their workability.
 - 6.4 Follow safe and systematic procedure.
- 7 Perform inspection of cylinder and cylinder block.**
 - 7.1 Inspect cylinder bore for taper and out of round wear.
 - 7.2 Inspect cylinder bore for glazing and other condition.
 - 7.3 Inspect cylinder block for fine crank.
 - 7.4 Remove and replace cylinder liner.
 - 7.5 Follow safe and systematic procedure.
- 8 Perform gasket making & setting.**
 - 8.1 Make different types of paper and cork gasket used in automotive engine.
 - 8.2 Show the use of gasket cement in automotive engines.
 - 8.3 Show the use of gasket kits.
- 9 Perform lubricating system overhauling.**

- 9.1 Disassemble lub oil pump and check side clearance, teeth clearance, end clearance and compare the reading with wear limit.
- 9.2 Assemble lub oil pump.
- 9.3 Remove and replace oil filter.
- 9.4 Adjust oil pressure.
- 9.5 Clean the oil strainer and fit it with pump.
- 10 Perform the cooling system overhauling.**
 - 10.1 Remove, test and replace a thermostat of cooling system.
 - 10.2 Flush the engine water jacket and radiator.
 - 10.3 Remove water pump, dismantle and examine all parts for crack and wear.
 - 10.4 Test the leakage of cooling system by using a pressure tester.
- 11 Perform assembling of complete engine.**
 - 11.1 Assemble the engine step by step.
 - 11.2 Follow necessary precautions.
- 12 Perform petrol fuel system overhauling.**
 - 12.1 Check delivery pressure and discharge rate of petrol fuel pump.
 - 12.2 Overhaul a conventional carburetor and replace the defective parts and gasket.
 - 12.3 Test the injection pattern and quantity of injected fuel by EFI injector.
- 13 Perform diesel fuel system overhauling.**
 - 13.1 Disassemble and assemble an injector.
 - 13.2 Disassemble and assemble a high pressure pump.
 - 13.3 Disassemble and assemble an unit injector.
 - 13.4 Adjust the speed limit of governor. .
- 14 Perform the engine installation on chassis.**
 - 14.1 Re-install the engine with care.
 - 14.2 Re-fit all external accessories of the engine.
 - 14.3 Connect all electrical and mechanical linkage.

REFERENCE BOOKS

- 1. Automotive Mechanics
 - by Crouse & Alinger.
- 2. Automobile Engine Overhauling
 - by A. W. Judge.
- 3. Automotive Engine Maintenance & Repair
 - by Venk and Billet.
- 4. Automotive Fundamentals
 - by Frederic C. Nash.

6253 AUTOMOTIVE TWO & THREE WHEELERS

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AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of automotive two and three wheelers with special emphasis on:

- Specification of automotive two and three wheelers
- Construction and operation of different system
- Servicing of two and three wheelers
- Trouble shooting and diagnosis

SHORT DESCRIPTION

Specification of two and three wheelers; Engine of two and three wheelers; Fuel system, Lubricating system; Starting system; Clutch mechanism; Gear transmission; Chain drive mechanism; Differential & propeller shaft; Steering system; Suspension system; Brake system; Ignition system; Lighting system, electric motor operated two & three wheelers. Trouble shooting & diagnosis.

DETAIL DESCRIPTION

Theory:

1 Understand the specification of two wheelers and three wheelers.

- 1.1 Define motor cycle scooter & mopped.
- 1.2 Mention the specification of engines of two wheelers of different models and brands
- 1.3 Mention the specification of engines of three wheeler of different models & brands.
- 1.4 List the common brands and models of two wheelers and three wheelers using in Bangladesh.
- 1.5 Compare among the motor cycle, Scooter & Mopped.

2 Understand the construction of two stroke engine of two & three wheeler.

- 2.1 Describe the construction of two stroke engine of two & three wheeler.
- 2.2 Describe the operation of two stroke engine of two & three wheeler.
- 2.3 Describe the construction of four stroke engine of two & three wheeler.
- 2.4 Describe the operation of four stroke engine of two & three wheeler.
- 2.5 Mention the difference in construction between the engines of two or three wheeler & a car.

3 Understand the features of fuel system of two wheeler and three wheeler.

- 3.1 Describe the operation of petrol fuel system of two wheelers.
- 3.2 Describe the operation of petrol fuel system of three wheelers.
- 3.3 Describe the operation of CNG fuel system of three wheelers.
- 3.4 Describe the construction of each components of CNG fuel system of three wheelers.
- 3.5 Mention the function of each components of CNG fuel system of three wheelers.

4 Understand the features of lubricating system of two wheelers and three wheelers.

- 4.1 Name the different types of lubricating system of two wheelers.
- 4.2 Describe the operation of lubricating system of two wheelers.
- 4.3 Name the different types of oil pump used in two wheelers.
- 4.4 Describe the operation of oil pump of two wheelers.
- 4.5 Name the different types of lubricating system used in three wheelers.
- 4.6 Describe the operation of lubricating system of three wheeler.
- 4.7 Name the different types of oil pump used in three wheelers.
- 4.8 Describe the operation of oil pump of three wheelers.

