Sr. No.MH 21X26-4

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER
Grade: MEO Class II Part 'A'
Function: Marine Engineering at Management Level

Subject:MECHANICS AND HYDROMECHANICS

(Time allowed :3 hours) Total Marks: 100

Note:
1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

1 A motor produces a constant output torque of 0.5 kN m during its run up from rest to an operational speed of 330 rev/ min. If the rotational parts have an equivalent mass of 425 kg with a radius of gyration of 750 mm, determine (i) the angular acceleration during run up, (ii) time taken to reach operational speed, (iii) the change in kinetic energy during the last 5 seconds of the run up to operational speed. [16]

2 A hand winch consists of a two-start square-thread worm on the driving shaft meshing with a gear wheel of 84 teeth, the helix angle of the teeth being 15° and the coefficient of friction between the square thread and teeth of the gear wheel is 0.105. The diameter of the lifting drum on the wheel shaft is 350 mm, the diameter of the rope is 25 mm, and the effective radius of the handle on the worm shaft is 250 mm. Find the effort required at the handle to lift a mass of 150 kg, taking the efficiency of the thread and worm as the efficiency of the winch and neglecting other frictional losses. [16]

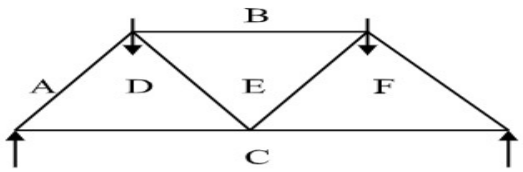
3 A beam of uniform section is 8 m long, its mass is 3.262 Mg and it is simply supported at each end. The beam carries concentrated loads of 20 kN at 2.5 m from the left end and 10 kN at 5 m from the left end. Sketch and dimension the shearing force and bending moment diagrams and calculate the position and magnitude of the maximum bending moment. [16]

4 A casting of mass 50 kg is placed on a plane inclined at 30° to the horizontal. If the coefficient of friction is 0.4, find the time taken for the casting to slide down the plane a distance of 10 m without any external force being applied. Find also, the force required to give the casting an acceleration of 2 m/s^2 up the plane. [16]

5 A solid copper bar 25 mm diameter is sheathed with a steel tube of equal length 40 mm outside diameter and 25 mm inside diameter, the tube being a sliding fit over the bar. They are secured together by a 10 mm diameter pin through the tube and bar at each end. Calculate the stress in the bar, tube and pins if the combination is raised in temperature through 100°C. Take the modulus of elasticity as 206 GN/m^2 for steel and 103 GN/m^2 for copper, and the coefficients of linear expansion per degree C as 12 x 10^{-6} for steel and 17 X 10^{-6} for copper. [16]

6 A vertical spring-loaded governor is operated by a pair of bell-crank levers, their fulcrums being at 40 mm from the centre line of the spindle. The horizontal arms engage with the sleeve which compresses the spring on the spindle and the vertical arms each carry a mass of 0.5 kg on their ends. The bell-crank leverage is 1.5 : 1. Find (i) the force on the spring when the rotational speed of the governor is 25 rev/s. If the spring is further compressed by 5 mm when the speed is increased by 2 %, find (ii) the stiffness of the spring in N/mm. [16]

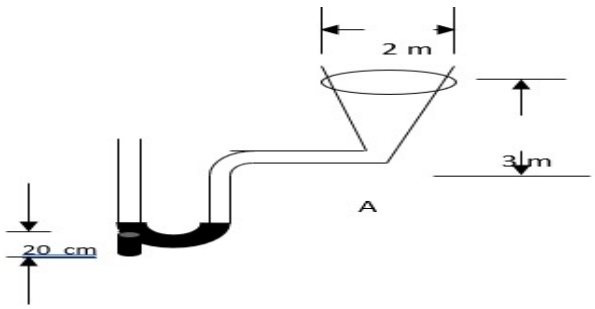
7 [16]



In the frame work shown, the length of each member is 3 m. Draw the vector diagram of forces to scale, measure the force in each member and state the nature of each force.

