

PAST PAPERS

<i>Faculty</i>	<i>Department / Section/Division</i>
<i>Not Applicable</i>	<i>Learning Resource Centre</i>

Past Papers

Faculty of maritime science
Department of Marine Engineering

**Engineering Class III
(Academic)**

2012-2023

<i>Document Control & Approving Authority</i>	<i>Senior Director – Quality Management & Administration</i>
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<i>1st Issue Date: 2017.011.30</i>	<i>Revision No.00</i>	<i>Revision Date: 29.08.2023</i>	<i>Validated by: Librarian</i>
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CINEC Campus (Pvt) Ltd

Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

Maritime Law (Repeat)

- TIME ALLOWED - THREE HOURS
- Answer Any Six questions only
- Date: 2023.07.05

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

1. Referring to United Nations Convention of the Law of Sea – III (UNCLOS-III), regulations for sharing ocean areas & its resources briefly explain following,
 - a. Various sea areas as defined by the convention using a suitable sketch. (04 Marks)
 - b. "Port State Jurisdiction". (03 Marks)
 - c. "Flag State Jurisdiction". (03 Marks)
 - d. "Innocent Passage". (03 Marks)
 - e. "Force Majure" (03 Marks)
2. With reference to SOLAS Chapter II-2 requirements,
 - a. State the safety requirement applicable the for the CO2 (Multi-bottle system) (04 Marks)
 - b. Who will decide to release fixed gas flooding system onboard the ship. (04 Marks)
 - c. State the periodical tests requirement applicable for above systems? (weekly, annually, 2 yearly) (08 Marks)
3. Referring to Risk Management on board ships,
 - a. Explain why it has become necessary to carry out risk assessment. (02 Marks)
 - b. Briefly explain what type of hazards could exist onboard. (06 Marks)
 - c. Make a risk assessment and state the control measures that you would propose when team of riding technicians boarded the vessel for carrying out essential generator repair, taking into consideration the present Corona pandemic. (08 Marks)
4. With Reference to International Maritime Organization (IMO).
 - a. Illustrate the basic organizational structure of IMO. (07 Marks)
 - b. Briefly define following,
 - I. "Contracting Government". (03 Marks)
 - II. "Ratification". (03 Marks)
 - III. "Tacit Approval". (03 Marks)

5. With Regard to SOLAS requirements for watertight doors fitted on watertight bulkheads in cargo ships, State,
- Classes (Types) of watertight doors. **(03 Marks)**
 - State the difference between water tight and weather tight **(04 Marks)**
 - The applicable safe operating requirements for power operated watertight doors. **(09 Marks)**
- 6.
- State the four (04) main objectives of the International Load Line Convention for assigning a minimum "Free Board" to a sea going ship. **(04 Marks)**
 - What is meant by "Margin line" of a ship. **(03 Marks)**
 - What is meant by "Permeability of a Compartment"? **(03 Marks)**
 - State various items on board ship which are subjected to examine during load line survey. **(06 Marks)**
7. Regarding the 'Marpol' Convention,
- State the requirements to be fulfilled (with regard to equipment & procedures) by a ship when pumping out bilge water accumulated in a machinery space while the ship is in a special sea area as defined by Marpol Annex I. **(08 Marks)**
 - What are the categories of hazardous Cargo as per the Marpol Annex II. **(02 Marks)**
 - Briefly define the categories stated in section "b". **(06 Marks)**
8. Emission of various gases from merchant ships are subjected to control by Marpol Annex VI.
- Explain the effect of "Green House Gasses" on global warming. **(03 Marks)**
 - Name four (04) Green House gases. **(04 Marks)**
 - List down 4 reasons of a high fuel oil consumption of a ship **(04 Marks)**
 - What are the certificates & documents required to carry on board ships to comply with annex VI requirements? **(05 Marks)**
9. Survey & Certification is one of the important processes of a merchant ships.
- Briefly explain why it is required to carry out surveys and issue a certificate for sea going vessels. **(02 Marks)**
 - State five (05) parties interested in ship certification. **(05 Marks)**
 - Differentiate the various categories of certificates carried on board ships. **(03 Marks)**
 - State the advantages of Harmonized system of Survey & Certification system (HSSC). **(02 Marks)**
 - State the maximum validity period of certificates issued under above system and the surveys require to carry out during that period to keep the validity of the certificates. **(04 Marks)**



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Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

NAVAL ARCHITECTURE AND SHIP CONSTRUCTION

- TIME ALLOWED - THREE HOURS
- Answer ANY FOUR (04) questions from Part A and ANY TWO (02) questions from Part B
- Date: 2022.07.04 Pass marks: 50%

Part A: NAVAL ARCHITECTURE

Q 1. A load water plane of a ship 180 m in length has $\frac{1}{2}$ ordinates sections indicated in the following table.

Section	AP	1	2	3	4	5	6	7	8	9	FP
$\frac{1}{2}$ width of water plane	1	7.5	12	13.5	14	14	14	13.5	12	7	0

- (i) Water plane area (9 Marks)
- (ii) TPC (4 Marks)
- (iii) Water plane area coefficient (3 Marks)
- Q 2. (i) Define the term "Virtual loss of metacentric height" (4 marks)
- (ii) A vessel of 10,000 tone displacement has a second moment of the water plane around the centerline of $60 \times 10^3 \text{ m}^4$. The center of buoyancy is 2.75m above the keel. The following are the masses on board
- 4000 tonne 6.30m above the keel
- 2000 tonne 7.50m above the keel
- 4000 tonne 9.15m above the keel
- Calculate the metacentric height (12 marks)

Q 3 (a) Explain the meaning of fresh water allowance. (4 Marks)

(b) 215 tonne of oil fuel and stores are used in a ship while passing from sea water of 1.026 t/m^3 into river water of 1.002 tonne/m^3 . If the mean draught remains unchanged, calculate the displacement in the river water. (12 Marks)

