

150 – MARINE ENGINEERING CRAFT

EXAMINATION STRUCTURE

The trade consists of the following trade related courses:

191 – General Metal Work

193 – Building/Engineering Drawing

194 – Basic Electricity

EXAMINATION SCHEME

022 – **Engine Maintenance and Refurbishing** (as in Motor Vehicle Mechanic Work – 020)

023 – **Auto Electricity** (as in Motor Vehicle Mechanic Work – 020)

151 – Gas, Cold and Hot Water Supply

The examination will comprise of two papers:

151-1 – PAPER I : This will comprise of forty (40) multiple choice Objective questions. Candidates will be required to answer all in 40 minutes, for forty (40) marks.

151-2 – PAPER II: This will comprise of seven (7) Essay questions, out of which five (5) questions will be answered in 2 hours. Each question carries 12 marks. This Section carries sixty (60) marks.

152 – Marine Engine and Transmission

This subject grouping consists of two papers:

152-1 – PAPER I : This will consists of two sections, viz:

SECTION A: OBJECTIVE: this will be forty (40) multiple choice questions. Candidates will be required to answer all in 40 minutes. This section carries forty (40) marks.

SECTION B: ESSAY: this will be a written paper of seven questions. Candidates are to answer five questions in 2 hours. This Section carries sixty (60) marks.

152-2 PAPER II: PRACTICAL: This will comprise of two (2) compulsory Practical Questions for a duration of three (3) hours; and it carries 100 marks.

MARINE GAS, COLD AND HOT WATER SYSTEM

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	<p>SOURCE AND PROPERTIES OF WATER AND CONTAMINATION OF WATER</p> <p>List the source and properties of water and identify sources of impurities and contaminants.</p>	<ol style="list-style-type: none"> The source of water in nature. The properties of water from wells, rivers, lakes and rain. The sources of impurities in water from wells, rivers, lakes and rain etc. Precautions to be taken to prevent contamination of water supplies. Types of hardness and softness of water. Simple treatment of water such as filtration sedimentation, boiling etc. 	<ol style="list-style-type: none"> Identify and explain the sources and properties of water. Differentiate between hardness and softness of water. Carry out simple treatment of water.
2.	<p>LAYOUT OF WATER SUPPLY SYSTEM</p> <ol style="list-style-type: none"> Describe the general principles underlying the layout of public and domestic water supply system. Select material for tanks and reservoir and install. 	<ol style="list-style-type: none"> The general principles underlying the layout of public and domestic water supply system. Selection of a suitable type of storage tank and reservoir. Types of materials used for pipe works in public water supply i.e cast iron, asbestos, steel, concrete and PVC. Installation of tank and service mains. Types of supports and protections required at various positions of the installation of trunk and service mains. Selection and fixing of appropriate fittings i.e bends, tee flanges etc and valves i.e shile air valve, gate valve non-return valves etc. 	<ol style="list-style-type: none"> Explain the general principles underlying the layout of public and domestic water supply system Identify the types of materials used for pipe work in public water supply system. Install tanks and service mains. Select appropriate fittings for various purposes.
3.	<p>CONSTANT AND INTERMITTENT SYSTEM</p> <ol style="list-style-type: none"> Describe the principle of constant and intermittent system of public cold water supply. Identify classes of pipes and select joints. 	<ol style="list-style-type: none"> The principle of constant and intermittent system of public cold water supply. Identification of various classes of pipe and their uses e.g. classes A, B, C. Selection of the various jointing compound suitable for cast iron, asbestos, cement steel, p.v.c. and concrete pipes used for public water supply. Various methods of jointing cast iron asbestos, cement, steel and concrete pipes used for public water supply. Installation of a public cold water supply system. 	<ol style="list-style-type: none"> Carry out identification of various classes of pipes and state their uses. Select various jointing compound suitable for various pipes materials. Install public cold water supply system.
4.	<p>HOT AND COLD WATER SUPPLY</p>	<ol style="list-style-type: none"> The principles of direct and indirect domestic cold water supply 	<ol style="list-style-type: none"> Explain the principles of direct and indirect domestic