8 A bar of bronze, 2.5 m long and 75 mm diameter is rigidly connected end on to a bar of steel 1.5 m long and 50 mm diameter so as to form one long bar. The extreme ends of the compound bar are securely fixed and a torque of 6 kN m is now applied at the junction of the bars. Calculate for each bar (a) the torque carried, (b) the maximum stress, and (c) the maximum angle of twist. Take the modulii of rigidity for bronze and steel as 42 and 84 GN/m^2 respectively. [16]

9 The figure shows a conical vessel having its outlet at A to which U tube manometer is connected. The reading of the manometer given in the figure shows when the vessel is empty. Find the reading of the manometer when the vessel is completely filled with water. [16]



Sr. No. TH-21X26-2

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO – Class-II Part 'A'

Function: Marine Engineering at Management Level

Subject:THERMODYNAMICS AND HEAT TRANSMISSION

(Time allowed : 3 hours) Total Marks: 100

Note:

1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

1 The initial condition of a gas at the beginning of compression is 1 bar, 9600 cm^3 and 20°C, and the final condition at the end of compression is 720 cm^3 and 512°C. Calculate (i) the index of compression, (ii) the work done during compression, (iii) change in internal energy, (iv) the transfer of heat during compression. For this gas, take R = 0.264 kJ/kg K and c_v = 0.657 kJ/kg K. The area under the compression curve $PV^n = (p_1V_1 - p_2V_2) / n-1$ [16]

2 The output of an electric generator is 7500 kW and the electrical efficiency is 95 % (neglecting all other losses). The volume flow of cooling air blown through the windings is 16.5 m^3/s at 21°C at a gauge pressure equal to 153 mm water, and this maintains the temperature of the windings at 55°C. Calculate the difference in temperature between the windings and the exit temperature of the cooling air, taking R for air = 0.287 kJ/kgK, c_p = 1.005 kJ/kgK, and atmospheric pressure = 1.013 bar. [16]

3 The pressure, volume and temperature of a gas mixture sample in a closed vessel is 1.01 bar, 500 cm^3 and 20°C, and is composed of 14% carbon dioxide and 86% nitrogen by volume. Taking R for CO_2 = 0.189 kJ/kgK, calculate (i) the partial pressure of each gas, (ii) the mass of carbon dioxide in the sample. [16]

4 Two copper pipes of a telemotor system are each 76 m long and 13 mm internal diameter when filled with oil at 16°C. Calculate the quantity of oil in litres that will be released into the replenishing tank from the pipes when the temperature rises to 30°C. Neglect the amount of oil in the cylinders. [16]

Coefficient of linear expansion of copper = 1.7 x 10^{-5}/°C

Coefficient of volumetric expansion of oil = 7.7 x 10^{-5}/°C

5 The pressure and temperature of the air at the beginning of compression in a single-state double-acting air compressor are 0.98 bar and 24°C, the pressure ratio is 4.55 and the index of compression and expansion is 1.25. The stroke is 1.2 x cylinder diameter, clearance equal to 5% of the stroke, and the compressor runs at 8 rev/s. If it takes air from the atmosphere at 1.013 bar, 16°C, at the rate of 5 m^3/min, calculate (i) the compressor power, (ii) volumetric efficiency, (iii) the dimensions of the cylinder. [16]

6 Dry saturated steam at 14 bar is expanded in a turbine nozzle to 10 bar, expansion following the law pV^n = constant, where the value of n is 1.135, calculate: [16]
(i) the dryness fraction of the steam at exit,
(ii) the enthalpy drop through the nozzle per kg of steam,
(iii) the velocity of discharge,
(iv) the area of nozzle exit in mm^2 per kg of steam discharged per second.

