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PAST PAPERS

Faculty	Department / Section/Division
Not Applicable	Learning Resource Centre

Past Papers

Faculty of maritime science
Department of Marine Engineering
Engineering Phase I
2014-2022

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Faculty of Marine Engineering
Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 43)

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge General

- Answer any ***Six*** questions

Date: 2022.08.16 Pass mark 70% Time allocated: 03 Hrs

1 a) Sketch and name the low pressure fresh water generator including all important components. [10 Marks]

b) Briefly explain how a reverse osmosis desalinating plant operate [06 Marks]

2. a) Draw a simple diagram of a refrigeration system and show the high pressure and low pressure areas and also the state of the refrigerant in each part of the circuit. [08 marks]

b) **State** the purpose of each component briefly [04 marks]

c) State 02 reasons for high discharge pressure [04 marks]

3 a) State steering gear checks prior to departure of a vessel [06 Marks]

b) Describe **one** of the following with the aid of sketches.

i). Heleshaw pump

ii). Swash plate pump [10 Marks]

4. Referring to Plate type Heat Exchangers state

a) Why plates are corrugated? [02 marks]

b) Write 3 advantages of using this type of Heat Exchanger. [06 marks]

c) Explain with simple sketches, [08 marks]

i) Streamline flow

ii) Turbulent flow

iii) Parallel flow

iv) Counter flow

5. a) Explain with a sketch how single entry Centrifugal Pump works. [08 marks]

b) Sketch and explain what is meant by 'Single entry' and 'Double entry' impeller [06 marks]

c) State the purpose of diffuser [02 marks]

6 a) Briefly explain the following terms

(i) Hardness

(ii) Ductility

(iii) Malleability

(iv) Plasticity

(v) Toughness [10 Marks]

b) Sketch a typical stress / strain curve for ferrous metal and mark on the sketch the following

(i) Proportional limit (ii) Elastic Limit (iii) Fracture point [06 Marks]

7. a) Sketch and describe the operation of a biological sewage treatment plant. [10 Marks]

b) What is meant by 'aerobic process' and 'anaerobic process' in sewage systems? Explain with their byproducts [06 Marks]

8. With reference to centrifugal separators

a) Explain with simple sketches the difference between clarifier and purifier [08 Marks]

b) Draw the forces acting on a solid particle travelling between 2 conical plates [04 Marks]

c) What is meant by 'limit size particle'? [01 Marks]

d) State 03 factors affecting the limit size particle [03 Marks]

9. Define following. [16 Marks]

a) Detecting element

b) Measuring element

c) Measuring unit

d) Illustrate with a diagram how they are interconnected.

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COURSE CODE: ED 0350 PI (BATCH 43)

MATHEMATICS

- **TIME ALLOWED - THREE HOURS**
- **Answer ANY SIX Questions**
- **Date: 2022.08.12** **Pass marks: 50%**

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

1.

a) Evaluate *i.* $\log_{0.2} 0.008$ *ii.* $\log_3 \sqrt{27}$ *iii.* $\log_4 128$. (05 marks)

b) If $\log_{10} 2 = x$, Find $\log_4 5$ in term of x. (05 marks)

c) Simplify $\frac{1}{\log_4 24} + \frac{1}{\log_3 24} + \frac{1}{\log_2 24}$ (05 marks)

d) Solve the logarithmic equation $\log_4(x-1) = \log_2(x-3)$. (05 marks)

2. a) Evaluate $(-128)^{\frac{3}{7}}$ (06 marks)

b) Simplify $\frac{1}{1+x^{b-a}+x^{c-a}} + \frac{1}{1+x^{a-b}+x^{c-b}} + \frac{1}{1+x^{a-c}+x^{b-c}}$ (07 marks)

c) Solve for x, $5(2^x) - 4^x - 4 = 0$ (07 marks)

3. a) Find the sum of roots and product of roots of equation of $x^2 + x - 3 = 0$. (07 marks)

b) Prove that $kx^2 + 2x - (k-2) = 0$ has real roots for any value of k. (07 marks)

c) If α and β are roots of quadratic the equation $ax^2 + 2bx + c = 0$, prove that the quadratic equation whose roots are $\alpha + \frac{1}{\beta}$ and $\beta + \frac{1}{\alpha}$ is

$acx^2 + 2b(a+c)x + (a+c)^2 = 0$ (06 marks)

4.

a) Express as complex numbers in the standard form a + bi

i. $\frac{13}{3-2i}$ ii. $\frac{3+2i}{2-3i}$ iii. $\frac{(1+i)(1+2i)}{(1+3i)}$

(3x2 marks)

b) Express as complex numbers in the form $r\angle\theta$

i. $\sqrt{3}-i$ ii. $\frac{\sqrt{3}}{4}+\frac{3i}{4}$ iii. $3-3i$

(3x3 marks)

c) Find the square root of $2+3i$ (5 marks)

Hint: $r\angle\theta \equiv r\left(Cos\,\theta + i\,Sin\,\theta\right)$

5.

a) Prove that (6 marks)

i. $\tan x.\sin x+\cos x=\sec x$

ii. $\frac{\cos x}{1+\sin x}+\frac{1+\sin x}{\cos x}=2\sec x$

b) Solve the trigonometric equation $\sin x+\sqrt{3}\cos x=1$. (6 marks)

c) Hence, Sketch the graph of $f(x)=2\sin\left(x+\frac{\pi}{3}\right)-1$. (8 marks)

6.

a) Differentiate the following function with respect to x

i. $y=x^3+x^2-5x+6-\frac{2}{x}$ (4 marks)

ii. $y=\frac{x^2+1}{\left(x^3-2\right)}$ (4 marks)

b) If $y=\sin\sqrt{x}$, show that $4x\frac{d^2y}{dx^2}+2\frac{dy}{dx}+y=0$ (06 marks)

c) Find $\frac{dy}{dx}$, if $y^2+y.cos\,x=0$ (06 marks)