5 Understand features of starting system of two wheelers and three wheelers.

- 5.1 Name the different types of starting system used in two wheelers.
- 5.2 Describe the operation of manual starting system of two wheelers.
- 5.3 Describe the operation of electric motor starting system of two wheelers.
- 5.4 Name the different types of starting system used in three wheelers.
- 5.5 Describe the operation of manual starting system of three wheelers.
- 5.6 Describe the operation of electric motor starting system of three wheelers.

- 6 Understand the features of clutch mechanism of two wheelers and three wheelers.**
 - 6.1 Mention the function of clutch.
 - 6.2 Name the different types of clutch used in two wheelers.
 - 6.3 Describe the operation of different types of clutch used in two wheelers.
 - 6.4 Name the different types of clutch used in three wheelers.
 - 6.5 Describe the operation of different types of clutch used in three wheelers.
 - 6.6 Describe the adjusting procedure of clutch.
- 7 Understand the features of gear transmission of two wheelers and three wheelers.**
 - 7.1 Mention the function of gear transmission.
 - 7.2 Name the different types of gear transmission used in two wheelers.
 - 7.3 Describe the operation of gear transmission system of two wheelers.
 - 7.4 Name the different types of gear transmission used in three wheelers.
 - 7.5 Describe the operation of gear transmission system to three wheelers.
 - 7.6 Describe the gear shifting mechanism of two wheelers.
 - 7.7 Describe the gear shifting mechanism of three wheelers.
- 8 Understand the features of chain drive mechanism of two wheelers and three wheelers.**
 - 8.1 Mention the purposes of chain drive mechanism.
 - 8.2 Describe the operation of chain drive mechanism of two wheelers.
 - 8.3 Describe the operation of chain drive mechanism of three wheelers.
 - 8.4 Describe the chain adjusting procedure of two wheelers.
 - 8.5 Describe the chain adjusting procedure of three wheelers.
- 9 Understand the features of differential and propeller shaft of three wheelers.**
 - 9.1 Mention the purposes of differential and propeller shaft.
 - 9.2 Describe the construction of differential of three wheelers.
 - 9.3 Describe the operation of differential of three wheelers.
 - 9.4 Describe the construction of propeller shaft.
 - 9.5 Describe the operation of propeller shaft.
- 10 Understand the features of steering system of two wheelers and three wheelers.**
 - 10.1 Mention the purposes of steering system.
 - 10.2 Describe the construction of steering system of two wheelers.
 - 10.3 Describe the construction of steering system of three wheelers.
- 11 Understand the suspension system of two wheelers and three wheelers.**
 - 11.1 Mention the purposes of suspension system.
 - 11.2 Describe the construction of suspension system of two wheelers.
 - 11.3 Describe the front suspension system of three wheelers.
 - 11.4 Describe the rear suspension system of three wheelers.
- 12 Understand the features of brake system of two wheelers and three wheelers.**
 - 12.1 Mention the purposes of brake system.
 - 12.2 Name the different types of brake system used in two wheelers.
 - 12.3 Describe the operation of mechanical brake system used in two wheelers.
 - 12.4 Describe the operation of hydraulic brake system of three wheelers
 - 12.5 Describe the operation of master cylinder of three wheelers
 - 12.6 Describe the operation of wheel cylinder of three wheelers.
 - 12.7 Compare disk and drum type brake used in two wheelers
 - 12.8 Describe the brake adjusting procedure.
- 13 Understand the features of ignition system of two wheelers and three wheelers.**
 - 13.1 Mention the purposes of ignition system.
 - 13.2 Describe the operation of different ignition system of two wheelers.
 - 13.3 Describe the operation of different ignition system of three wheelers.
 - 13.4 Describe the construction and operation of ignition coil.
 - 13.5 Describe the construction of spark plug.
- 14 Understand the features of lighting system of two wheelers and three wheelers.**
 - 14.1 List the lighting system used in two wheelers.
 - 14.2 Draw a circuit diagram of lighting system of two wheelers.
 - 14.3 List the lighting system used in three wheelers.