7 A Freon-12 refrigerating machine operates on the ideal vapour compression cycle between the limits -15°C and 25°C. The vapour is dry saturated at the end of isentropic compression and there is no undercooling of the condensate in the condenser. Calculate (a) the dryness fraction at the suction of the compressor, (b) the refrigerating effect per kg of refrigerant, [16]
(c) the coefficient of performance, (d) the carnot coefficient of performance.

8 Describe the apparatus that is commonly used for the analysis of dry exhaust gases. Discuss the probable sources of error in such an analysis.
A boiler burns coal of the following composition: C = 88%, H_2 = 3.8%, O_2 = 2.2% and the remainder ash. On a particular occasion the percentage of CO_2 passing up the chimney was 10%. The temperature of chimney gases was then 250°C. If a sample of this gas is analysed by the Orsat apparatus at room temperature, which percentage of CO_2 would you expect, assuming complete combustion of the fuel. [16]

9 In a combined separating throttling calorimeter the total quantity of steam passed was 2 kg ; water collected from the separator 0.166 kg; steam pressure in the steam main 10 bar ; temperature of steam after throttling 125°C and pressure 1.1 bar. Determine the dryness fraction of steam before inlet to the calorimeter. The specific heat of superheated steam may be taken as 2.09 kJ/kg K. [16]

Sr. No.291026-2

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO Class II

Function: Controlling operation of ship and care for persons on board at Management Level

Subject: NAVAL ARCHITECTURE

(Time allowed :3 hours) Total Marks: 100

Note:
1) Answer **SIX** Questions only. **Three** from each Section.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

Section - I

1 With reference to dry docking, define the responsibilities of the Second Engineer and instructions to Junior Engineers: [16]
(a) Prior to docking
(b) Whilst the vessel is in dry dock
(c) Prior to flooding and leaving the dock.

2 (a) Sketch the cross-section of a bulk carrier with either deep or shallow double bottom showing the type of framing used. [8]

(b) (i) Describe the corrosion problems experienced with ballast tanks. [8]
(ii) State how such tanks are protected against extensive corrosion.

3 Describe the relationship between frictional resistance and each of the following: [4x4]
(a) Ship speed
(b) The wetted area
(c) The surface roughness
(d) The length of the vessel

4 (a) Draw a simple line diagram of the bow of a ship to show the position of the following component parts of the ship's anchoring system: (i) Hawse pipe, (ii) Cable stopper, (iii) Windlass and Cable lifter, (iv) Spurling pipe and Chain locker. [5]

(b) Describe the cable stopper and state its purpose. [3]
(c) Show by means of a sketch how the anchor cable is attached to the ship. [5]
(d) Describe how the chain locker is drained of water, sand and mud. [3]

5 With reference to membrane tanks for the carriage of liquefied gas at very low temperatures:
(a) Describe with the aid of a sketch one method of building up the insulation. [6]
(b) State with reasons the alloy, which is used for the membrane. [4]
(c) Describe with the aid of a sketch how the tanks are located and supported: [6]
(i) Longitudinally (ii) Transversely

Section - II

6 (a) Describe the effect of cavitations on the propeller blades. [6]

(b) The righting moments of a ship at angles of heel of 0°, 15°, 30°, 45° and 60° are 0,1690,5430,9360 and 9140 kNm respectively. Calculate the dynamical stability at 60°. [10]

7 (a) Describe the general precautions to be taken against capsizing. [6]

(b) A ship 120m long has a light displacement of 4000 tonne and LCG in this condition 2.5m aft of midships. The following items are then added: [10]

Cargo 10000 tonne LCG 3.0 m forward of midships
Fuel 1500 tonne LCG 2.0 m aft of midships
Water 400 tonne LCG 8.0 m aft of midships
Stores 100 tonne LCG 10.0m forward of midships

Using the following hydrostatic data, calculate the final draughts:

Draught (m)	Displacement (t)	MCT1cm (tm)	LCB from midships (m)	LCF from midships (m)
8.50	16650	183	1.94 F	1.20A
8.00	15350	175	2.10 F	0.60F