7.

a) Find the partial fractions of $\frac{4x^2+6x-9}{(x+2)(x-1)}$ (06 marks)

b) Hence, integrate following expression with respect to x. (06 marks)

$$\int \frac{4x^2+6x-9}{(x+2)(2x-1)}dx$$

c) Evaluate the integral $\int_0^1 (x+1)^2\,dx$. (08 marks)

8. a) Evaluate (06 marks)

$$\lim_{x\to 0} \frac{\sin(\pi\cos^2 x)}{x^2}$$

b) Use 1/3 Simpson's rule to interpolate a value for the integration $\int_0^1 \frac{1}{1+x^2}dx$ for ten ordinates (n = 10). (10 marks)

c) Hence, determine the value of π for four decimal places. (4 marks)

9.

a) If $A=\begin{pmatrix}2 & 3\\ 2 & 3\end{pmatrix}$ and $B=\begin{pmatrix}-1 & 3/2\\ 1 & -1\end{pmatrix}$ show that $AB = BA = I$ where $I=\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$ (6 marks)

b) Show that $\begin{vmatrix}0 & b & c\\ b & 0 & a\\ c & a & 0\end{vmatrix} = 2abc$ (6 marks)

c) Find the inverse of $A=\begin{pmatrix}1 & -1 & 1\\ 1 & -2 & 3\\ 2 & 1 & -3\end{pmatrix}$ (8 marks)

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COURSE CODE: ED 0350 PI (BATCH 43)

2ND SEMESTER EXAMINATION QUESTION PAPER
Electrotechnology

- *This question paper consists of eight questions.*
- *Answer any six (06) Questions*
- *Date: 2022.08.09*

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01. a. i. What is an atomic number and atomic weight?

ii. Draw the carbon atom name all the particles.

iii. What are called free electrons? (2 x 3= 06 Marks)

b. i. What are the different between conductors and insulators?

ii. Give two examples of semi-conducting materials (2 x 4=08 Marks)

C. i. The length of a copper wire 400m and size of conductor 1/1.13 mm.

ii. What will be ohmic resistance of the wire? (Resistive of copper = $1.785 \times 10^{-8} \Omega m$) (06 Marks)

02. a. What is an electric circuit?
Draw and explain the essential parts of an electric circuit along with their functions (08 Marks)

b. A 30A motor operates from a 240V "Insulated" system. The supply cables have a total impedance of 0.01Ω.If
i. an open circuit fault
ii. an earth fault and
iii. a short circuit fault occurred; what circuit current would flow in each case?
(3 x 2=06 Marks)

c. The following data are impressed on the base of a miniature lamp 6Volts / 30 mA. Calculated
i The resistance
ii Power of the filament at rated voltage (2 x 3=06 Marks)

03. a. Explain Kirchhoff 's current law (KCL) and voltage law (KVL) (3 x 2=06 Marks)

b. Two batteries, A and B connected in parallel, and an 80 ohm resistor is connected across the battery terminals. The E.M.F and the internal resistance of battery A are 100V and 5Ω respectively, and the corresponding value battery B are 95V and 30 ohm respectively. Find

i. The value and direction of the current in each battery and
ii The terminal voltage. (2 x 7=14 Marks)

04. a. A moving coil galvanometer, of resistance 5Ω ,gives a full-scale reading when a current of 15mA pass through the instrument. Explain, with the aid of circuit diagrams, how its range could be altered so as to read up to ; (i). 5A , and (ii). 150V. Calculate the values of the resistors required.

(2 x 6=12 Marks)

b. How do you check, the insulation-resistance on a three phase six terminal induction motor.

(08 Marks)

05. a. What are the two basic types of batteries? Given two examples for each type.

(2 x 3=06 Marks)

b. How the Ah capacity and voltage are calculated, when the batteries are connected parallel and series.

(06 Marks)

c. Thirty cells having an E.M.F 1.5V and internal resistance 0.5Ω are connected ten in series per row, three rows in parallel. If a 2.5Ω resistance is connected across the battery, find the value of the current passing through the external load. (Draw the circuit diagram)

(08 Marks)

06. a. Describe the Fleming's left-hand and Right-hand rules. (2 x 2=04 Marks)

b. State Faraday's laws of electromagnetic induction. (04 Marks)

c. A coil of 100 turns is rotated at 1500 rev/min. in a magnetic field having a uniform density of 0.05T,the axis of rotation being at right angles to the direction of the flux. The mean area per turn is 40 cm^2. Calculate

i. The frequency
ii. The period
iii. The Maximum value of the generated E.M.F when the coil has rotated through 30° from the position of zero E.M.F.

(4 x 3=12 Marks)

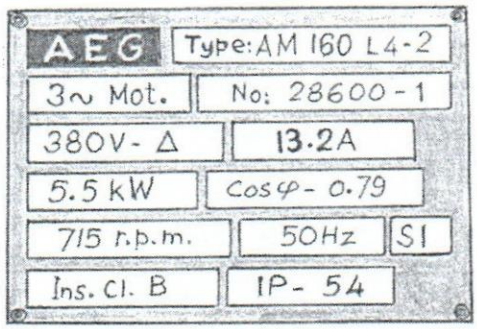
07. a. Three capacitors have capacitance of 10μF,15μF and 20μF respectively. Calculate the total capacitance when they are connected i. In series ii. In parallel

(2 x 4=06 Marks)

b. A coil of resistance 5.94 ohm and inductance 0.35 A is connected in series with a capacitance of 35μF across a 200V -50Hz supply. Find:

i. The impedance
ii. The current flowing
iii. The power factor
iv. The angle of phase difference between the voltage and current.
v. The voltage across the coil
vi. The voltage across the capacitor
vii. The total active power taken from the supply. (2 x 7=14 Marks)