Q4. A ship 135m long, 18m beam and 7.6 m draught has a displacement 14000 tonne. The area of the load water plane is 1925 m^2 and the area of the immersed mid-ship section 130m^2 calculate

(a) C_w (b) C_m (c) C_b (d) C_p (16 Marks)

Q5. Define following terms with respect to marine propellers;

- a. Theoretical Speed (V_t) (02 Marks)
- b. Wake Fraction (w) (02 Marks)
- c. Speed of Advance (V_a) (02 Marks)
- d. Real Slip (02 Marks)

II. The diameter & the pitch ratio of a propeller fitted on 130 m long, 10,000 tonne displacement vessel is 6.0 m & 0.8 respectively. The beam of the vessel is 12.0 m and propeller rotate at 120 RPM at 8.0 m design draft in 1.025 tonne/m^3 seawater density.

The wake fraction $w = 0.5C_b - 0.05$ and the real slip is found 36 %.

Calculate;

- a. Speed of advance (04 Marks)
- b. The speed of the ship (02 Marks)
- c. Apparent slip (02 Marks)

Q6. An oil tanker of 17000 tonne displacement has its centre of gravity 1m aft of mid ships and has 250 tonne of oil fuel in its forward deep tank 75m from midships. This fuel is transferred to the after oil fuel bunker whose centre is 50m from midships.

200 tonne of fuel from after bunker is now burned.

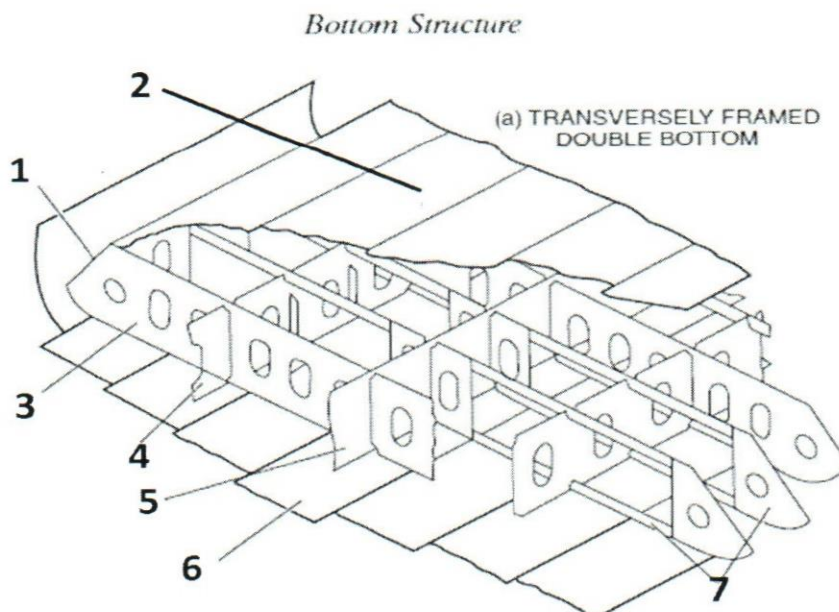
Calculate the new position of the centre of gravity.

- (i) After the oil has been transferred (10 Marks)
- (ii) After the oil has been used. (06 Marks)

Part B:

Answer to any four (02) questions only

7. State the two main category of forces acting on the ship's hull structure. **(02 Marks)**
- a. Explain how "Hogging" & "Sagging" moments created on the hull girder. **(04 Marks)**
 - b. Name various structural members used on hull girder construction to resist to longitudinal bending moment. **(10 Marks)**
8. With the use of suitable sketch, Identify followings of a Marine Propeller,
- I. Face **(01 Marks)**
 - II. Back **(01 Marks)**
 - III. Leading Edge **(01 Marks)**
 - IV. Trailing Edge **(01 Marks)**
 - V. Hub **(01 Marks)**
 - VI. Rake **(01 Marks)**
- a. Briefly explain how the propeller convert torque in to thrust. **(05 Marks)**
 - b. State the kinds of defects that you could find on the propellers when the vessel is in drydock. **(04 Marks)**
- 9.
- a. Identify the component numbered from 1 to 7 of a bottom construction of a ship shown below. **(04 Marks)**
 - b. Briefly Explain the function of any six components stated in above part 'a' **(12 Marks)**





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**Examination for Officer in Charge of an Engineering Watch on Ships of 750KW
Propulsion Power or More**

Thermodynamics

- **TIME ALLOWED - THREE HOURS**

- **Answer ANY SIX Questions**

- **Date: 2023.07.04**

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks

For air $c_p = 1.005 \text{ kJ/kg K}$, $c_v = 0.717 \text{ kJ/kg K}$, $\gamma = 1.4$

Composition of air (mass proportions): 77 % of *Nitrogen* and 23 % of *Oxygen*

Specific heat capacity of water 4.2 kJ/kg K

- The analysis of a sample of coal burned in the furnace of a boiler is 85% of *Carbon*, 5% *Hydrogen*, 4% *Oxygen*, and the remainder *ash*. Calorific values of C and H are 33MJ/kg and 144 MJ/kg respectively.
 - Determine
 - The *calorific value* of the fuel (4 marks)
 - The *theoretical mass of air required per kg of coal* for perfect combustion taking the molecular mass of C, H and O 12, 1 and 16 respectively (4 marks)
 - The *actual mass of air* if it is supplied with 70% excess (4 marks)
 - The *percentage mass analysis of the products* of combustion (4 marks)
 - An auxiliary boiler produces steam at 10 bar 0.96 dry from feed water at 60 °C by using the coal analyzed at the rate of 900 kg per day. Assuming an efficiency of 72%, determine the *steam production per hour*. (4 marks)
- Steam is supplied to a turbine at 30 bar 350 °C and the condenser pressure is 0.045 bar. The power developed is 5 MW when the steam consumption is $22.5 \times 10^3 \text{ kg/h}$.
 - Find the *dryness fraction* of the steam after isentropic expansion in the turbine (5 marks)
 - Draw the *TS* diagram assuming no sub cooling in the condenser. (5 marks)
 - The *Rankin efficiency* of the cycle (5 marks)
 - Actual *efficiency* of the plant (5 marks)