8 (a) Explain the effect of trim on tank soundings. [6]

(b) A ship of 6600 tonne displacement has KG 3.6m and KM 4.3m. A mass of 50 tonne is now lifted from the quay by one of the ship's derricks whose head is 18m above the keel. The ship heels to a maximum of 9.5° while the mass is being transferred. Calculate the outreach of the derrick from the ship's centreline. [10]

9 (a) Explain the effect on GM during the filing of a double-bottom tank. [6]

(b) A ship 130m long displaces 14000 tonne when floating at draughts of 7.5m forward and 8.10 m aft. GML 125m, TPC 18, LCF. 3m aft of midships. [10]
Calculate the final draughts when a mass of 180 tonne lying 40m aft of midships is removed from the ship.

10 (a) Describe how the distribution of mass within the ship affects the rolling period. [6]

(b) A ship turns in a circle of radius 100 metres at a speed of 15 knots. The GM is 2/3 metres and BG is 1 metre. If g = 981 cm/sec^2 and 1 knot is equal to 1.8532 Km/hour, find the heel due to turning. [10]

Sr. No.281026-2

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO Class II

Function: Controlling operation of ship and care for persons on board at Management Level

Subject:SHIP SAFETY, ENVIRONMENTAL PROTECTION AND PERSONNEL CARE

(Time allowed :2 hours) Total Marks: 100

Note:
1) Answer **FIVE** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

1 India, one of the world's five major ship recycling countries, has acceded to the IMO Hong Kong Convention, the treaty that will set global standards for safe and environmentally sound hip recycling. Discuss the key features of "The Hong Kong International convention for the safe and environmentally sound Recycling of Ships". [20]

2 With reference to regulation 12 SOLAS Chapter XII, dealing with Water Level Detection and Alarm System to spaces:
(a) Type of ships Water Level Detection and Alarm System is required to be installed. [5]
(b) Brief description of such installation. [5]
(c) Requirements with respect to detection system [5]
(d) Requirements with respect to alarm system. [5]

3 (a) Explain 'Enhanced Survey Programme(ESP)' with a reference to the convention requirement. List the special risks to certain type of ships that prompted the application of the ESP to those ship types. [12]

(b) What are the major inspection and survey requirements? List the preparations required to be undertaken in the engine room as a pre-requisite for a ESP. [8]

4 For an ISM certification, explain the key clauses, which are required to be complied with for obtaining Interim DOC. State the responsibility of a Second Engineer with respect to satisfactory implementation of SMS on board ship. [20]

5 With reference to Port State Control:
(a) State the various MOU's and the purpose of having a port state control regime. [7]
(b) Give at least 3 examples of deficiency which may lead to detention of your vessel [3]
(c) If your vessel gets detained by the PSCO owing to a deficiency, what would be your action for redressal. [4]
(d) What are the various deficiency action code used in PSC. [3]
(e) Briefly explain the difference between PSC and FSI . [3]

6 (a) Sketch a line diagram of a mechanical low expansion foam fixed firefighting system [6]

(b) Describe the operation of the system sketched. [6]

(c) Explain how a mixture of foam making compound and sea water are converted into foam. [4]

(d) What are the periodic maintenance required on the system. [4]

7 (a) Sketch a simplified circuit that may be incorporated in a control panel for an array of fire detectors. [8]

(b) Describe the following features that may be found in a control panel for fire detectors:

(i) Audible fire alarm circuits. [4]

(ii) Identification of zone of fire [4]

(iii) Automatic change over from normal power supply [4]

8 As a Second Engineer, list risks you envisage in the process of opening and further cleaning of a double bottom tank in the Engine room. Give methodology used in detail, for determining the risk during the above process. Mention different methods which can be used to determine such risks. [20]

Sr. No. 27X26-1

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER
Grade: MEO Class II
Function: Marine Engineering at Management Level

Subject:MARINE ENGINEERING KNOWLEDGE (General)

(Time allowed :3 hours) Total Marks: 100

Note:
1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (**X**) at the end of each question.