08. a. Figure shows a rating plate of an electric machine. Determine the following parameters.



i. The apparent power
ii. The active power
iii. The number of poles
iv. The synchronous speed
v. The slip
vi. The phase current. (2 x 6=12 Marks)

b. Draw the circuit diagram of power and control circuit for direct-on-line D.O.L magnetic contractor motor starter circuit. (Mark the all terminals number and equipment identification letters)

Specifications:
Power supply - 3 ~ ,440V-60Hz (insulated neutral system)
Motor - 440V/7.5kW - 60Hz (3520 r.p.m)
Control Supply - 240V - 60 Hz

(08 Marks)

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COURSE CODE: ED 0350 PI (BATCH 43)

2ND SEMESTER EXAMINATION QUESTION PAPER
Naval Architecture

- This question paper consists of eight questions.
- Answer Any Six (06) Questions

Date: 2022.08.08 Pass mark 50% Time allocated: 03 Hrs

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1. A ship 180m long has half widths of water plane of 1, 7.5,12,13,5,14,14,14,13.5,12.7and 0 respectively.

Calculate

(i) Water plane area (9 Marks)

(ii) TPC (4 Marks)

(iii) Water plane area coefficient (3 Marks)

2. (i) Define the term centre of buoyancy of an object. (4 marks)

ii) A box barge 65m long and 12 m wide floats at a draught of 5.5 M in sea water. Density of sea water is 1025kg/m^3 .

Calculate (a) the displacement of the barge (8 marks)

(b) its draught in fresh water (4 marks)

3. The length of a ship is 7.6 time the breath, while the breath is 2.85 times the draught. The block coefficient is 0.69, prismatic coefficient 0.735, waterplane area coefficient 0.81 and the wetted surface area 7000 m^2 . The wetted surface area S is given by ;

$$S = 1.7Ld + \frac{\nabla}{d}$$

Calculate

(i) displacement in tonne (8 marks)

(ii) Area of immersed mid-ships section. (4 marks)

(iii) waterplane area. (4 marks)

4. (a) Define MCT 1cm and TPC (4 marks)

(b) A ship 150 m long has draught of 7.70m forward and 8.25m aft , MCT1 cm 250tm ,TPC 26 and LCF 1.8m forward of mid ships. Calculate the new draughts after the following masses have been added.

50 tone 70m aft of mid ships,

170 tone 36m aft of midships,

100 tone 5m aft of midships,

130 tone 4m forward of midship

40 tone 63m forward of midship. (12 marks)

5. (a) What is the meaning of freshwater allowance? (4 marks)

(b) A ship of 8000 tonne displacement floats in sea water of 1.025tonne/m^3 and has a TPC of 14. The vessel moves into fresh water of 1.000 tonne/m^3 and loads 300 tonne of oil fuel. Calculate the change in mean draught. (12 marks)

6. A vessel of 10000 tonne displacement has a second moment of area of water plane about the centerline of the ship $60X10^3$ m^4. The centre of buoyancy is 2.75m above the keel.

The following are the disposition of masses on board the ship.

4000 tonne 6.3 m above the keel

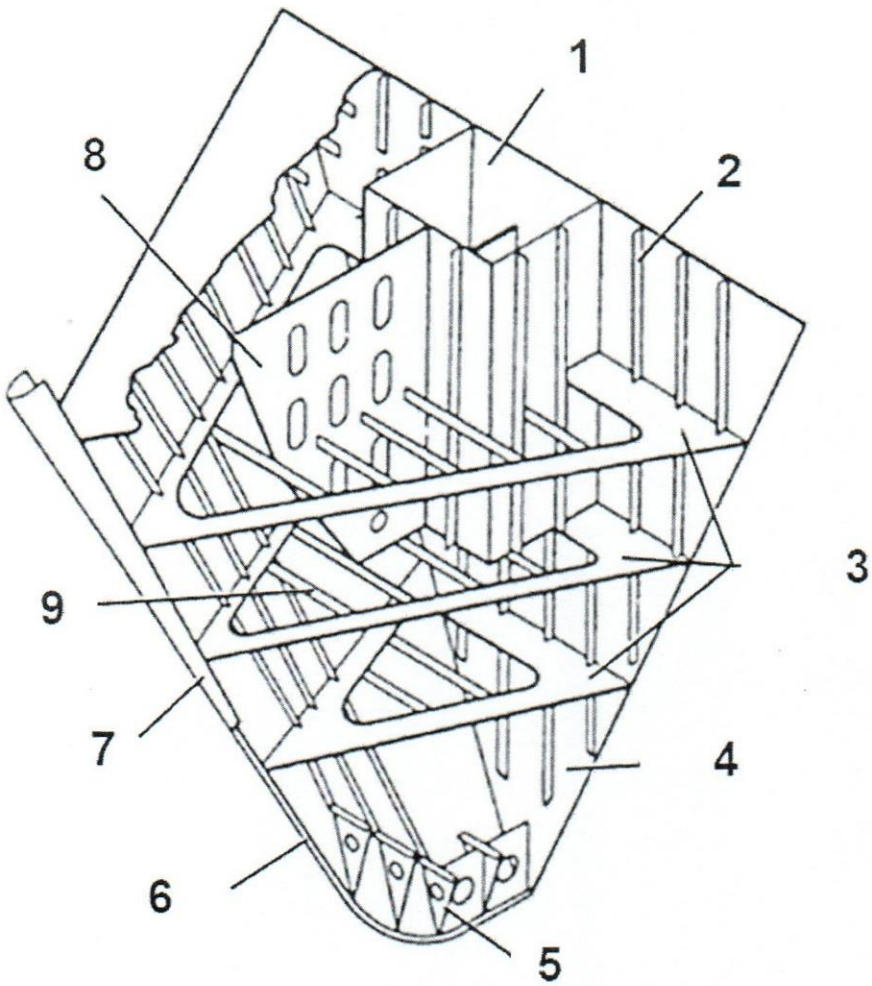
2000 tonne 7.5 m above the keel

4000 tonne 9.15m above the keel.