3. A wall made up of two layers of bricks each **100 mm** thick with a **50 mm** air space between them. The wall is **6 m** long and **5 m** high. The coefficients of thermal conductivity of inside brick, outside brick and air **0.6**, **0.8** and **0.025 W/m K** respectively. Determine
- The **overall heat transfer coefficient** in **W/m² K**. (6 marks)
 - The **heat loss per hour** through the wall if the inside face temperature is **24 °C** and the outside face temperature is **-7 °C** (6 marks)
 - The **interface temperatures** (8 marks)
4. **Refrigerant -134a** uses to operate a reefer container in the temperature range of **-15 °C** and **35 °C**. The refrigerant enters the condenser as dry saturated vapour and leaves the condenser as a saturated liquid at **35 °C**.
- Draw the **T-S** diagram for the refrigeration process. (4 marks)
 - Estimate the followings
 - The dryness fraction of the refrigerant at the entrance and exit of the evaporator. (4 marks)
 - Refrigerant effect per kg (4 marks)
 - The coefficient of performance (4 marks)
 - The refrigerant flow rate if the cooling capacity is **3.6 kW** (4 marks)
5. The pressure, volume and temperature at the beginning of the compression of **Otto cycle** are **1.05 bar**, **0.002 m³** and **25 °C** respectively. The maximum temperature of the cycle is **1250 °C**. The volume ratio of the cycle is **8:1**. The cycle is repeated **4000 times/min**. Determine for the cycle
- Pressure and temperature of each cardinal point of the cycle (6 marks)
 - The **thermal efficiency** (4 marks)
 - The **mean effective pressure** (4 marks)
 - The **theoretical output in kilowatts** (4 marks)
 - The **Carnot efficiency** within the same temperature limits (2 marks)
6. A test on a six-cylinder, 2 stroke engine resulted in the following data: brake power per cylinder **1.2 MW**. The engine has a bore of **890 mm** and stroke of **2050 mm** and the mechanical efficiency is **92 %**. At a full load speed of **107 rev/min**, The engine uses **850 kg** of fuel per hour and calorific value of fuel is **42.3 MJ/kg**.
- Estimate
- The brake power, indicated power, and friction power (6 marks)
 - The indicated mean effective pressure (6 marks)
 - Brake specific fuel consumption and indicated specific fuel consumption (4 marks)
 - Indicated thermal efficiency and brake thermal efficiency (4 marks)

7. An engine working on an ideal *Diesel cycle* has a clearance volume of 0.00025 m^3 . It has a bore and stroke of 152.5 mm and 200 mm respectively. At the beginning of the adiabatic compression the air in the cylinder has a pressure of 100 kPa and temperature of $20 \text{ }^\circ\text{C}$ respectively. The maximum temperature of the cycle is $1090 \text{ }^\circ\text{C}$. Determine
- The *temperature* and *the pressure* at the end of the adiabatic compression (7 marks)
 - The *temperature* and *pressure* at the end of the adiabatic expansion (7 marks)
 - The *thermal efficiency* of the cycle (6 marks)
8. A quantity of a gas has a mass of 0.2 kg and initial temperature of $15 \text{ }^\circ\text{C}$. It is then compressed adiabatically through a volume ratio of $4:1$. The final temperature after compression is $237 \text{ }^\circ\text{C}$. The work transfer during the compression is 33 kJ . For the gas, determine.
- The *specific heat capacity at constant volume* (5 marks)
 - The *adiabatic index* (5 marks)
 - The *specific heat capacity at constant pressure* (5 marks)
 - The *characteristic gas constant* (5 marks)
- 9.
- Describe the *first law in thermodynamics*. Hence write an expression for the enthalpy by using internal energy, volume and pressure. (4 marks)
 - A closed vessel of 0.8 m^3 capacity contains *dry saturated* steam at 360 kPa . The vessel is cooled until the pressure is reduced to 200 kPa . Determine
 - The *mass of steam* in the vessel (4 marks)
 - The *final dryness* of the steam (4 marks)
 - The amount of *heat transferred* during the cooling process (8 marks)

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Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

Mathematics

- TIME ALLOWED - THREE HOURS

- Answer ANY SIX Questions

- Date: 2023.07.02

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks

1.

- a. Differentiate the following functions with respect to x

i. $y = \frac{\sin x}{2 + \cos x}$ (4 marks)

ii. $y = \ln(x^2 + \tan^2 x)$ (4 marks)

- b. Determine the stationary values of $y = \frac{x^3}{x^2 - 1}$ and describe the nature of them (6 marks)

- c. If $x = \cos t$, $y = \sin t$, show that $y^3 \frac{d^2 y}{dx^2} + 1 = 0$ (6 marks)

2. The function $f(x) = \frac{x}{x^2 - 1}$

a. Determine $\lim_{x \rightarrow -\infty} \frac{x}{x^2 - 1}$ and $\lim_{x \rightarrow \infty} \frac{x}{x^2 - 1}$ (6 marks)

- b. Determine the singular point of $f(x)$ (2 marks)

c. Find $\frac{dy}{dx}$, $\frac{d^2 y}{dx^2}$ and discuss the nature of the stationary points (8 marks)

- d. Draw a rough sketch of $f(x)$ (4 marks)

3.