14.4 Draw a circuit diagram of lighting system of three wheelers.

15 Understand the features of electrical motor operated two & three wheeler.

15.1 Define electrical motor operated vehicle.

15.2 Mention the advantages & disadvantages of motor operated two & three wheeler.

15.3 Describe the construction of motor operated two & three wheeler.

15.4 Describe the operation of motor operated two & three wheeler.

15.5 Describe the construction of Brushless & Brushless motor.

15.6 Mention the advantages of Brushless motor.

15.7 Compare the electrical motor operated two & three wheeler with engine operated two & three wheeler.

16 Understand the trouble shooting and diagnosis of automotive two wheelers and three wheelers.

16.1 List the common problems arise in engine of two wheelers and three wheelers.

16.2 Find out the causes and remedies of the engine problems.

16.3 List the common problems arises in clutch, gear and drive chain mechanism.

16.4 Find out the causes and remedies of problems of clutch, gear and drive chain.

Practical :

- 1 Study the construction of two wheelers.**
 - 1.1 Identify the different systems of two wheelers.
 - 1.2 Identify the components of different system.
- 2 Study the construction of three wheelers automobile.**
 - 2.1 Identify the different systems of three wheelers.
 - 2.2 Identify the components of different system.
- 3 Remove and reinstall the engine of two wheelers from chassis.**
- 4 Remove and reinstall the engine of three wheelers from chassis.**
- 5 Disassemble and assemble the engine of two wheelers.**
- 6 Describe and assemble the engine of three wheelers.**
- 7 Study CNG fuel system of three wheelers.**
 - 7.1 Identify the components of CNG fuel system.
 - 7.2 Remove all components from the engine.
 - 7.3 Reinstall the components.
 - 7.4 Start the engine.
 - 7.5 Test the performance of the CNG system.
- 8 Study the clutch mechanism of two & three wheelers.**
 - 8.1 Identify the components of clutch mechanism of two wheelers.
 - 8.2 Remove clutch assembly and disassemble.
 - 8.3 Clean and assemble the components.
 - 8.4 Reinstall the clutch.
 - 8.5 Test the performance of clutch assembly.
- 9 Study the gear transmission of two wheelers.**
 - 9.1 Identify the components of gear transmission of two wheelers.
 - 9.2 Remove and disassemble the gear transmission.
 - 9.3 Clean and assemble the components.
 - 9.4 Reinstall the gear transmission.
 - 9.5 Test the performance of gear transmission.
- 10 Study the gear transmission of three wheelers.**
 - 10.1 Identify the components of gear transmission of three wheelers.
 - 10.2 Disassemble the gear assemble.
 - 10.3 Clean and assemble the gear assemble.
 - 10.4 Test the performance of gear transmission.
- 11 Study the mechanism of drive chain of two & three wheelers.**
 - 11.1 Identify the components of drive chain mechanism.
 - 11.2 Disassemble the components.
 - 11.3 Clean and assemble the components.
 - 11.4 Test the performance.
- 12 Study the propellers shaft and differential of three wheelers.**
 - 12.1 Remove propeller shaft from three wheelers.
 - 12.2 Remove the differential and disassemble.
 - 12.3 Clean and assemble the differential.
 - 12.4 Reinstall the differential and propeller shaft.
 - 12.5 Test the performance.
- 13 Study the brake system of two & three wheelers.**
 - 13.1 Identify the components of brake system of two wheelers.
 - 13.2 Disassemble the brake system of two wheelers.
 - 13.3 Clean and assemble the system.
 - 13.4 Adjust the brake shoe clearance.
 - 13.5 Test the performance.
- 14. Study the operation of electric motor operated two & three wheeler.**
 - 14.1 Identify the components of electrical motor operated two & three wheeler.

- 14.2 Remove the components of electrical motor operated two & three wheeler.
- 14.3 Disassemble and assemble of the motor.
- 14.4 Test the batteries performance.
- 14.5 Reinstall & complete the circuit.
- 14.6 Test the operation of the circuit.

REFERENCE BOOKS

1. Automobile Engine
– By G. B. S. Narang.
2. Small Engines
– by American Association for Vocational Instructional Materials.
3. Manuals of Different Two Wheelers and Three Wheelers.
4. Motor Cycle mechanics , -Lynn Moshier.

7142 ENGINEERING MECHANICS

T	P	C
3	3	4

AIMS

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

- force system, moment and couple
- center of gravity
- moment of inertia
- friction
- stress & strain
- Torsion
- shear force & bending moment
- work, power and energy
- simple lifting machines and gear train

SHORT DESCRIPTION

Force system, Moment and couple, Center of gravity & centroid, Moment of inertia, Friction, Stress & strain, Torsion, Shear force and bending moment, Work, power & energy, Simple lifting machines and Gear train.

DETAIL DESCRIPTION

Theory :

FORCE SYSTEM

1 Understand the composition and resolution of forces.

- 1.1 State the effect of forces.
- 1.2 Mention the characteristics of forces.
- 1.3 Learn the laws of forces.
- 1.4 Define resolution of forces.
- 1.5 Define resultant force and composition of forces.
- 1.6 Find the resultant force graphically and analytically.
- 1.7 Solve problems related to resultant forces.

MOMENT AND COUPLE

2 Understand the aspects of moment and couple of forces.

- 2.1 Define moment and couple of a force.
- 2.2 Represent the moment of a force geometrically.
- 2.3 State the laws of moments.
- 2.4 State the Varignon's principles of moments.
- 2.5 Proof the Varignon's principles of moments
- 2.6 Identify the clockwise and anticlockwise moment.
- 2.7 Distinguish between clockwise couple and anticlockwise couple.
- 2.8 Define leverage functions.
- 2.9 Solve problems related to moment and couple of forces.