	<ol style="list-style-type: none"> Describe the principle of direct and indirect domestic cold water supply system. Select fittings and valves and appropriate pipes for service pipes. 	<ol style="list-style-type: none"> system. Select fittings and valves required for carrying out service connections to water mains. Selection of appropriate pipes and fittings for service pipes. Connection of service pipe to water mains. The need for valves in a water supply system and its installation on the service pipes. Types of joints in domestic cold water supply pipes such as mild steel, (galvanized) copper plastics The need for support and protection of pipe runs within buildings. Installation of a direct or indirect domestic cold water supply system. 	<ol style="list-style-type: none"> cold water supply system. Select fittings and valves required to carryout service connections to water mains. Select pipes and fittings for service pipes. Connect service pipe to water mains. Identify types of joints in domestic cold water supply pipes for various materials. Install direct and indirect domestic cold water supply system.
5.	<p>TAPS VALVES AND COCKS Explain the principles of operation of taps, valves and cocks.</p>	<ol style="list-style-type: none"> The principles of operation of bib, pillar, globe taps, stop valve, high and low pressure ball valves, gate valves, drain cocks, plug cocks, safety valves, spring loaded valve etc. Sketches of valves, taps and cocks. Selection and installation of appropriate valves and taps. The need for and installation of storage system in a domestic water supply. The need for protecting and siting of necessary connections and controls for the storage cistern. 	<ol style="list-style-type: none"> Explain the general principles of operation of taps, valves and cocks. Produce sectional sketches of valves taps and cocks. Identify the need for and installation of storage system in a domestic water supply.
6.	<p>STORAGE CISTERN Explain the design principle and select suitable materials for its construction.</p>	<ol style="list-style-type: none"> Designing a sample support to storage cistern and its contents. Selection of suitable materials for the construction of cistern for cold water supply. Installation of water storage cistern and its support. 	<ol style="list-style-type: none"> Design a sample support to a storage cistern and select suitable materials for its construction. Install water storage cistern and its support.
7.	<p>FAULTS AND DEFECTS Identify faults and defects and rectification of the faults</p>	<ol style="list-style-type: none"> Causes of noise in cold water system and rectification of the fault. Identification and rectification of other types of faults such as air-locks, worn valves, leakages etc in cold water supply system. 	<ol style="list-style-type: none"> Identify causes of noise and other faults in cold water system and rectify them.
8.	<p>RURAL WATER SUPPLY Explain the principle of operations of various pumps and describe their maintenance.</p>	<ol style="list-style-type: none"> The sources of water supply in rural area. The types and principles of operations of pump e.g. Jack, lift and force, semi-rotary, and hydraulic ram, centrifugal pumps, vane pumps, piston pumps etc. 	<ol style="list-style-type: none"> List the sources of water supply in rural areas. Identify and sketch various types of pumps. Explain the importance and siting of essential valves for efficient performance of

		<ol style="list-style-type: none"> 3. Sketching and labeling of pumps in 2 above. 4. The importance and siting of essential valves used for efficient performance of pumps of foot valves, air-vessels. 5. Installation and maintenance of pumps. 	<ol style="list-style-type: none"> pumps. 4. Install and maintain pumps.
9.	<p>SAFETY IN HOT WATER INSTALLATION State the safety precautions to be observed in the installation and use of domestic hot water supply.</p>	<ol style="list-style-type: none"> 1. The main provisions of the model and relevant local hot water installation. 2. Reasons for installing safety valves, control valves, air-release valves and gauges etc. and installation of these items in a hot water supply system. 3. The danger associated with the storage and use of fuels electricity, gas oil etc. 4. Reasons for installing thermostats and thermometer in the heating system. 5. The danger associated with boiler and cylinder explosion. 6. Causes of noises in water supply system. 	<ol style="list-style-type: none"> 1. Explain the reasons for installing safety valves, and install these items in a hot water supply system. 2. Describe the danger associated with the storage of fuels and boiler and cylinder explosion.
10.	<p>HOT WATER INSTALLATION Interpret the blue print of hot water system layout and test installations for safety and efficiency.</p>	<ol style="list-style-type: none"> 1. Interpretation of blue print of public and domestic cold and hot water system layout. 2. Positioning and supporting the components of the hot water installation e.g boiler, feed tank and hot storage cylinder. 3. Piping of hot water installation. 4. Reasons for carrying out complete insulation to all components of the hot water installation. 5. Testing the completed hot water installation for safety and efficient working of the system. 	<ol style="list-style-type: none"> 1. Study and interpret blue print of public and domestic cold and hot water system layout. 2. Carrying out piping of hot water installation. 3. Test hot water installation for safety and efficiency.
11.	<p>INSTALLING A DOMESTIC HOT WATER SUPPLY Describe the different types of heaters and install a domestic hot water supply.</p>	<ol style="list-style-type: none"> 1. The different type of electric and gas water heaters. 2. The working principles of the different types of electric and gas water heaters. 3. The ratings and efficiency of a common immersion and gas heaters and appropriate capacity for any given job. 4. Siting and installation of appropriate hot water heaters. 5. Diagnosis and rectification of relevant faults in the hot water system e.g leakages, faulty valves etc. 	<ol style="list-style-type: none"> 1. Identify different type of electric and gas water heaters and their working principles. 2. Select correct ratings of electric and gas water heaters for any given job. 3. Diagnose and rectify faults in the hot water system.