Calculate the metacentric height. (16 marks)

7. Below diagram shows construction features of forward end of a ship.

Part Names are given below and write down the relevant numbers according to the suitable features. Wash bulkhead, chain locker, vertical stiffeners, stringers , panting beams, COllision bulkhead, deep floors, stem bar and Breast hook (16 marks)



8. Briefly explain the purpose of following features included in ship structure. You may use suitable sketches where necessary.

i) Transverse framing system. (4 marks)

ii) Void space (4 marks)

iii) Longitudinal girders and shell plating (4 marks)

iv) Watertight bulkhead (4 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2022.08.03 *Pass mark 50%* *Time allocated: 03Hrs*

Q: 1

The given figure shows the exploded pictorial view of a cast iron bearing. Assemble the different parts in their correct position and draw in fill size the following views in first angle projection.

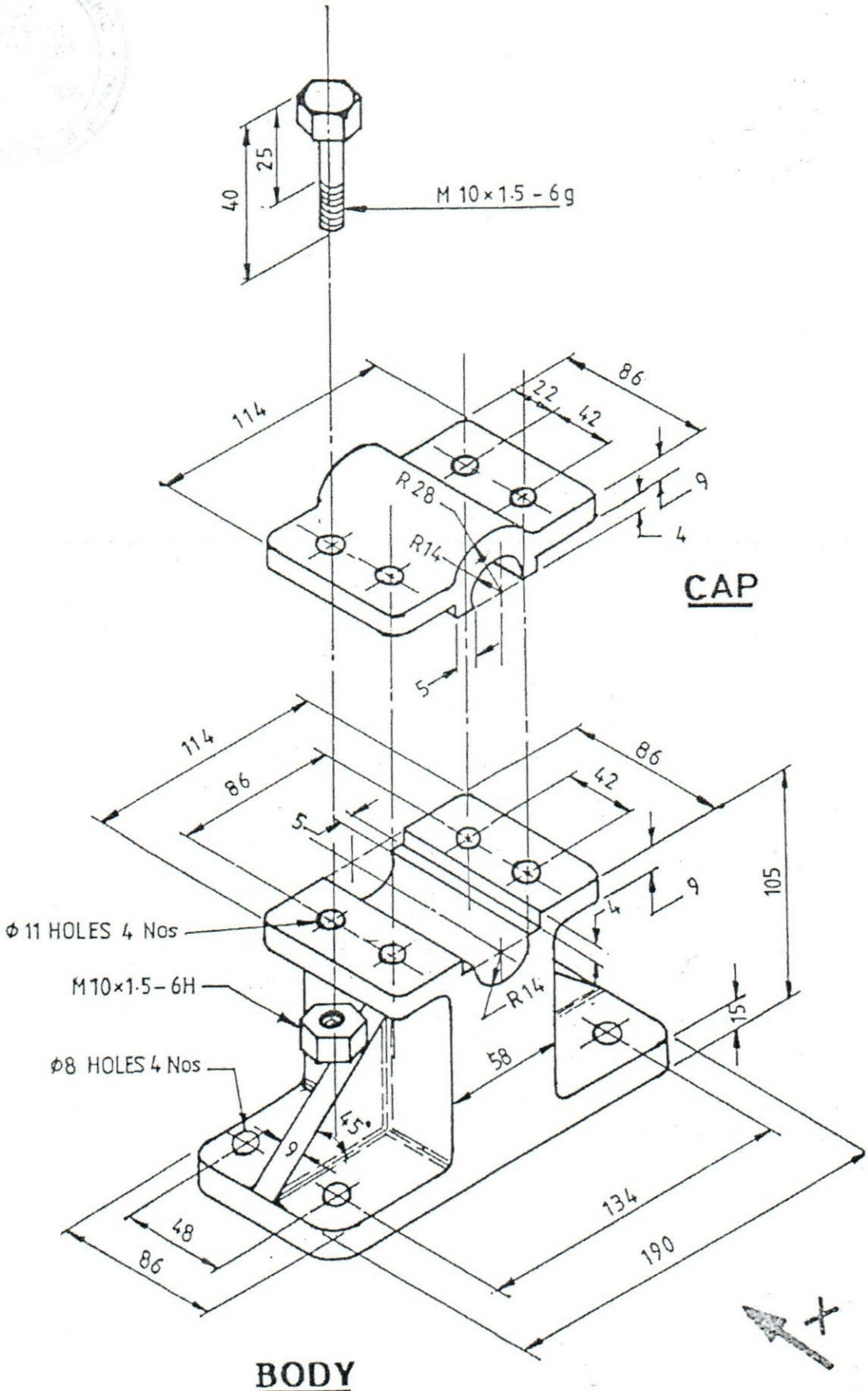
a. Sectional front elevation looking from the direction of arrow X
b. End elevation projected in the right of view "a"
c. Plan projected from "a"

**Print main title "CAST IRON BEARING", scale and dimensions on your drawing. Estimate any missing dimensions*

Marking System

Q: 1

a.	Sectional front elevation	:	35 Marks
b.	End elevation	:	25 Marks
c.	Plan	:	20 Marks
	Dimensioning	:	10 Marks
	Titles and lettering	:	05 Marks
	Boundaries Lines and overall neatness	:	05 Marks


40
25
M 10×1·5 – 6g
114
86
22
42
R 28
R14
9
4
5
CAP
114
86
86
42
5
105
9
4
Φ 11 HOLES 4 Nos
M10×1·5 – 6H
R14
15
58
Φ8 HOLES 4 Nos
45°
9
134
190
48
86
BODY