3 Understand the aspects of equilibrium of forces.

- 3.1 Mention different system of forces.
- 3.2 Mention the various types of equilibrium of forces.
- 3.3 State the principles of equilibrium of forces.

- 3.4 State the Lami's theorem.
- 3.5 Express the derivation of Lami's theorem.
- 3.6 Describe different methods of the equilibrium of coplanar forces.
- 3.7 Explain the conditions of equilibrium.
- 3.8 Solve problems related to equilibrium of forces.

CENTER OF GRAVITY

4 Understand the concept of center of gravity.

- 4.1 Define center of gravity and centroid.
- 4.2 Distinguish between center of gravity and centroid.
- 4.3 Determine the center of gravity of simple geometrical figure geometrically and by integration.
- 4.4 Identify the axis of reference and axis of symmetry.
- 4.5 Determine the center of gravity of plain geometrical figure by first principle of moments.
- 4.6 Calculate the center of gravity of compound geometrical figure or areas by moments.
- 4.7 Calculate the center of gravity of solid bodies.

MOMENT OF INERTIA

5 Understand the application of moment of inertia.

- 5.1 Explain the term moment of inertia.
- 5.2 Mention the units of moment of inertia.
- 5.3 Express the derivation of the formulae for moment of inertia of an area.
- 5.4 Explain polar moment of inertia.
- 5.5 Describe the methods for finding out the moment of inertia.
- 5.6 Find the moment of inertia of a simple areas by integration.
- 5.7 State the theorem of perpendicular axis as applied to moment of inertia.
- 5.8 Proof the theorem of perpendicular as applied to moment of inertia.
- 5.9 State the parallel axis theorem.
- 5.10 Explain the radius of gyration and section modulus.
- 5.11 Calculate the moment of inertia and section modulus of simple solid bodies and composite sections.

FRICTION

6 Understand the principles and application of friction.

- 6.1 Define friction.
- 6.2 State the laws of static and dynamic friction.
- 6.3 Explain coefficient of friction.
- 6.4 Determine the frictional force of a body lying on horizontal and inclined plane.
- 6.5 Identify the ladder and wedge friction.
- 6.6 Describe the screw friction.
- 6.7 Solve problems on wedge and ladder friction.

STRESS AND STRAIN

7. Understand the aspect of stress and strain.

- 7.1 Define stress, strain, modulus of elasticity, modulus of rigidity, Bulk modulus, Poison's ratio and principle of shear stress.
- 7.2 Establish the relation between stress and strain.
- 7.3 Explain the stress in composite bar, stress in nuts and bolts, and thermal stress.
- 7.4 Describe the linear and lateral strain.
- 7.5 Explain the stress-strain diagram.
- 7.6 Solve problems on stress and strain.

8. Understand the effects of torsion of solid and hollow shafts.

- 8.1 Explain torsion and torsion shear.
- 8.2 Deduce the equations used in case of designing solid and hollow shafts.
- 8.3 Deduce the equations of twist angle.
- 8.4 Solve problems using the equation of solid, hollow shafts and twist angle.

SHEAR FORCE AND BENDING MOMENT

9. Understand the fundamentals of shear force and bending moment.

- 9.1 Define beam.
- 9.2 Identify the types of beam.
- 9.3 Identify the types of loading on beam.
- 9.4 Determine the support reactions of different types of beam under different loading conditions.
- 9.5 Define shear force (SF) and bending moment (BM).
- 9.6 Differentiate shear force (SF) and bending moment (BM).
- 9.7 Explain the sign convention and characteristics of S.F and B.M diagram.
- 9.8 Draw S.F and B.M diagram of simple supported beams with point load and distributed load.
- 9.9 Draw S.F and B.M diagram of cantilever beams with point load and distributed load.

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

- 10.1 Define work, power and energy.
- 10.2 Explain the work done in rotation.
- 10.3 Mention the types of engine power.
- 10.4 State the meaning of the engine efficiency.
- 10.5 Mention the types of energy.
- 10.6 Express the derivation of the equation of kinetic energy.
- 10.7 Solve problems related to work, power and energy.

SIMPLE LIFTING MACHINES

11. Understand the principles of simple machines.

- 11.1 State the meaning of simple machine, compound machine and ideal machine.
- 11.2 Define the terms velocity ratio, mechanical advantage and efficiency of a machine.
- 11.3 Relate between efficiency, mechanical advantage and velocity ratio of lifting machine.
- 11.4 State the law of the machine.
- 11.5 Explain the reversibility of a machine and self locking machine.
- 11.6 Solve problems involving velocity ratio, mechanical advantage and efficiency of simple lifting machines.

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 epicyclic gear train.
- 12.8 Express the derivation of the velocity ratio of an epicyclic gear train.
- 12.9 Solve problems related to gear trains.