12.	LIQUIFIED PETROLEUM GAS Describe the method of production and storage of L.P.G. and safety precautions associated with this operation.	<ol style="list-style-type: none"> 1. The method of production and storage of liquified petroleum gases. 2. The various types of Liquefied Petroleum gases and their properties. 3. Necessary safety precautions to be observed when storing and using L.P.G. 	<ol style="list-style-type: none"> 1. Identify and explain the production and storage of L.P.G. 2. List and identify the types of L.P.G. and their properties. 3. Explain general safety precautions to be observed when storing and using L.P.G.
13.	BUNSEN FLAMES AND DOMESTIC GAS INSTALLATION Describe the principles of Bunsen flame and carry out the installation and piping of domestic gas cookers, heaters and Bunsen.	<ol style="list-style-type: none"> 1. The principles of luminous and Bunsen flame combustion and oxidation. 2. The Common products of combustion and how to get rid of them. 3. The various types of fittings used with LPG and their functions. 4. Identifying different methods of gas installation, their advantages and disadvantages. 5. Construction and positioning of platforms for receiving gas cylinder. 6. Installation of gas pipework to feed suitable appliances. 7. Detection of leakages and defective fittings using tests. 	<ol style="list-style-type: none"> 1. Explain the principles of luminous and Bunsen flame, combustion and oxidation. 2. List the common product of combustion and explain how to get rid of them. 3. List methods of gas installation and their advantages and disadvantages. 4. Construct platforms for gas cylinders. 5. Install gas pipework to suitable appliances. 6. Carryout deflection of leakages and defective fittings using soapy water test.
14.	STEAM GENERATOR Describe the principles, functions and the constructional features of steam generator.	<ol style="list-style-type: none"> 1. Types of steam generator. 2. The working principles of a steam generator. 3. The functions and constructional detail of a steam generator. 	List the types of steam generators and explain their working principles.
15.	STEAM AND GAS WORK Identify the various types of steel, pipes and fittings used for steam and gas installations.	<ol style="list-style-type: none"> 1. The importance and usage of stem in manufacturing industry. 2. Differences in the various types of stem e.g wet, dry and superheated with facility. 3. The purpose and types of insulation of steam pipes and fittings. 4. Insulation of steam pipes. 5. Selection of various types of pipes used for gas, water and steam installations. 6. Selection and description of various types of valves used in steam installations. 	<ol style="list-style-type: none"> 1. Explain the importance of steam usage in manufacturing industry. 2. Differentiate between the various types of steam. 3. Insulate stem pipes. 4. Select suitable types of pipes used for gas, water and steam installations. 5. Select and explain the various valves used in stem installations.
16.	INSTALLATION OF STEAM PIPE SYSTEM Describe the installation of a steam pipe system and provide adequate support and insulation of the system.	<ol style="list-style-type: none"> 1. Setting out pipe line from the source to the point of use. 2. Fixing correct bracket or clips along the pipe lines to support steam pipes. 3. Laying of pipes on to bracket and chrome secure. 4. Joining steam pipe. 	<ol style="list-style-type: none"> 1. Set out pipeline for steam pipe. 2. Fix pipes with bracket or clips and test for firmness. 3. Explain reasons for insulating a steam pipe select and apply suitable materials to insulate a steam pipe.