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Knowledge General

- *Answer any **Six** questions*

Date: 2022.05.28 *Pass mark 70%* *Time allocated: 03 Hrs*

1) a) State 4 types of pumps used on ships. **(04 Marks)**

b) Sketch a double acting resciprocating pump & name it. **(06 Marks)**

c) Draw a cross section of a centrifugal pump and briefly explain the working process. **(06 Marks)**

2) With reference to plate type fresh water generator,

a) Draw and explain the function **(10 marks)**

b) Explain start and stop procedure **(06 marks)**

3) a) Draw a simple diagram of a refrigeration system and show the high pressure and low pressure areas and also the state of the refrigerant in each part of the circuit. **(08 marks)**

b) List the safety cut offs found on a refrigeration compressor. **(04 marks)**

c) What is the effect on a refrigeration system if there is air in the circuit? **(04 marks)**

4) a) Sketch and describe a four ram steering system. **(08 marks)**

b) Explain the function of the floating lever. **(04 marks)**

c) Explain with the aid of a sketch the operation of the tele motor transmitter and receiver. **(04 marks)**

5) a) Sketch a tubular heat exchanger used on a ship for cooling engine cooling water. **(4 Marks)**

b) How is expansion accommodated in the type of heat exchanger you have sketched?

(4 Marks)

c) What are the advantages and disadvantages of this type of heat exchanger as against a plate type heat exchanger? **(8 Marks)**

6) a) State what a purifier and a clarifier are. **(4 Marks)**

b) With the aid of sketches show the difference between a purifier and clarifier bowls. **(12 Marks)**

7) a) Oily water separator is a very important piece of equipment on board a ship. For what purpose is it used? **(02 Marks)**

b) Sketch and describe an oily water separator. **(14 Marks)**

8) Sketch and describe a biological sewage plant used on ships. **(16 Marks)**

9) a) With reference to mechanical properties of metals describe in simple terms

i. Elasticity

ii. Brittleness

iii. Hardness

iv. Toughness **(08 marks)**

b) Name three types of steels commonly used in engineering and the carbon percentages **(04marks)**

c) State for what purposes they are used **(04 marks)**

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I

COURSE CODE: ED 0350 PI (BATCH NO 44)

1ST SEMESTER EXAMINATION QUESTION PAPER

MARITIME LAW

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2022.05.28 *Pass mark 50%* *Time allocated: 03 Hrs*

1) Write full terms of the following abbreviations **(16 marks)**
   a. IMO
   b. ILO
   c. STCW
   d. UNCLOS
   e. ISM Code
   f. ISPS Code
   g. MLC
   h. PFSO
   i. SSAS
   j. SOLAS
   k. IMDG Code
   l. ORB
   m. IOPP
   n. EEBD
   o. ODS
   p. VOC

2) With related to MARPOL,
   a. List 6 Annexes of MARPOL **(06 marks)**
   b. According to annex I, state the requirements to discharge into the sea outside special areas of oil or oily mixture from a ship of 400GT and above **(06 marks)**
   c. State 2 certificates/documents required to carry onboard according to Annex I **(04 marks)**

3) With reference to UNCLOS, write brief notes on the following
   a. Internal waters **(04 marks)**
   b. Territorial waters **(04 marks)**
   c. Contiguous zone **(04 marks)**
   d. Exclusive Economic Zone **(04 marks)**

4) With regard to IMO
   a. Name 4 main committees of IMO **(04 marks)**
   b. Define 'convention' and 'protocol' **(04 marks)**
   c. State any 4 conventions of IMO **(08 marks)**

5) With reference to SOLAS,
   a. State the main objective of SOLAS **(02 marks)**
   b. Define 'Non- combustible material' **(02 marks)**
   c. Explain the difference between 'weathertight' and 'watertight' **(04 marks)**
   d. State the regulations pertaining to the ships' steering gear **(08 marks)**

6) Write all chapters of SOLAS convention **(16 marks)**

7) With reference to ISM and ISPS codes, briefly explain
   a. Purpose/objective of ISM **(04 marks)**
   b. Role of 'Designated Person' **(04 marks)**
   c. Role of 'Port facility security officer' **(04 marks)**
   d. Ship Security Alert System **(04 marks)**

8) With reference to International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)
   a. State the ballast water exchange standard and explain two methods used for this **(06 marks)**

   b. State the ballast water performance standard and 3 methods proposed for achieving this with examples **(10 marks)**

9) With reference to MARPOL,
   a. State regulations for discharging sewage **(06 marks)**
   b. State regulations for discharging food waste outside special area **(06 marks)**
   c. State sulphur content limit of fuel in ECA and the rest of the world on a ship which does not use any exhaust gas cleaning system **(04 marks)**

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I

COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER

MARITIME LAW

- *This question paper consists of eight questions.*
- *Answer any SIX questions*

Date: 2022.05.28 *Pass mark 50%* *Time allocated: 03 Hrs*

1) With reference to UNCLOS define the followings
   a) Internal waters **(04 marks)**
   b) Territorial waters **(04 marks)**
   c) Contiguous zone **(04 marks)**
   d) Exclusive Economic Zone **(04 marks)**

2) As per **MARPOL annex I,**
   a) Describe the procedure of pumping out Engine Room Bilges outside special areas?**(05 marks)**
   b) What is the certificate which has to be carried onboard as per MARPOL annex I and what is the validity period of it. **(02 marks)**
   c) State the information which must be entered in the Oil Record Book when pumping out bilges. **(03 marks)**
   d) list the 6 annexures of MARPOL 73/78 **(06 marks)**

3) with related to MARPOL
   a) List the 6 Annexes of MARPOL **(06 marks)**
   b) Define Special Areas **(04 marks)**
   c) Name the Special Areas Under MARPOL Annex1 **(04 marks)**
   d) What is the meaning Of IOPP? **(02 marks)**