Practical :

- 1 Verify the triangle law of forces.
- 2 Verify the polygon law of forces.
- 3 Show the resultant of forces by using the force board.
- 4 Proof Lami's theorem by using the force board.
- 5 Determine the coefficient of friction of timber, concrete and mild steel.
- 6 Determine the tensile stress-strain by testing a mild steel specimen (also draw stress-strain diagram).
- 7 Determine the compressive stress of a timber specimen.
- 8 Determine the mechanical advantage of a screw jack.
- 9 Determine the center of gravity of a wooden block.
- 10 Determine the reaction of beam by using spring balance.

REFERENCE BOOKS

- 1 Structural Mechanics – W. Morgan and D.T Williams
- 2 Structure Mechanics – Singer/Popov
- 3 Applied Mechanics – R. S. Khurmi
- 4 Mechanics of Materials – Philip Guatave Laurson
Williams Junkin Cox.
- 5 Analytical Mechanics – Virgil Moring Faires
- 6 Vector mechanics for engineers - Beer and Johnston.
- 7 Engineering mechanics - P. L. Ballaney.

6254

SERVICE STATION OPERATION

T	P	C
2	6	4

AIMS

To provide the students with an opportunity to acquire knowledge, skill and attitude in the area of automotive service station operation with special emphasis on:

- fundamental of service station
- planning and site selection of service station
- organogram and management of service station
- Servicing & maintenance different systems of automobile.
- Engine tuning.

SHORT DESCRIPTION

Fundamentals of service station; Planning and site selection of service station; Organogram of service station; Management of service station; Estimating and costing; Insurance claim; Tools and equipment: servicing and maintenance of automobile, Engine tuning, Tire construction & servicing..

DETAIL DESCRIPTION

Theory:

- 1. Understand the fundamentals of service station.**
 - 1.1. Define service station.
 - 1.2. Mention the purpose of service station.
 - 1.3. Mention the classification of the service station.
 - 1.4. Mention the services offered by different types of service station and garage.
- 2. Understand the planning and site selection of service station.**
 - 2.1. Mention the steps in planning a service station.
 - 2.2. Identify the sections of an ideal service station.
 - 2.3. List the factors to be considered before selecting a service station.
 - 2.4. Describe a good site plan of a service station considering entry, exit and parking.
 - 2.5. Draw the layout of a modern service station showing its different sections with dimensions.
- 3. Understand the organogram of service station.**
 - 3.1. List the different types and number of employee required for an ideal service station.
 - 3.2. Describe the organization chart of an ideal service station.
 - 3.3. Define the terms: job description, job specification and personnel specification of the employees.
 - 3.4. Prepare a job description, job specification and personnel specification of a diploma engineer employed in a service station.
- 4. Understand the management of service station.**
 - 4.1. Define the terms: management, store keeping, inventory, job card, bin card, goodwill and VAT.**
 - 4.2. Mention the functions of store keeping in a garage or service station.**
 - 4.3. Prepare various types of forms and job cards for better store recording.
 - 4.4. Mention the laws and rules of taxation on automotive service work.**
 - 4.4. Identify the points for developing better goodwill between the customers and suppliers.**
 - 4.5. Identify the incentive measure necessary in service station operation.**
- 5. Understand the estimating and costing of services in a service station.**
 - 5.1. Define the term estimating and costing.
 - 5.2. Distinguish between estimating and costing.

- 5.3. **Identify different types of costing of service in a service station.**
- 5.4. Describe the process of job estimating and costing.
6. **Understand the insurance claim process for service station.**
 - 6.1. Define insurance.
 - 6.2. Mention the functions of insurance.
 - 6.3. Explain the insurance of motor vehicle.
 - 6.4. Explain the insurance of workshop equipment and injured employee.
 - 6.5. Describe the insurance claim procedure.
7. **Understand the tools and equipment for service station.**
 - 7.1. **List the tools and equipment for different sections of service station.**
 - 7.2. **List the special tools and equipment required for special services in the service station.**
 - 7.3. **Describe the operation of air compressor, hydraulic bottle jack, hydraulic trolley jack, hydraulic lift and electric motor operated car lift.**
8. **Understand the servicing of automobile.**
 - 8.1. **Describe the cleaning / washing and dryings procedure of a vehicle.**
 - 8.2. Describe the polishing procedure of a vehicle body.
 - 8.2. Describe the procedure of changing engine oil, gear oil, automatic transmission fluid (ATF), differential oil., & oil filter.
 - 8.3. Describe the procedure of greasing of automobile chassis.
 - 8.4. Describe the internal cleaning process by vacuum cleaner.
 - 8.5. Describe the servicing procedure of carburetor & EFI engine fuel system.
 - 8.6. Describe the procedure of diesel engine fuel system servicing.
 - 8.7. Describe the procedure of servicing engine cooling system.
 - 8.8. Describe the procedure of servicing electrical equipment of a car.
 - 8.9. Describe the servicing of automotive brake system.
 - 8.10. Describe the servicing procedure of power transmission system.
 - 8.11. Describe the procedure of wheel alignment & balancing
9. **Understand the construction & servicing of tire.**
 - Define tubed & tubeless tire.
 - Mention the functions of tire.
 - Explain the parts of tire.
 - Explain Radial & Bias ply tire.
 - Mention advantages & disadvantages of radial and Bias ply tire.
 - Explain tire tread pattern.
 - Explain tire specification.
 - Mention the causes of abnormal tire. wear.
 - Explain tire rotation procedure.
 - Explain tire trouble shooting.
10. **Understand tire. Vulcanizing.**
 - Define tire Vulcanizing.
 - Mention the type of tire vulcanizing.
 - Describe the different types of tire vulcanizing method.
11. **Understand wheel balancing.**
 - Define wheel balancing.
 - Classify wheel balancing procedure.
 - Mention the necessity of wheel balancing.
 - Describe the different type of wheel balancing procedure.
12. **Understand the aspect of engine maintenance.**
 - Mention the meaning of maintenance.
 - Outline the importance of engine maintenance
 - Mention the types of engines maintenance.
 - Explain the preventive maintenance of IC engine.
 - Explain the daily maintenance of IC engine.
 - Explain the routine/schedule maintenance of IC engine.