1 (a) Explain how analysis of used lubricating oil can be used as a "health-monitoring" tool for diesel engines. [8]

(b) Describe how vibration measurement of a main engine turbocharger can be used: [8]

(i) for fault analysis.
(ii) for condition monitoring with respect to maintenance.
(iii) as a substitute to opening machinery for survey.

2 Compare the destructive testing done on engineering materials with non-destructive testing done on engineering components. Briefly describe one destructive test and two non-destructive tests to illustrate your answer. [16]

3 (a) Describe the preparation necessary before the application (in dry dock) of approved long life coating to the underwater surface of the hull. [8]

(b) State the significance of the roughness profile. [4]

(c) List the different approved coatings which are available for use. [4]

4 With reference to steels used in shipbuilding and marine engineering:

(a) Describe the following types of failure. [6]

(i) Brittle failure (ii) Ductile failure.

(b) Explain the term ductile to brittle transition stating the factor that determines ductile to brittle transition. [6]

(c) Describe a test to determine the value of brittle fracture of a specimen test piece. [4]

5 (a) Define proportional control action. [4]

(b) Sketch and describe a simple pneumatic proportional controller. [6]

(c) State a suitable process where a proportional controller may be employed. [3]

(d) State the disadvantage of proportional only action. [3]

6 With reference to Keyless Propellers:

(a) Sketch a section through a keyless sleeved propeller. [6]

(b) State the advantages of using a keyless sleeved propeller. [6]

(c) State with reasons, which metal sleeve, should be made for contact with the forged mild steel tail shaft. [2]

(d) State the material uses to bond the sleeve to the propeller and the general thickness of the bonding material. [2]

7 (a) Draw a block diagram for a fully automated accommodation air conditioning unit, labelling the component parts and indicating the directions of air flow. [8]

(b) Explain why the unit includes means of dehumidification and humidification. [4]

(c) A chart is used for ensuring that the accommodation conditions are within the so-called Comfort Zone: what useful information does the chart give? [4]

8 With respect to the steering gear, answer the following:

(a) Explain with a diagram, a "fail safe steering gear" fitted on a tanker of more than 100000 DWT. [10]

(b) Explain the sequence of events that take place when an oil leak takes place in one of the hydraulic pipelines. [6]

9 (a) Describe the principle of a coil-operated brake suitable for winches and other deck machinery. [8]

(b) Explain with suitable sketches how the windlass is relieved of strain when a ship is anchored . [8]

Sr. No.27X26-2

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO Class II

Function: Marine Engineering at Management Level

Subject:MARINE ENGINEERING KNOWLEDGE (MOTOR)

(Time allowed :3 hours)

Total Marks: 100

Note:
1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

1 (a) Explain the construction, working principle, and control philosophy of the modern electronically controlled two-stroke marine diesel engine. [8]

(b) Discuss the contrast in its fuel injection and exhaust valve actuation mechanisms, with conventional (mechanically controlled) engines, and detail the advantages it offers regarding emissions and fuel efficiency. [8]

2 (a) Describe, with the aid of a sketch, a main engine holding down system explaining how the design features help prevent excessive stress in the holding down studs. [10]

(b) Describe, with the aid of a sketch, an engine top bracing arrangement, explaining why they are fitted and how they are checked for operational performance. [6]

3 With reference to abnormal and excessive cylinder liner wear:

(a) Explain how it may be caused, stating how it is detected . [4]

(b) Explain the effects and consequences of excessive cylinder liner wear. [4]

(c) Explain how abnormal cylinder liner wear may be prevented. [4]

(d) Explain how the liner wear rate is calculated. [4]

4 (a) Sketch a commonly employed method of attachment between crosshead and slippers. [8]

(b) Explain why guide clearance is strictly limited. [4]

(c) Give reasons why lubricant is usually fed to the slippers and not the guides. [4]

5 With regards to modern diesel engine raising the Life Cycle Value (LCV). describe the importance of following: [4x4]

(a) Low Sac Volume of Fuel Injection Valve

(b) Fuel Valve opening Pressure regulation

(c) Contamination of combustion Chamber and impact on LCV

(d) Contamination of lube oil and impact on LCV.