a. Show that

i.
$$\frac{\cos 2x}{\cos x + \sin x} = \cos x - \sin x$$
 (5 marks)

ii.
$$\frac{1}{2}(\cos 2x - \sin 2x) = \cos^2 x - \cos x \sin x - \frac{1}{2}$$
 (5 marks)

b. Hence, or otherwise, show that the equation $\cos x \left(\frac{\cos 2x}{\cos x + \sin x} \right) = \frac{1}{2}$ can be written as

$$\cos 2x = \sin 2x. \quad (5 \text{ marks})$$

c. Solve, $\cos 2x = \sin 2x$ for $0 \leq x \leq 2\pi$ (5 marks)

4.

a. The complex number $u = -10 + 9i$. Find the complex number v such that $uv = -11 + 28i$ and show that $|u + v| = 8\sqrt{2}$ (6 marks)

b. If $x \in \mathbb{C}$ (complex number), solve the equation $x^4 + 5x^2 + 4 = 0$ (6 marks)

c. Given that ω is one of the complex roots of the equation $x^3 - 1 = 0$, show that $\omega^2 + \omega + 1 = 0$. Show that ω^2 is the other complex root. (8 marks)

5.

a. Solve the equation $\log_3 x + 4 \log_x 3 = 5$ (6 marks)

b. The difference between the roots of the equation $x^2 + 5x + q = 0$ is 1. Find the value of q . (6 marks)

c. Show that the function $f(x) = 2x^2 + 4x + 5$ is positive for all real values of x and find its minimum value. Hence show that $0 < \frac{6}{f(x)} \leq 2$. (8 marks)

6.

a. Integrate each of the following

i.
$$\int \left(\frac{3}{x} - \frac{2}{4+x^2} \right) dx$$
 (5 marks)

ii.
$$\int \frac{3x+5}{x^2+x-12} dx$$
 (5 marks)

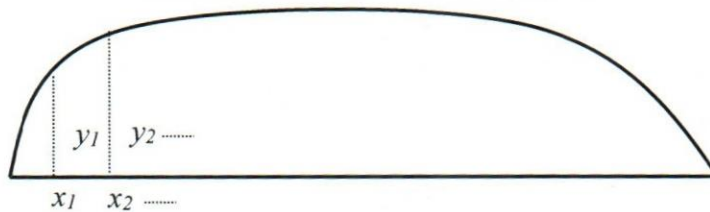
iii.
$$\int_0^1 x \tan^{-1} x dx$$
 (5 marks)

b. Find the area of the region enclosed by the parabolas $y = x^2 - 4x + 9$ and $y = 3 + 4x - x^2$ (5 marks)

7.

- a. Express $\frac{x^2 + x - 3}{(x^2 + 2)(x - 2)}$ in partial fractions. (5 marks)
- b. Show that $x - 2$ is a factor of $x^3 + 3x^2 - 6x - 8$ and hence find the other factors of the expression (5 marks)
- c. Solve the inequality $\frac{2}{x-1} \geq 2 - x$ (5 marks)
- d. Find the inverse function of $f(x) = \frac{x+1}{x-1}$ and show that $f(x)$ is self-inverses. (5 marks)

8. Figure shows the variation of height of a lamina along the x-axis from 0 to 1 cm



x (cm)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y (cm)	0	3.75	4.95	5	5	5	5	4.75	3.5	2.4	0

- a. Determine the area of the lamina in the figure by using the coordinates given in the table. (Hint: Simpson's 1/3 rule). (6 marks)
- b. Find the center of gravity of the lamina about x-axis. (8 marks)
- c. Hence, determine the volume generated by half of a revolution (π radians) of the lamina in the figure about x-axis. (Hint: Pappas theorem) (6 marks)

9.

- a. Find the inverse matrix of A by performing elementary row operations that transform $[A : I]$ to $[I : A^{-1}]$.

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix} \quad (10 \text{ marks})$$

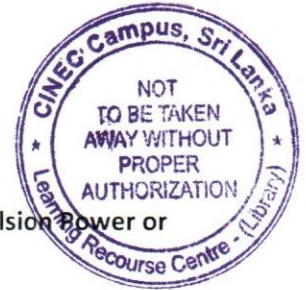
- b. Find the solution for the following system of equations

$$x_1 + x_2 + 2x_3 = -1$$

$$x_1 - 2x_2 + x_3 = -5$$

$$3x_1 + x_2 + x_3 = 3$$

(10 marks)



Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

Applied Mechanics

- TIME ALLOWED - THREE HOURS
- Answer ANY SIX Questions
- Date: 2023.07.01

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks

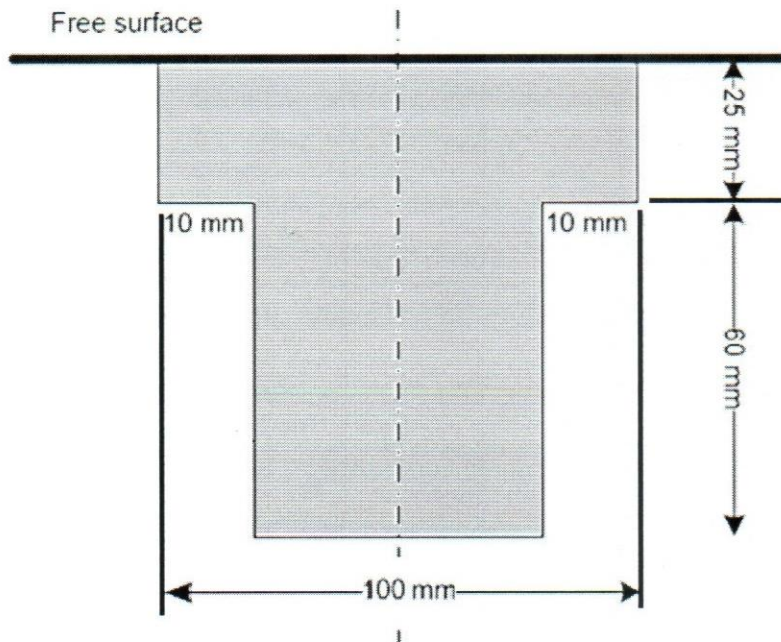
Density of water – 1000 kgm^{-3} Gravitational acceleration – 9.81 ms^{-2}

Density of sea water – 1025 kgm^{-3}

1.