		<ol style="list-style-type: none"> 5. The reasons for insulating a steam pipe. 6. Selection and application of suitable materials to insulate a steam pipe system. 7. Essential tests on completed installations. 	<ol style="list-style-type: none"> 4. Test a completed steam pipe installations.
17.	<p>SYMBOLISING AND COLOUR CODING OF SURFACE LAID PIPES</p> <p>Explain the need for the use of colours in identifying medium transported by pipes and also the use of symbol to indicate direction of flow in pipes, identifying of valves and taps in use.</p>	<ol style="list-style-type: none"> 1. Using symbols to identify the direction of flow of medium transported through pipes. 2. Identifying the medium flowing through a pipe based on the pipe coating colour. 	<ol style="list-style-type: none"> 1. Explain the reasons for using double colour on pipes. 2. Explain the need for symbols on valves, pipes and cocks.

152 – MARINE ENGINE AND TRANSMISSION (CMC 11, 12, CMV 14)

S/NO	TOPICS/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
1.	<p>CLUTCHES Explain the construction and operation of single and multi-plate clutch systems identify and state the characteristics of the types used on board ship.</p>	<ol style="list-style-type: none"> The construction and operation of the single and multi-plate clutch systems. The characteristics of various types of clutch used in ship propulsion system e.g single plate, multi-plate and hydraulic clutches etc. The disengagement process of clutches by mechanical and hydraulic means. Sketching component parts in good proportion in relation to various parts of the transmission system. Various tools and equipment used for the removal/repair and adjustment of a clutch assembly e.g jig for equalising springs. Faults diagnosis in any clutch assembly. Removal of clutch assembly for repair. Dismantling of clutch assembly. Testing clutch springs compression. Repair and replacement of part of the clutch in the right procedure. Bench testing clutch assembly. Fitting clutch assembly to the gear-box and adjusting for free engagement and disengagement. Carry out sea trial to ascertain good grip and release of plates and discs. 	<ol style="list-style-type: none"> Identify the materials used for the construction of clutches, operations of single and multi-plate clutches. Identify by touch and state the characteristics of single and multi-plate, hydraulic and mechanical. Identify servicing tools/equipment for clutch and sketch component parts. Check for faults in clutch, dismantle, repair, assembly and test for effectiveness. Fit clutch assemble to gear box and adjust clearance and carry out sea trial
2.	<p>GEAR BOXES</p> <ol style="list-style-type: none"> Identify tools and equipment used for removal, repair and adjustment of reverse reduction gear box and describe the construction and operation of a 3-speed 4-speed and constant mesh type. Explain the principles of synchronisation, gear ratio driving torque, bearing load and types of locking devices. State the purpose of locking and interlocking devices in the selector 	<ol style="list-style-type: none"> Identification of various tools and equipment used for removal, repair and adjustment of reverse reduction gear box. Description of the construction and operation of a three speed, four speed and constant mesh type of gear box. The principles of synchronisation, gear ratio, driving torque bearing load and various types of locking devices. The purpose of locking and interlocking devices in the selector mechanism. The functions of the free-wheel and overdrive units. The lubrication methods of the rotating parts of a gear box. 	<ol style="list-style-type: none"> Identify the of various tools and equipment used for servicing of gear box. Describe the construction and materials used for design of gear box gears. Sketch typical 3 and 4 speed gear box and label parts. State the purpose of locking, inter-locking and selector mechanism and method of gear box lubrication. State the functions of the tree wheel and the over drive. Carry out repairs on a gear box. Emphasize the importance of good explanation and