4) According to IMO
   a) What is the IMO briefly Explain **(06 marks)**
   b) Explain the Procedure Of making law **(06 marks)**
   c) What is the Tacit Acceptance? **(04 marks)**

5) With reference to ISM code

a) Explain why ISM is necessary? **(06 marks)**

b) Who is a designated person? **(06 marks)**

c) What are the certificates to be carried on board? **(04 marks)**

6) Explain (in –short) the followings

a) LOADLINE **(02 marks)**

b) STCW code **(02 marks)**

c) ORB (Oil Record Book) **(02 marks)**

d) Garbage record book **(02 marks)**

e) ILO **(02 marks)**

f) IMDG code **(02 marks)**

g) ISPS code **(02 marks)**

h) **SSO** with reference to the ISM CODE **(02 marks)**

7)

a) Explain how ships ballast water can pollute the sea, with examples **(08 marks)**

b) Name the convention which have been introduced by IMO to minimize this **(02 marks)**

c) What are the methods proposed to achieve the performance standard? **(06 marks)**

8) With relevant to the knowledge of SOLAS

a) What is the purpose of SOLAS **(02 marks)**

b) Write down All the SOLAS Chapters **(14 marks)**

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COURSE CODE: ED 0350 PI

1ST SEMESTER EXAMINATION QUESTION PAPER
Workshop Theory (Batch 44)

- This question paper consists of six questions.
- Answer All questions

Date: 2022.05.26 Pass mark 50% Time allocated: 03 Hrs

Q 1. Briefly explain following workshop tools and their uses with suitable sketches where necessary. (2 marks each)

(i) Surface- plate

(ii) Depth gauge

(iii) Dial gauge

(iv) V block

(v) Scriber

(vi) Filler gauge

(vii) Thread gauge

(viii) Out- side and inside calipers

(ix) Centre punch

(x) Taps and dies.

Q2. (a) With a suitable sketch mark following points on a threaded bolt. (1 mark each)

i. Pitch of the thread.

ii. Minor diameter.

iii. Major diameter.

iv. Pitch diameter.

v. Root

vi. Crest

(b) Explain the meaning of M 14 marked on a bolt. (2 marks)

(c) Name the type of drilling machines use for small jobs? (6 marks)

(d) What is the meaning of BSP and M thread? (2 marks)

Q3.

a. Name various type of manufacturing processes widely used in industry. You may use sketches for explaining each type of above-mentioned method (4 marks)

b. Plane carbon steels are mainly of iron with small quantities of carbon.

Explain with examples following type of steel with their uses. Your answer should include the percentage of carbon in each type of steel.

i. Low carbon steel (3 marks)

ii. Medium carbon steel (3 marks)

iii. High carbon steel (3 marks)

iv. What is meant by cast iron? Give some examples of engineering component manufactured by cast iron. What are the advantages and disadvantage of using cast iron? (3 marks)

Q 4.

(i) With regard to properties of materials explain following terms. (2 marks each)

a) Hardness b) Toughness c) Brittleness d) Ductility

(ii) Explain the different between hot rolling and cold rolling of steel. (4 marks)

(iii) Explain the following heat treatment methods. (2 marks each)

a) Normalizing b) Annealing

Q5.

(i) Draw the circuit diagram of a simple DC electric arc welding machine. Your answer should clearly show the polarity of electrode (4 marks)

(ii) Explain various position of manual electric arc welding positions. Use Sketches where necessary.

(8 marks)

(iii) List down 4 welding faults in an arc welding joint. (4 marks)

Q6. With an aid of a suitable graph (strain against stress) identify ranges of following physical properties of material. (9 marks)

a. Yield strength and yield point. (1 mark)

b. Ultimate strength. (1 mark)

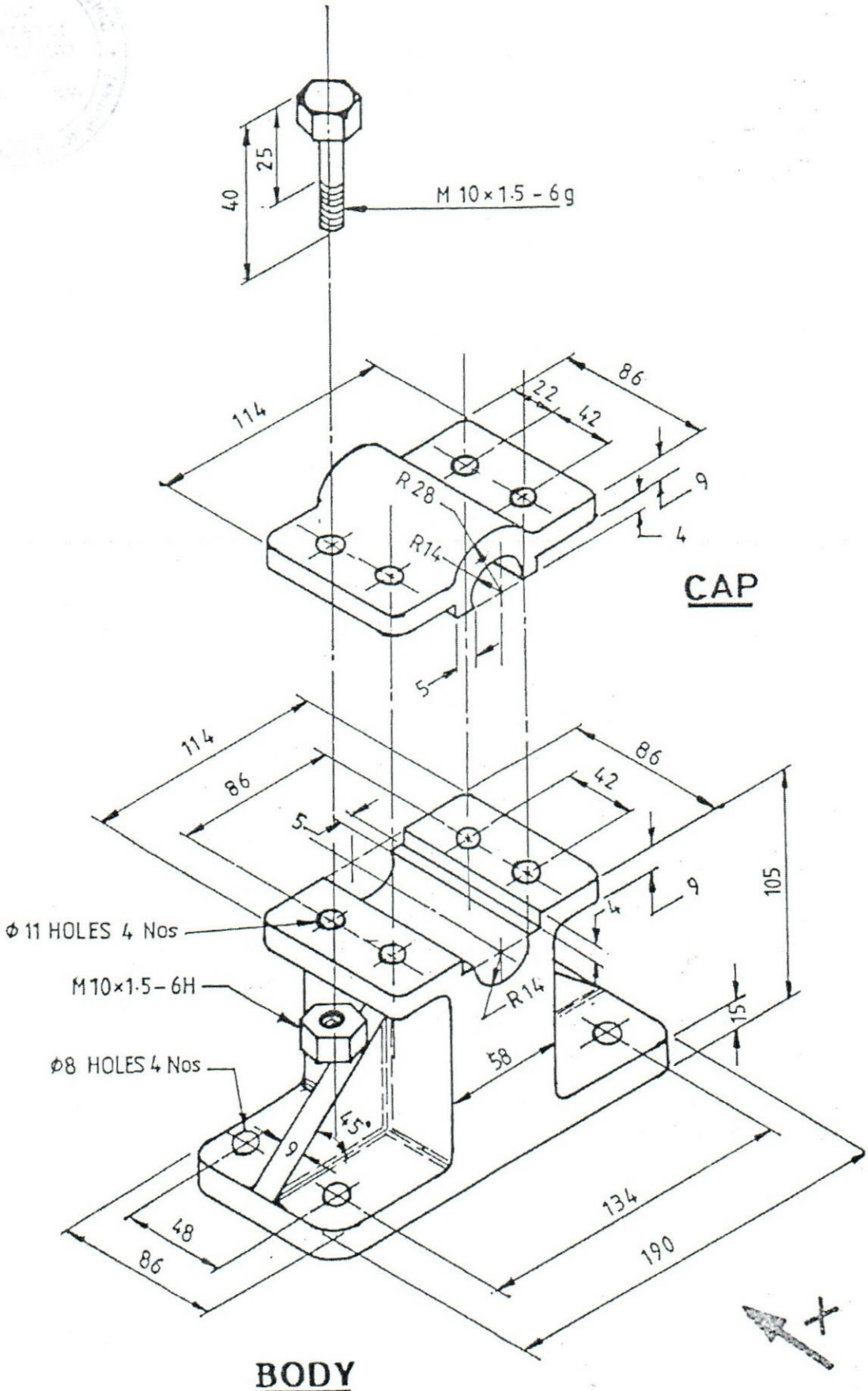
c. Strain hardening. (1 mark)