Explain the typical preventive daily schedule maintenance chart of IC engine.

13. Understand the aspect of engine tuning.

Define engine tuning.

Mention the necessity of engine tuning.

Describe the procedure of engine tuning.

Practical:

1. Study the tools and equipment of service station.

1.1. Identify the tools and equipment for different types of work in a service station.

1.2. Identify the special tools and equipment for special work of service station.

2. Study the hydraulic bottle jack or hydraulic trolley jack.

2.1. Identify the components of a jack.

2.2. Service a hydraulic bottle jack.

2.3. Service a hydraulic trolley jack.

3. Perform servicing of an electric motor operated car lift / hoist.

3.1. Identify the components of the lift.

3.2. Clean the required components.

3.3. Apply grease to required components.

4. Perform cleaning and greasing of a vehicle.

4.1. Clean the dirt from vehicle by cold water or steam.

4.2. Wipe the water particles from auto body.

4.3. Apply grease at different greasing point of the vehicle.

4.4. Apply polish on vehicle body.

5. Perform following test of and adjustment of IC engine.

5.1. Measure tappet clearance and adjust tappet clearance of a petrol/diesel engine.

5.2. Test engine timing belt-tension and adjust belt tension of a petrol/diesel engine.

6. Service the gasoline fuel system.

6.1. Identify the component of gasoline fuel system.

6.2. Remove & reinstall fuel filter.

6.3. Remove, clean and reinstall the air filter element

6.4. Clean and adjust the carburetor properly.

7. Service the EFI engine fuel system.

7.1. Clean and test the injector of EFI engine.

7.2. Test the fuel pump performance of EFI engine.

8. Service the diesel fuel system.

8.1. Identify the components of the diesel fuel system.

8.2. Remove & reinstall the fuel filter(s).

8.3. Remove, clean and reinstall the air filter element.

8.4. Remove air from the fuel line.

8.5. Adjust the injection pressure.

9. Service the lubricating system.

9.1. Identify the components of lubricating system.

9.2. Drain the engine oil

9.3. Remove and reinstall the lube oil filter.

9.4. Flush the lubricating system.

9.5. Remove and reinstall the main engine oil seals.

9.6. Refill the engine oil.

10. Service the cooling system.

10.1. Identify the components of cooling system.

10.2. Adjust fan belt tension.

10.3. Test cooling system for leakage.

10.4. Flush the radiator.

10.5. Flush the water jacket.

10.6. Remove, test and install the thermostat valve.

10.7. Fill up the cooling system with coolant.

- 11. Service the ignition system.**
 - 11.1 Identify the components of ignition system.
 - 11.2 Clean, align and adjust the CB point.
 - 11.3 Clean the spark plug and adjust spark plug gap.
 - 11.4 Test and adjust the ignition timing.
 - 11.5 Test the condenser of ignition system.
 - 11.6 Test the ignition coil of ignition system.
 - 11.7 Test the spark intensity of the ignition system & test for missing cylinder.
- 12. Service the charging system.**
 - 12.1. Identify the components of charging system.
 - 12.2. Test the alternator output.
 - 12.3. Clean, topping up and test the condition of battery.
 - 12.4. Charge the battery.
 - 12.5. Test the alternator regulator for its workability.
- 13. Service the automotive brake system.**
 - 13.1. Identify the components of brake system.
 - 13.2. Disassemble, clean and assemble a master cylinder.
 - 13.3. Disassemble, clean and assemble the wheel cylinders.
 - 13.4. Clean the brake shoe and brake drum.
 - 13.5. Remove air from brake system.
 - 13.6. Adjust the different clearances of brake system.
- 14. Perform the wheel alignment.**
 - 14.1. Inflate all the wheel properly.
 - 14.2. Test the camber angle, toe-in and toe-out on turn.**
 - 14.3. Adjust the camber angle, toe-in and toe-out.
- 15. Perform wheel balancing.**
 - 15.1. Remove and inflate all the wheel properly.
 - 15.2. Test the wheel for unbalance.
 - 15.3. Balance the wheel with accurate weight.
- 16. Perform the tire rotation.**
 - 16.1 Draw the perfect tire rotation diagram.
 - 16.2. Rotate the tire as per diagram.
 - 16.3. Tighten the wheel properly.
 - 16.4. Inflate the tire accurately and test with tire pressure gage.
- 17. Perform the tube vulcanizing.**
 - 17.1. Remove the tube from tire.
 - 17.2. Detect the place of leakage.
 - 17.3. Clean and roughen the leakage surface.
 - 17.4. Vulcanize the leakage.
- 18. Repair the tubeless tire.**
 - 18.1. Detect the place of leakage.
 - 18.2. Clean and roughen the leakage area.
 - 18.3. Insert plug of accurate size.