S/NO	TOPICS/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	mechanism. 4. Diagnose gearbox faults, replace worn out parts.	7. The principles of operations of the different types of epicyclic gearing and automatic gear boxes. 8. Diagnosing gearbox faults by inspection or/and sea trial. 9. Replacing reverse reduction type gear-box. 10. Removal of gear box from propulsion unit. 11. Carrying out repairs to a gearbox using the correct procedures.	correct coupling procedure.
3.	GEAR LINKAGES 1. Explain the principles of gearing and sketch various layout of gear train. 2. Sketch the layout and construction of the parts of chassis and steering mechanism. 3. State the function of the planetary and spur gears and different assembly.	1. The basic principles of gearing. 2. Sketching various layouts of gear train. 3. Sketching in good proportion, the layout and construction of the component parts of chassis, and steering system. 4. The purpose of locking and interlocking devices in the selector mechanism. 5. The function of the stern tube and thrust block. 6. Testing gearbox for correct gear ratios. 7. Refitting assembled gearbox to engine. 8. Sea trial of vessel fitted with a reconditioned gearbox.	1. With the aid of a neat sketch, explain the basic principles of gearing. 2. Sketch in good proportion chassis engine mounting and rudder control system. 3. Sketch in good proportion chassis engine positioning and steering system. 4. State the purpose of the selector mechanism, lock and interlocking devices. 5. Service gearbox.
4.	PROPELLER AND SHAFT RECONDITIONING 1. Explain the principles of operation, mode of construction, layout and assembly. 2. Explain the concept of motion and change in velocity in relation to change in propeller pitch. 3. Explain and sketch the propeller shaft in transmission system and diagnose its fault.	1. The principles of operation, construction layout and assembly of propeller and drive shaft. 2. The principles of thrust reaction in relation to the action of propeller shaft coupling joint, thrust washer etc. 3. Identification of various special tools and equipment used for removal, repair and adjustment of propeller shaft joints. 4. The concept of motion and change in velocity in relation to change in propeller pitch. 5. The advantage of twin screw or multi-screw system over single screw propeller system. 6. The function of propeller shaft in transmitting power from engine to the propeller. 7. Sketching the component parts in good proportion in relation to various parts of the transmission system. 8. Diagnosing faults on drive shaft and propeller shaft by sea trial	1. Explain the principles of operations, mode of construction layout and assembly of propeller and drive shaft. 2. Use the appropriate tools/equipment to reconditioned propeller and shaft. 3. State the advantages of twin screw over single screw propeller arrangement. 4. State the functions of the propeller shaft, its component parts and alignment. 5. Display a diagram showing the related position of propeller to the vessel.

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		or/and visual inspection. 9. Reconditioning of the propeller shaft and its coupling using the correct assembly procedure.	
5.	PROPELLER SHAFT Dismantle in correct sequence and assess for wear on joints, coupling, bearings and replaced damaged unit	1. Dismantling in the correct sequence the universal joints noting safety provision. 2. Assessment of wears on joints, coupling bearings and replacement of damaged units. 3. Assembling of universal joints using correct procedures. 4. Sea trial for effectiveness after repair.	1. Emphasis should be on how to dismantle the universal joint in a systematic manner and observe the faults and replace if necessary. 2. Using the appropriate tools, assemble universal joints following the correct procedure.
6.	PROPELLER MOUNTING UNIT 1. Explain the fitting of the stern tube and relate it to the stoffin box . 2. Explain how propeller is safely secured on propeller shaft. 3. Diagnose faults, remove, repair, replace and adjust propeller (fixed or controllable pitched types).	1. The function of propeller in transmission of torque to the hull of the ship/vessel. 2. Identification of various types of propellers e.g. fixed pitch, controllable pitch and their methods of assembly. 3. Sketching the component parts of various types of propellers. 4. The relationship between the rudder and the propeller. 5. Causes of fouling of propeller and its removal. 6. Dismantling of propeller from propeller shaft for proper maintenance or repair. 7. Replacement of worn or damaged parts using correct tools. 8. Re-assembling the propeller assembly in logical sequence and carrying out sea trial for performance.	1. Using appropriate tool to assemble propeller shaft to proper alignment. 2. Identification of each component and state the function of each. 3. Dismantle the propeller unit using appropriate wrench and identify the parts. 4. Use appropriate sketch to illustrate the mode of operation of the propeller of a ship. 5. Use appropriate sketch to illustrate the mode of operation of the differential and final drives.
7.	FINAL DRIVE 1. Fix the propeller hub onto the propeller. 2. Position it with the aid of the key and safety washers, bolt the buss to the shaft firmly to correct recommended torque. 3. Assemble the oil distribution box, servo motors and their fittings using correct procedures to controllable pitch propeller.	1. Examine hydraulic control system, the tail-shaft and the propeller blades carefully and replace if not in good condition. 2. Carefully replace the worn out or damaged parts with correct ones. 3. Re-assemble the replaced parts in correct sequential order. 4. Carry out sea trial for efficient performance.	1. Use appropriate tool to adjust the component parts of the nub of the controllable pitch propellers. 2. Examine the shaft and the sleeves for wear and adjust as appropriate. 3. Carry out correct and adequate physical inspection, fixing and adjustment.
8.	MULTI-PROPULSION PLANT 1. Explain the operation of single screw twin screw	1. The operation of one shaft, fixed propeller, two engines arrangement and others. 2. The process of assembly and	1. Emphasise the importance of maintenance of propeller shaft and propeller. 2. make labeled sketches of