d. Necking. (1 mark)

e. Failing point (fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

g. Proportional limit. (1 mark)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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Knowledge General

- *Answer any **Six** questions*

Date: 2022.05.28 *Pass mark 70%* *Time allocated: 03 Hrs*

1) a) State 4 types of pumps used on ships. **(04 Marks)**

b) Sketch a double acting resciprocating pump & name it. **(06 Marks)**

c) Draw a cross section of a centrifugal pump and briefly explain the working process. **(06 Marks)**

2) With reference to plate type fresh water generator,

a) Draw and explain the function **(10 marks)**

b) Explain start and stop procedure **(06 marks)**

3) a) Draw a simple diagram of a refrigeration system and show the high pressure and low pressure areas and also the state of the refrigerant in each part of the circuit. **(08 marks)**

b) List the safety cut offs found on a refrigeration compressor. **(04 marks)**

c) What is the effect on a refrigeration system if there is air in the circuit? **(04 marks)**

4) a) Sketch and describe a four ram steering system. **(08 marks)**

b) Explain the function of the floating lever. **(04 marks)**

c) Explain with the aid of a sketch the operation of the tele motor transmitter and receiver. **(04 marks)**

5) a) Sketch a tubular heat exchanger used on a ship for cooling engine cooling water. **(4 Marks)**

b) How is expansion accommodated in the type of heat exchanger you have sketched?

(4 Marks)

c) What are the advantages and disadvantages of this type of heat exchanger as against a plate type heat exchanger? **(8 Marks)**

6) a) State what a purifier and a clarifier are. **(4 Marks)**

b) With the aid of sketches show the difference between a purifier and clarifier bowls. **(12 Marks)**

7) a) Oily water separator is a very important piece of equipment on board a ship. For what purpose is it used? **(02 Marks)**

b) Sketch and describe an oily water separator. **(14 Marks)**

8) Sketch and describe a biological sewage plant used on ships. **(16 Marks)**

9) a) With reference to mechanical properties of metals describe in simple terms

i. Elasticity

ii. Brittleness

iii. Hardness

iv. Toughness **(08 marks)**

b) Name three types of steels commonly used in engineering and the carbon percentages **(04marks)**

c) State for what purposes they are used **(04 marks)**

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I

COURSE CODE: ED 0350 PI (BATCH NO 44)

1ST SEMESTER EXAMINATION QUESTION PAPER

MARITIME LAW

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2022.05.28 *Pass mark 50%* *Time allocated: 03 Hrs*

1) Write full terms of the following abbreviations **(16 marks)**
   a. IMO
   b. ILO
   c. STCW
   d. UNCLOS
   e. ISM Code
   f. ISPS Code
   g. MLC
   h. PFSO
   i. SSAS
   j. SOLAS
   k. IMDG Code
   l. ORB
   m. IOPP
   n. EEBD
   o. ODS
   p. VOC

2) With related to MARPOL,
   a. List 6 Annexes of MARPOL **(06 marks)**
   b. According to annex I, state the requirements to discharge into the sea outside special areas of oil or oily mixture from a ship of 400GT and above **(06 marks)**
   c. State 2 certificates/documents required to carry onboard according to Annex I **(04 marks)**

3) With reference to UNCLOS, write brief notes on the following
   a. Internal waters **(04 marks)**
   b. Territorial waters **(04 marks)**
   c. Contiguous zone **(04 marks)**
   d. Exclusive Economic Zone **(04 marks)**

4) With regard to IMO
   a. Name 4 main committees of IMO **(04 marks)**
   b. Define 'convention' and 'protocol' **(04 marks)**
   c. State any 4 conventions of IMO **(08 marks)**

5) With reference to SOLAS,
   a. State the main objective of SOLAS **(02 marks)**
   b. Define 'Non- combustible material' **(02 marks)**
   c. Explain the difference between 'weathertight' and 'watertight' **(04 marks)**
   d. State the regulations pertaining to the ships' steering gear **(08 marks)**