REFERENCE BOOKS

1. Automotive Mechanics
-Crouse and Anglin.
2. Audel Automobile Guide
-Frederick E. Bricker.
3. Service Station Operation
- Md. Radwanoor Rahman.
4. Garage and Service Station Hand Book
- JOHN QUEENBOROUGH
5. Automobile Engineering
- K. K Ramalingan.

6255 SPECIALIZED VEHICLE

T	P	C
1	3	2

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; Dumper; Fork lifts; 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. Mention the classification of 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 front and rear wheel installation mechanism.
 - 2.8 Describe the hydraulic control mechanism.
 - 2.9 Describe the operation of steering system of tractor.
 - 2.10 Mention the specification of a tractor.
 - 2.11 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, balance trailer converter dolly and pole trailer.
 - 3.5. State three ways in which a full trailer differs from a semi trailer.
 - 3.6. Describe the construction of trailer.
 - 3.7. Describe the operation of trailer.
 - 3.8. 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 construction & 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 dumper/Dump truck.**
 - 7.1 State the meaning of dumper/Dump truck.
 - 7.2 Mention the classification of dumper/Dump truck.
 - 7.3 Describe the uses of dumpers/Dump truck.
 - 7.4 Name the major components of dumpers/Dump truck.
 - 7.5 Describe the operation of dumpers/Dump truck.
 - 7.6 Mention the troubles, Possible causes and remedies of dumpers/Dump truck.
- 8. Understand the features of fork lifts.**
 - 8.1 State the meaning of fork lifts.
 - 8.2 Mention the classification of fork lift.
 - 8.3 Name different components of fork lift.
 - 8.4 Describe the uses of fork lift.
 - 8.5 Describe the operation of fork lift.
 - 8.6 Mention the troubles, possible causes and remedies of fork lift
- 9. Understand the features of road roller.**
 - 9.1 State the meaning of road roller.
 - 9.2 Name different components of road roller.
 - 9.3 Describe the uses of road roller.
 - 9.4 Describe the operation of road roller.
 - 9.5 Mention the troubles, possible causes and remedies of road roller.

Practical:

- 1. Study the 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. **Study the 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. **Study the 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. **Study the final drive / differential of farm tractor.**
 - 4.1. Remove the final drive of farm tractor.
 - 4.2. Inspect the components of final drive.
 - 4.3. Install the final drive of farm tractor.
5. **Study the 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. **Study the trailers.**
 - 6.1. Identify the different systems of trailers.
 - 6.2. Identify the components of trailer.
 - 6.3. Observe the operation of trailer.
7. **Study the power tiller operation.**
 - 7.1. Identify the different systems of power tiller.
 - 7.2. Identify the components of power tiller.
 - 7.3. Observe operation of power tiller.
 - 7.4. Diagnose and rectify the troubles of power tiller.
8. **Study the dozer.**
 - 8.1. Identify the different systems of dozer.
 - 8.2. Identify the components of dozer.
 - 8.3. Observe the operation of dozer.
9. **Study the hydraulic excavators.**
 - 9.1. Identify the different systems of excavators.
 - 9.2. Identify the components of excavator.
 - 9.3. Observe the operation of excavators.
10. **Study the dumpers.**
 - 10.1. Identify the different system of dumper.
 - 10.2. Identify the components of dumpers.
 - 10.3. Observe the operation of dumpers.
11. **Study the fork lift.**
 - 11.1. Identify the different systems of fork lift.
 - 11.2. Identify the components of fork lift.
 - 11.3. Observe the operation of fork lift.
12. **Study the road roller.**
 - 12.1. Identify the different systems of road roller.
 - 12.2. Identify the components of road roller.
 - 12.3. Observe the operation of road roller.
13. Visit some industry in where maximum specialized vehicles are available.