6 With reference to a Closed Loop engine exhaust gas SOX scrubber system:

(a) Describe, with the aid of a sketch, such a system [8]

(b) State, with reasons, the fluid which is used for SO_X scrubbing in this system. [3]

(c) State how the effectiveness of the scrubbing fluid is maintained and how the sludge is removed and disposed of. [5]

7 With reference to a waste heat boiler/economiser:

(a) write a procedure for the cleaning of the gas side of a waste heat boiler/economiser when the associated main engine is:
(i) running (ii) stopped [2x5]

(b) write a procedure for operation of the main engine when the associated waste heat boiler/economiser cannot be operated due to tube failure. [6]

8 (a) Explain why pilot injection is required for a dual fuel engine when burning natural gas. [4]

(b) Describe, with the aid of a sketch, the arrangements for a dual fuel engine which is capable of burning natural gas on:(i) Otto cycle, (ii) Diesel cycle [12]

9 Analyse the problem of cylinder liner lubrication with reference to oil injection timing relative to piston position, speed and direction of motion. Describe the worst effects of inaccurate lubricant injection timing and how it can have a detrimental effect on developed power in the cylinder. Describe with sketches the arrangement for conveying the oil through the cylinder jacket. [16]

Sr. No. EM-21X26-ST

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO Class II

Function: Marine Engineering at Management Level

Subject:MARINE ENGINEERING KNOWLEDGE (STEAM)

(Time allowed :3 hours)

Total Marks: 100

Note:

1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages whether part or full, to be striked off by (X) at the end of each question.

1 With regard to keeping the gas side of boilers in good condition discuss EACH of the following:

(a) The mechanism of combustion, stating the factors which are important to good combustion; [6]

(b) Oil fuel treatments; [5]

(c) Soot removal equipment. [5]

2 Give a reasoned opinion as to the accuracy of the following references to turbine gland system: [16]

(a) Turbine casing glands are only intended to limit water consumption.

(b) Gland steam condensers are an unnecessary complication.

(c) Mechanical clearance of the labyrinth packing in casing glands should be as fine as possible.

3 Subsequent to manoeuvring, the low-pressure main turbine exhibits severe vibration coincident with a rapid rise in feed density.

(a) State the immediate actions to be taken and the advice to be given to the master of the vessel. [6]

(b) Describe the investigations, repairs, and tests to be carried out in a port with: [2x5]
(i) Limited facilities (ii) Unlimited facilities.

4 State the indications and consequences of both moderate and excessive steam leakage to astern turbines during ahead operation. Describe suitable tests to ascertain the relative leakages of astern manoeuvring valve and guard isolating valve. If the leakage appears serious, what action would you advise? [16]

5 Describe the manner in which a complete set of soot blowers in a water tube boiler are checked for angle and range. What would be the sequence of operation of such a set, and for a typical main boiler of about 68,000 lb steam per hour evaporation what would be approximate steam consumption during soot blowing? [16]

6 Explain why regular testing of water in auxiliary boilers is desirable. For each test normally carried out, state –

(a) Reasons for the testing of Boiler water; [6]

(b) Acceptable values trends for any particular type of auxiliary boiler; [5]

(c) Action required when measured values differ appreciably from desired values. [5]

7 Describe the method of renewing a section of refractory lining of the front wall of a furnace. Explain, how the correct contour for the burner throat is achieved, how allowance is made for brickwork expansion and the precautions to be observed when first bringing the repaired furnace back into service. [16]

8 With regard to membrane wall construction in main boilers: [4x4]

(a) State the reasons for its introduction.