1.1 Figure shows a metal sheet which is vertically immersed in water such that its top edge is touching with free surface.

- a. Find total pressure force acting on one side of the plate. (8 marks)
- b. What is the distance to center of pressure from free surface? (12 marks)



2.

2.1 Define work done and hence derive expressions for;

- a. Power (2 Marks)
- b. Potential energy (2 Marks)
- c. Kinetic energy (2 Marks)

Clearly express any assumptions and notations used.

2.2 A body weighing 300 N is pushed up a 30° plane by a 400 N force acting parallel to the plane. If the initial velocity of the body is 1.5 m/sec and coefficient of kinetic friction is $\mu = 0.2$, calculate the velocity of the body after moving 6m, only using work-energy principles?

(14 Marks)

3.

3.1 A ball A falls vertically from rest from the top of a tower 63 m high. At the same time as A begins to fall, another ball B is projected vertically upward from the bottom of the tower with a starting velocity of 21 m/s. After sometime two balls collide with each other. Find the distance of the point where the balls collide from the bottom of the tower. (10 marks)

3.2 If the ball A lost half of its velocity due to the collision, calculate the speed at which the ball A hit the ground.

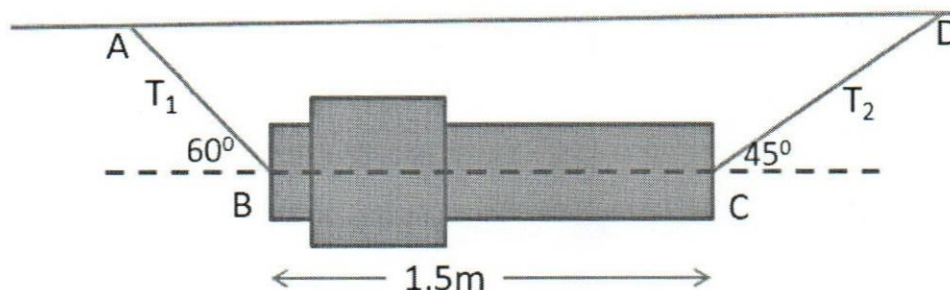
(10 marks)

4.

4.1 Write Parallelogram law of forces with the help of a diagram (6 marks)

4.2 A machine component of 1.5m long and weight 1000N is supported by two ropes AB and CD as shown in the fig given below. Calculate the tensions T_1 and T_2 in the ropes AB and CD.

(14 marks)



5.

5.1 Explain the idea of a clutch and describe the primary purpose of a friction clutch? (6 marks)

5.2 The plate clutch provides five contact surfaces has outer diameter 650 mm and inner diameter 450 mm, provides maximum intensity of pressure at any point in the contact surface is not to exceed 0.55 N/mm^2 . The coefficient of friction between contact surfaces is 0.55. Find amount of power transmission when clutch runs at speed of 5500 rpm. (14 marks)

6.

6.1 Define *relative density* and *specific gravity* (4 Marks)

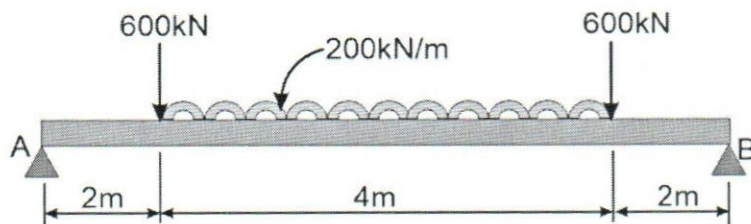
6.2 State and prove Archimedes Principle (4 Marks)

6.3 A Block of wood having a mass of 12 Kg floats on fluid. Find the volume of the block inside the fluid if the relative density of the fluid is 0.7. And also find the extra weight that should be placed on the object for it to immerse another 100 cm^3 in the water. (12 Marks)

7.

7.1 A simply supported beam carrying 200 kN/m uniformly distributed load and two point loads of 600 kN each is shown in below diagram. Considering the loading arrangement of the beam draw;

- Find the reactions at supports A and B (4 marks)
- Shear force diagram (6 marks)
- Bending moment diagram (10 marks)



8.

8.1 Write Bernoulli's equation and identify the variables

(4 Marks)

8.2 In a smooth pipe of uniform diameter 25 cm a pressure of 50 kPa was observed at section 1 which is at an elevation of 10m above the deck. The section 2 of the pipe at an elevation of 12m above the deck, the liquid pressure is observed to be 20 kPa. If the fluid flowing inside the pipe is fresh water having a velocity of 1.25 ms^{-1} , determine;

a. Volume flow rate

(4 Marks)

b. The direction of flow

(6 Marks)

c. The head loss between these two sections.

(6 Marks)

9.

9.1 An electric motor is connected to a pedestal grinding wheel and is rotating at its regular angular speed of $1.06 \times 10^2 \text{ rev/min}$. after some time it was switched off. The rotating wheel was decelerated uniformly at a rate of 1.96 rad/s^2 .

a. How long does it take the grinding wheel to completely stop?

(4 marks)

b. During the time interval found in part (a), how many radians and revolutions has the wheel turned?

(4 marks)

9.2 After complete stop of the wheel, the motor was switched back on. If the angular acceleration of the motor is 2.4 rad/s^2 , how long it would take the wheel to get to its regular angular speed assuming no losses during the process?