S/NO	TOPICS/OBJECTIVES	CONTENTS	ACTIVITIES/REMARKS
	<p>and four shaft configuration systems of propulsion.</p> <p>2. Draw layout of typical two shaft configuration, four shaft configuration and a single screw propulsion unit.</p>	<p>maintenance of multi-screw propeller arrangement system.</p> <p>3. The layout of the four shaft configuration propulsion system and other arrangements.</p> <p>4. The operation of single screw and multi-screw propeller arrangement system.</p> <p>5. Carry out necessary synchronisation of two or more engines to propel a vessel.</p> <p>6. Description of methods of construction of synchronising gear box casing.</p> <p>7. The materials need for propellers and propeller shafts.</p>	<p>four shaft configuration, two shaft configuration and single shaft configuration systems of propulsion.</p> <p>3. Use simple sketch to explain single screw, twin screw and four shaft configuration system of propulsion.</p>
9.	<p>POWER TRANSMISSION Explain the transmission of power by oars, sails, paddle wheel etc. and carry out calculations on thrust and hull efficiency.</p>	<p>1. How power is transmitted by Oars, sails, paddle wheels, jets (jet propulsion) propellers (numerous types etc).</p> <p>2. Description of the working principle of screw propellers.</p> <p>3. Calculation of thrust deduction using $T = (I-Rt)$</p> <p>4. Calculation of Hull efficiency using $\frac{(i-t)}{(i-w)}$</p> <p>5. The speed, range and safety in operation of vessels.</p>	<p>Describe how power is transmitted with the aid of sketches.</p> <p>Calculate for</p> <p>a. Thrust</p> <p>b. Hull efficiency Speed etc.</p> <p>c. Speed etc.</p>
10.	<p>PROPULSION Explain different types of propulsion and understand the load characteristics curves, external characteristic curves and propeller characteristic curves.</p>	<p>1. How power is transmitted from engine to propulsor.</p> <p>2. The materials used in making propellers and reasons for selecting the materials.</p> <p>3. The ratio of the effective power required in towing the hull or the shaft power delivered to the propeller.</p> <p>4. The drawing of shaft arrangement of single shaft ships.</p> <p>5. Constant pitch propellers (cp) and controllable reversible pitch (CRP).</p> <p>6. Load characteristic curves, external characteristic curves and propeller characteristic curves.</p>	<p>1. Identify the sequence of power transmission from the engine to the propulsor.</p> <p>2. Name the materials used in making propellers.</p> <p>3. Sketch the shaft arrangement of single shaft ship.</p> <p>4. Discuss C.P and C.R.P.</p> <p>5. Discuss load characteristics curves, External Characteristic curves etc.</p>
11.	<p>TWO AND FOUR STROKE CYCLES ENGINES Describe the construction of the internal combustion engine and their principles of operation.</p>	<p>1. The working principles of two and four stroke cycles and the advantages of the respective cycles.</p> <p>2. The general principles and types of combustion chamber design.</p> <p>3. Determination of the correctness of ignition timing using timing</p>	<p>1. Explain the working principles of internal combustion engines.</p> <p>2. Determine the procedure of timing internal combustion engines.</p>

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		light. 4. The expansion and contraction of solids, liquid and gases.	
12.	ITEMS IN INTERNAL COMBUSTION ENGINES 1. State the functions of parts of internal combustion engines. 2. List the materials used for the different parts.	1. The functions of cylinder blocks, wet and dry liners, crankcases and cylinder heads. 2. The correct sequence of tightening nuts on all types of joints. 3. Assembling of piston rings, gudgeon pins, connecting rods to plate. 4. The function of crankshaft small and big end bearing. 5. The difference between flat and vee engines. 6. The common firing orders of the two engines. 7. Description of the operation of i. Valves ii. Crankshaft iii. Driving gear iv. Tappets v. Pushrods vi. Rockers. 8. Drawing and labeling of item 7 above 9. Valve clearance and method of adjustment. 10. Tappet adjustment. 11. Calculation of corresponding pressure on the gudgeon-pin bearing.	1. State the specific functions of items in internal combustion engine. 2. Demonstrate the tightening of nuts on all types of joints. 3. Use correct tools in assembling internal combustion engine parts. 4. Visually identify the difference between flat and Vee engines. 5. State correctly the firing orders of flat and Vee engine. 6. Describe with aid of neat sketches the items of internal combustion engines. 7. Demonstrate the procedure of adjusting valve clearance. 8. Calculate data on pressure as related to gudgeon-pin bearing.