REFERENCE BOOKS

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

5851	BOOK KEEPING & ACCOUNTING	T	P	C
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AIMS

- To be able to understand the principles and practices of book keeping and accounting.
- To be able to understand the procedures of general accounting, financial accounting and their applications.

SHORT DESCRIPTION

Concept of book keeping and accounting; Transactions; Entry systems; Accounts; Journal; Ledger; Cash book; Trial balance; Final accounts; Cost account & financial accounting; Depreciation; Public works accounts.

DETAIL DESCRIPTION

1 Understand the concept of book keeping and accounting.

- 1.1 Define book keeping and accountancy.
- 1.2 State the objectives of book keeping.
- 1.3 State the advantages of book keeping.
- 1.4 Differentiate between book keeping and accounting.
- 1.5 State the necessity and scope of book keeping and accounting.

2 Understand the transactions.

- 2.1 Define transactions and business transaction.
- 2.2 Explain the importance of transactions.
- 2.3 Describe the characteristic features of transactions.
- 2.4 Discuss the classification of transaction.
- 2.5 Identify the transaction from given statements stating reasons.

3 Understand the entry system.

- 3.1 State the aspects of transactions.
- 3.2 Define single entry system.
- 3.3 State the objectives of single entry system.
- 3.4 Discuss the disadvantages of single entry system.
- 3.5 Define double entry system.
- 3.6 Discuss the principles of double entry system.
- 3.7 Justify whether double entry system is an improvement over the single entry system.
- 3.8 Distinguish between single entry and double entry system of book keeping.

4 Understand the classification of accounts.

- 4.1 Define accounts.
- 4.2 State the objectives of accounts.
- 4.3 Illustrate different type of accounts with example.
- 4.4 Define "Golden rules of Book keeping".
- 4.5 State the rules for "Debit" and "Credit" in each class of accounts.
- 4.6 Determine Debtor (Dr) and Creditor (Cr.) from given transactions applying golden rules.
- 4.7 Define accounting cycle.
- 4.8 State the different steps of accounting cycle.

5 Understand the Journal.

- 5.1 Define Journal.
- 5.2 State the object of Journal.
- 5.3 State the functions of Journal.

- 5.4 Mention the various names of Journal.
- 5.5 Interpret the form of Journal.
- 5.6 Journalize from given transactions.

6 Understand the ledger.

- 6.1 Define ledger.
- 6.2 Interpret the form of ledger.
- 6.3 State the functions of ledger.
- 6.4 Distinguish between Journal and Ledger.
- 6.5 Prepare ledger from given transactions.
- 6.6 Explain why ledger is called the king of all books of accounts.

7 Understand the cash book.

- 7.1 Define cash book (single, double and triple column).
- 7.2 Explain cash book as both Journal and Ledger.
- 7.3 Prepare double column cash book from given transactions showing balances.
- 7.4 Prepare triple column cash book from given transaction and find out the balances.
- 7.5 Define petty cash book.
- 7.6 Prepare analytical and imprest system of cash book.
- 7.7 Define discount.
- 7.8 Explain the different types of discount.

8 Understand the trial balance.

- 8.1 Define trial balance.
- 8.2 State the object of a trial balance.
- 8.3 Discuss the methods of preparation of a trial balance.
- 8.4 Explain the limitations of a trial balance.
- 8.5 Prepare trial balance from given balance.

9 Understand the final accounts.

- 9.1 State the components of final account.
- 9.2 Distinguish between trial balance and balance sheet.
- 9.3 Identify the revenue expenditure and capital expenditure.
- 9.4 Select the items to be posted in the trading account, profit & loss account and the balance sheet.
- 9.5 State the adjustment to be made from the given information below or above the trial balance.
- 9.6 Prepare trading account, profit & loss account and balance sheet from the given trial balance & other information.

10 Understand the cost and financial accounting.

- 10.1 Define financial accounting.
- 10.2 State the objectives of financial accounting.
- 10.3 Define cost accounting.
- 10.4 Discuss the relationship between financial Accounting and cost accounting.
- 10.5 State the elements of direct cost and indirect cost.
- 10.6 Prepare cost sheet showing prime cost, factory cost, cost of production,

total cost and selling price.

10.7 Discuss the capital budgeting

10.8 Discuss the discounted cash flow method

10.9 Explain the following terms:

a. Fixed cost b. Variable cost c. Factory cost d. Overhead cost e. Process cost

f. Direct cost g. Operating cost h. Standard cost

11 Understand the depreciation

11.1 Define depreciation.

11.2 State the objects of depreciation.

11.3 Discuss the necessity for charging depreciation.

11.4 Describe the different methods of determining depreciation.

11.5 Explain the relative merits and demerits of different method of depreciation.

12 Understand the public works accounts.

12.1 State the important aspects of public works accounts.

12.2 Describe the main features of public works accounts.

12.3 Explain "Revenue and Grant".

12.4 Define Value Added Tax (VAT)

12.5 State the merits and demerits of VAT.

12.6 Define Bill and Voucher.