(b) State, with reasons, the main factors that govern the relationships between the pitch, diameter and thickness of the tubes used.

(c) Describe how large membrane panels are supported and prevented from vibrating.

(d) Explain why the water treatment used in this type of boiler is considered to be more critical than in the tangent tube construction.

9 Describe a three element feed water controller (i.e. regulator) measuring steam flow, drum level and feed water flow. Explain what relationship is maintained between the three variables and how? [16]

Sr. No.29X26-1

India
(**2026**)

EXAMINATION OF MARINE ENGINEER OFFICER
Grade: MEO Class II
Function: Marine Engineering at Management Level

Subject:MARINE ELECTROTECHNOLOGY

(Time allowed :3 hours) Total Marks: 100

Note:
1) Answer **SIX** Questions only. **Three** from each Section.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages if any, to be strike off by (**X**) at the end of each question.

Section - I

1 (a) Explain the meaning of the term power factor correction. [4]

(b) State TWO advantages of power factor correction. [4]

(c) Explain, with the aid of a circuit diagram, how power factor correction can be effected in a three phase circuit using capacitors. [4]

(d) Explain ONE method other than the use of capacitors by means of which power factor correction may be effected. [4]

2 (a) List the various losses which occur in a squirrel cage induction motor on load. [7]

(b) State which of these losses is: (i) independent of load current and speed; (ii) dependent on load current; (iii) dependent on speed. [9]

3 In the event of a failure of the main electrical power supply on a ship, an emergency source of power must be available. State the circuits which must be fed from such a source and discuss the reasons governing the selection of such circuits. [16]

4 (a) Draw a circuit diagram illustrating how a single thyristor ('silicon controlled rectifier') may be used to provide a variable voltage d.c. output from a single phase a.c. supply. [8]

(b) Explain how the firing angle of the thyristor is varied. [3]

(c) Sketch waveforms for the output voltage when the firing angle is: (i) 60^{o}; (ii) 120^{o} . [5]

5 With reference to a 3 speed A.C. motor driven cargo winch:

(a) Sketch a circuit diagram for a pole change motor; [8]

(b) Describe how speed change and braking are achieved. [8]

Section - II

6 (a) Explain what is meant by the terms wave form, frequency and average value. [6]

(b) A total load of 8000 kW at 0.8 power factor is supplied by two alternators in parallel. One alternator supplies 6000kW at 0.9 power factor. Find the kVA rating of the other alternator and the power factor. [10]

7 (a) By means of a schematic circuit diagram illustrate the peak rectifier. If the supply voltage is v(t) = V m Sin wt, what is the voltage across the load resistor? [6]

(b) A series circuit comprising a 50 Ω resistor, a coil having resistance and inductance and a capacitor is connected across a 50 V variable frequency supply. When the frequency is 400 Hz the current reaches its maximum value of 0.6 A and the voltage across the capacitor is 200 V. [10]

Calculate each of the following:

(i) the value of the capacitance;

(ii) the resistance and inductance of the coil;

(iii) the power taken from the supply;

8 (a) Why is it important to maintain high efficiency of operation and low values of voltage regulation for power transformers? [6]

(b) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01Ω respectively, and the corresponding leakage reactances are 1.1 Ω and 0.035Ω respectively. The supply voltage is 2200 V. Calculate: [10]

(I) The equivalent impedance referred to the primary circuit;

(II) The voltage regulation and secondary terminal voltage for full load having a power factor of (i) 0.8 lagging and (ii) 0.8 leading.

9 (a) List the factors that determine the starting torque of the three- phase induction motor. How does this torque generally compare with the value of the rated torque? [6]

(b) A 3 ph, 440 V, 60 Hz 8 pole induction motor runs at a power factor of 0.85 lag and drives a load of 8 kW at a speed of 14.4 rev/sec. The stator loss is 1 kW and the rotational losses (windage and friction) amount to 0.8 kW. Calculate EACH of the following: [10]

(i) the synchronous speed;

(ii) the rotor copper loss;

(iii) the input power to the motor;

(iv) the motor current.