(12 marks)

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CINEC Campus (Pvt) Ltd

Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

Marine Engineering Drawing and Design

(Repeat Examination)

- TIME ALLOWED - FOUR HOURS
- Answer ALL questions.

Date: 2023.07.01

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

The pictorial drawing shows details of a **Cylinder Relief Valve** for preventing the rupture of a normally pressurized cylinder.

Draw the following views of the assembled **Cylinder Relief Valve** in **first angle projection**. Select a suitable scale.

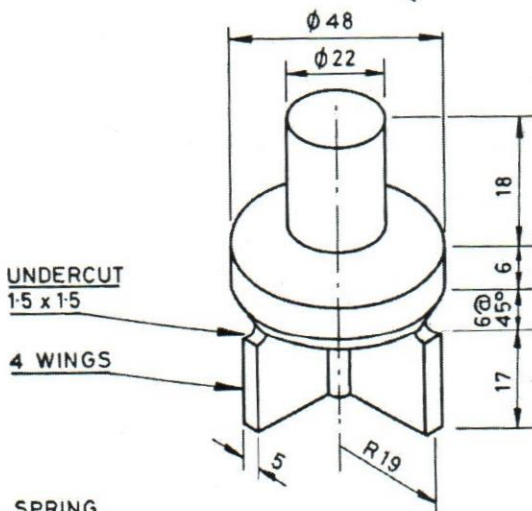
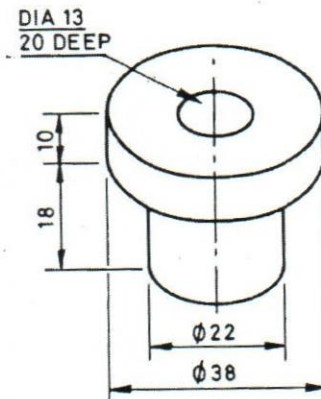
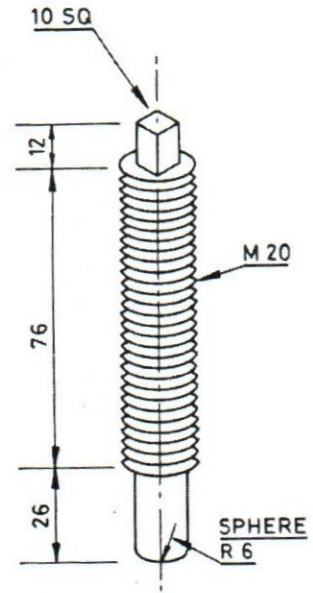
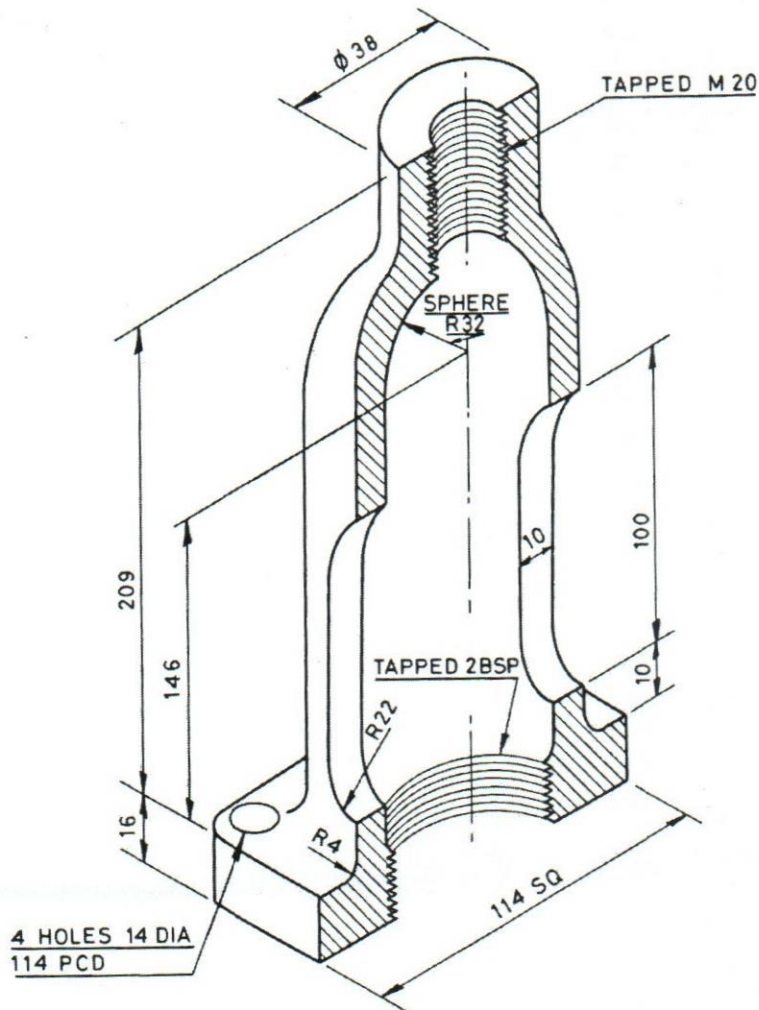
- The sectional front elevation showing the valve assembled. Plane of section should be same as given housing section plane.
- End elevation projected to the right of view (a)
- Plan view

Spring should be shown in free length. Draw M20 lock nut with the adjusting screw. .

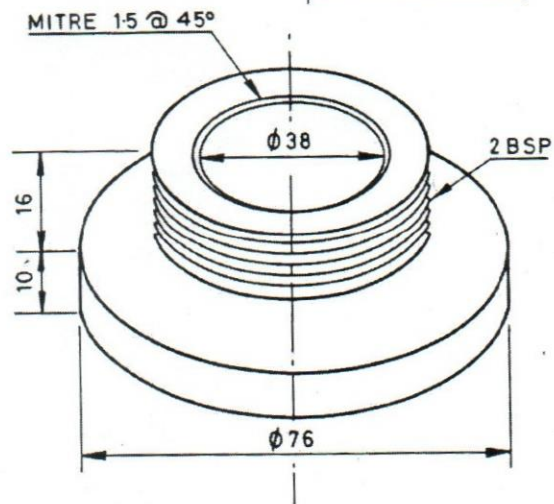
Suitable dimensions should be estimated where not provided. Hidden details are not required in any view. Complete the drawing by including the title, projection symbol and dimensions.

Marking System

- | | |
|---|------------|
| (a) Assembling accuracy of view (a) | (40 marks) |
| (b) Assembling accuracy of view (b) | (25 marks) |
| (c) Assembling accuracy of view (c) | (15 marks) |
| (d) Optimization of space | (05 marks) |
| (e) Dimensioning (at least 12 dimensions correctly) | (05 marks) |
| (f) Title block, projection symbol, lettering | (05 marks) |
| (g) Final appearance | (05 marks) |



SPRING
 FREE LENGTH 146
 LENGTH COMPRESSED 127
 MEAN DIA 32
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CYLINDER RELIEF VALVE



Faculty of Marine Engineering
Department of Marine Engineering



Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

ENGINEERING KNOWLEDGE – II (Motor)

Time Allowed- Three Hours

Answer Six questions

Marks for each part of the question are shown in the brackets

Date: 2023.06.13

Pass marks: 50%

1. a) Explain the checks to be carried on the bedplate during routine inspection. (5 marks)
 b) Name the common defects could be located during the above inspection. (5 marks)
 c) Explain the basic function of the thrust bearing fitted in main propulsion engine (2 marks)
 d) Describe the procedure of crankcase inspection (4 marks)
2. With reference to a 2-stroke slow speed main propulsion engine air starting system State, with reasons,
 - a) Three safety features incorporated in an air starting system. State with reason why an engine may fail to turnover on air. (10 marks)
 - b) Explain how the cause of an engine failing to turn over on air may be determined. (4 marks)
 - c) What are the interlocks fitted in the above system. (2 marks)
3.
 - a). Describe, with the aid of sketches, how an auxiliary engine cylinder liner is calibrated. (6 marks)
 - b). State, with reason, the positions on the liner at which the calibration readings should be taken. (4 marks)
 - c). State how liner calibration readings should be recorded. (4 marks)
 - d) State cause of excessive cylinder liner and piston ring wear. (2 marks)

4.

With reference to an electronically controlled large slow speed engine.

- a. State 4 benefits of electronically controlled fuel injection (2 marks)
- b. Describe any cylinder lubrication system used in electronically controlled engine (4 marks)
- c. State the function of following controllers.
 - i. MPC (2marks)
 - ii. CCU (2 marks)
 - iii. EICU (2 marks)
 - iv. ACU (2 marks)
 - v. ECU (2 marks)

5.

- a) Draw a pipeline diagram of the fuel oil system of a vessel operating with fuel oil. (6 marks)
- b) In the above diagram mark the mark the approximate pressures and temperatures at each stage. (4 marks)
- c) What is the best viscosity range to be maintained at the fuel injector (2 marks)
- d) What is the purpose of fitting fuel coolers in modern engine rooms (4 marks)

6. a). State the essential conditions, which must be satisfied by the air supply for a pneumatic control system. (2 marks)

b). State the possible consequences if the air supply is contaminated. (2 marks)

c). Sketch & describe a pneumatic control system for controlling temperature of main engine lubricating oil outlet of the cooler. (12 marks)

7.

With reference to turbochargers explain:

- a) Why are air coolers fitted? (2 marks)
- b) Why excessive cooling of air should be avoided? (2 marks)
- c) How are turbine glands sealed? (2 marks)
- d) How are bearings lubricated? (2 marks)
- e) Explain the term surging, stating how it occurs, its effect on the turbocharger and how it can be avoided; (6 marks)
- f) State two main types of turbocharging used in engines? (2 marks)

8.

- a) Explain how to residue accumulation of sludge in the scavenge space of a large slow speed two stroke engine (2marks)
- b) What are the indications of a scavenge fire (2 marks)
- c) Briefly explain the procedure of extinguishing a scavenge fire. (8 marks)
- c) Explain the possible damage which could be caused by a scavenge fire. (4 marks)

9.

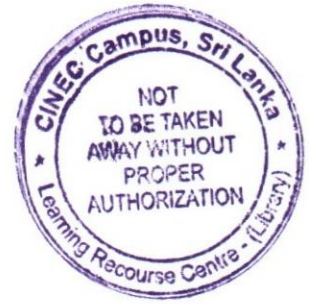
- a) With reference to obtaining an indicator card from a large slow speed diesel engine;
- i) Name four types of indicator cards (2 marks)
- ii) Describe your initial checks and preparations (2 Marks)
- iii) State, the additional information required (2 Marks)
- b) Briefly explain how to calculate indicated power (10 marks)

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Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

Marine Engineering Drawing and Design

- TIME ALLOWED - FOUR HOURS
- Answer ALL questions.

Date: 2023.06.06

Pass marks: 50%

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

The figure shows details of a **Crane Hook**. Draw the following views of the assembled **Crane Hook** in *First Angle Projection* method.