10 (a) With the aid of delta and star connection diagrams, state the basic equation from which the delta- star and star- delta conversion equation can be derived. [6]

(b) Three batteries A, B, and C have their negative terminals connected together. Between the positive terminals of A and B there is a resistor of 0.5 ohm and between B and C there is a resistor of 0.3 ohm. Battery A: → 105 V, Internal resistance 0.25 ohm, Battery B: → 100 V, Internal resistance 0.20 ohm, Battery C: → 95 V, Internal resistance 0.25 ohm. Determine the current values in the two resistors and the power dissipated by them. [10]

Sr. No.-281026-1

India (2026)

EXAMINATION OF MARINE ENGINEER OFFICER

Grade: MEO Class II

Function: Marine Engineering at Management Level

Subject:MARINE ENGINEERING PRACTICE

(Time allowed :3 hours)

Total Marks: 100

Note:

1) Answer **SIX** Questions only.
2) All Questions carry equal marks
3) Neatness in handwriting and clarity in expression carries weightage
4) Illustration of an Answer with clear sketches/diagrams carries weightage.
5) Start answering from the backside of the front cover page.
6) Blank pages if any, to be strike off by (**X**) at the end of each question.

1 Describe the procedure to be undertaken for overhaul of an oil cooled Main Engine Piston detailing the OEM tools used for overhauling the piston. Also, describe the procedure for testing of the Main engine oil cooled Piston after overhaul. [16]

2 It is found that the Main engine cylinder head studs are breaking during voyage:

(a) State, with reasons, the possible causes. [6]

(b) State, with reasons and the likely effects on the engine if it is allowed to operate with broken studs. [5]

(c) Explain how this problem can be minimized? [5]

3 Describe the procedure for carrying out the rocking test of a deck electrohydraulic crane. Please explain how will you ensure that you get the correct readings and how do you interpret the readings obtained from this test for planning future overhauls of the crane. [16]

4 During the overhaul of medium- speed auxiliary diesel generator you find that the white metal of one of the bottom end bearings has cracked. Explain how you would fit a spare bearing and enumerate the various tests you would carry before putting the machine back into service. [16]

5 A Plate type LT cooler of the centralized cooling water system on your ship is showing poor performance. What measures you would initiate to rectify the problem and improve the performance. [16]

5 As a second engineer of an ocean going ship, what actions you will take if the specification of the bunkers received in the last port is substantially different than the old bunkers with respect to:

(a) Density (b) Cat fines (c)Viscosity [3x3]

(d) Sulphur content (e) Water content [7]

6 Briefly describe the methods of carrying out a bend test and an impact test. Illustrate the general form of the test pieces used and how the final results offer comparison of different materials. What practical use does the figures obtained serve? [16]

7 With respect to hydraulic ram steering gears:

(a) What emergency locking device can be used in order to speedily bring the steering gear to rest? State with reasons, the best angular position to lock the steering gear. [4]

(b) Use a simple sketch to show where the jumping (top) and wear down (bottom) rudder carrier ring clearances can be measured. Indicate what clearances you would expect with a new steering gear. [6]

(c) State the consequences of the wear down clearances being reduced to less than zero. [6]

8 While carrying out ship's hull inspection, describe the various defects and corresponding repairs that might be expected in shell plating, fore end of the ship, aft end of the ship, openings in shell plating, rudder, propeller and the stern tube. [16]

9 With reference to the exhaust gas boiler of a ship, explain the following: [4x4]

(a) Composition and reasons for the soot deposits.

(b) Various stages of soot fire leading to high temperature fire.

(c) Procedures to be followed for firefighting under different stages of soot fire.

(d) Actions required prior to dry running of an exhaust gas boiler.