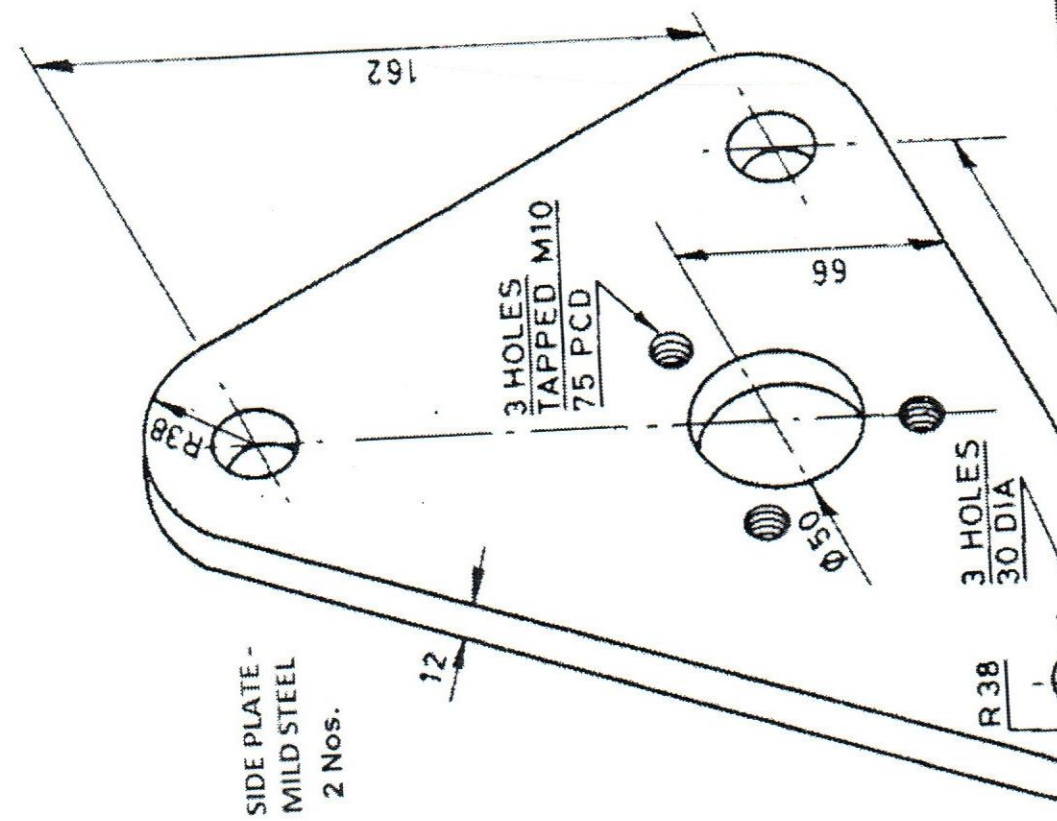
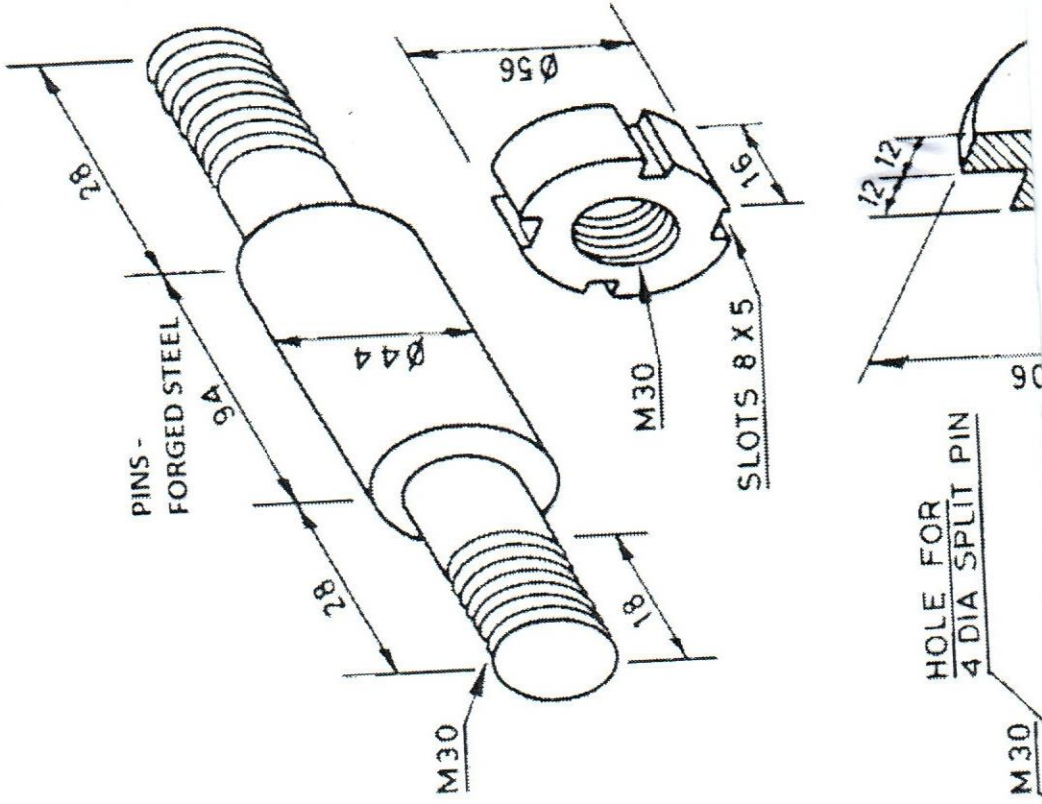
- (a) Sectional Elevation through the horizontal axis of the Swivel block showing all parts assembled.
- (b) End Elevation projected to the right of (a)

Suitable dimensions should be estimated where not provided. Hidden detail is not required in any view.

Complete the drawing by including the title, projection symbol, dimensions and a list of material of parts.

Marking System

- | | |
|---|------------|
| (1) Assembling accuracy of view (a) | (45 marks) |
| (2) Assembling accuracy of view (b) | (30 marks) |
| (3) Optimization of space | (05 marks) |
| (4) Dimensioning | (05 marks) |
| (5) List of materials of parts | (05 marks) |
| (6) Title block, projection symbol, lettering | (05 marks) |
| (7) Final appearance, neatness | (05 marks) |



CRANE HOOK