6) Write all chapters of SOLAS convention **(16 marks)**

7) With reference to ISM and ISPS codes, briefly explain
   a. Purpose/objective of ISM **(04 marks)**
   b. Role of 'Designated Person' **(04 marks)**
   c. Role of 'Port facility security officer' **(04 marks)**
   d. Ship Security Alert System **(04 marks)**

8) With reference to International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)
   a. State the ballast water exchange standard and explain two methods used for this **(06 marks)**

   b. State the ballast water performance standard and 3 methods proposed for achieving this with examples **(10 marks)**

9) With reference to MARPOL,
   a. State regulations for discharging sewage **(06 marks)**
   b. State regulations for discharging food waste outside special area **(06 marks)**
   c. State sulphur content limit of fuel in ECA and the rest of the world on a ship which does not use any exhaust gas cleaning system **(04 marks)**

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I

COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER

MARITIME LAW

- *This question paper consists of eight questions.*
- *Answer any SIX questions*

Date: 2022.05.28 *Pass mark 50%* *Time allocated: 03 Hrs*

1) With reference to UNCLOS define the followings
   a) Internal waters **(04 marks)**
   b) Territorial waters **(04 marks)**
   c) Contiguous zone **(04 marks)**
   d) Exclusive Economic Zone **(04 marks)**

2) As per **MARPOL annex I,**
   a) Describe the procedure of pumping out Engine Room Bilges outside special areas?**(05 marks)**
   b) What is the certificate which has to be carried onboard as per MARPOL annex I and what is the validity period of it. **(02 marks)**
   c) State the information which must be entered in the Oil Record Book when pumping out bilges. **(03 marks)**
   d) list the 6 annexures of MARPOL 73/78 **(06 marks)**

3) with related to MARPOL
   a) List the 6 Annexes of MARPOL **(06 marks)**
   b) Define Special Areas **(04 marks)**
   c) Name the Special Areas Under MARPOL Annex1 **(04 marks)**
   d) What is the meaning Of IOPP? **(02 marks)**

4) According to IMO
   a) What is the IMO briefly Explain **(06 marks)**
   b) Explain the Procedure Of making law **(06 marks)**
   c) What is the Tacit Acceptance? **(04 marks)**

5) With reference to ISM code

a) Explain why ISM is necessary? **(06 marks)**

b) Who is a designated person? **(06 marks)**

c) What are the certificates to be carried on board? **(04 marks)**

6) Explain (in –short) the followings

a) LOADLINE **(02 marks)**

b) STCW code **(02 marks)**

c) ORB (Oil Record Book) **(02 marks)**

d) Garbage record book **(02 marks)**

e) ILO **(02 marks)**

f) IMDG code **(02 marks)**

g) ISPS code **(02 marks)**

h) **SSO** with reference to the ISM CODE **(02 marks)**

7)

a) Explain how ships ballast water can pollute the sea, with examples **(08 marks)**

b) Name the convention which have been introduced by IMO to minimize this **(02 marks)**

c) What are the methods proposed to achieve the performance standard? **(06 marks)**

8) With relevant to the knowledge of SOLAS

a) What is the purpose of SOLAS **(02 marks)**

b) Write down All the SOLAS Chapters **(14 marks)**

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COURSE CODE: ED 0350 PI

1ST SEMESTER EXAMINATION QUESTION PAPER
Workshop Theory (Batch 44)

- This question paper consists of six questions.
- Answer All questions

Date: 2022.05.26 Pass mark 50% Time allocated: 03 Hrs

Q 1. Briefly explain following workshop tools and their uses with suitable sketches where necessary. (2 marks each)

(i) Surface- plate

(ii) Depth gauge

(iii) Dial gauge

(iv) V block

(v) Scriber

(vi) Filler gauge

(vii) Thread gauge

(viii) Out- side and inside calipers

(ix) Centre punch

(x) Taps and dies.

Q2. (a) With a suitable sketch mark following points on a threaded bolt. (1 mark each)

i. Pitch of the thread.

ii. Minor diameter.

iii. Major diameter.

iv. Pitch diameter.

v. Root

vi. Crest

(b) Explain the meaning of M 14 marked on a bolt. (2 marks)

(c) Name the type of drilling machines use for small jobs? (6 marks)

(d) What is the meaning of BSP and M thread? (2 marks)

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(i) Draw the circuit diagram of a simple DC electric arc welding machine. Your answer should clearly show the polarity of electrode (4 marks)

(ii) Explain various position of manual electric arc welding positions. Use Sketches where necessary.

(8 marks)

(iii) List down 4 welding faults in an arc welding joint. (4 marks)

Q6. With an aid of a suitable graph (strain against stress) identify ranges of following physical properties of material. (9 marks)

a. Yield strength and yield point. (1 mark)

b. Ultimate strength. (1 mark)

c. Strain hardening. (1 mark)

d. Necking. (1 mark)

e. Failing point (fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

g. Proportional limit. (1 mark)

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COURSE CODE: ED 0350 PI

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 43)

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- *Answer All questions*

Date: 2022.05.26 *Pass mark 50%* *Time allocated: 03 Hrs*

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d. Necking. (1 mark)

e. Failing point (fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

g. Proportional limit. (1 mark)

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COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER EXAMINATION REPEAT QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: ~~2022.01.10~~ 2022/05/25 *Pass mark 50%* *Time allocated: 03 Hrs*

1.

1.1 Derive from basics, four equations of linear motion with constant acceleration. (4 marks)

1.2 'A' and 'B' are two points on a straight road 100 m away from each other. An object starts at rest from 'A' travel towards 'B' with 1/3 ms^{-2} constant acceleration. At the same time another object starts with 4 ms^{-1} initial velocity from 'B' travel toward 'A' with 1/2 ms^{-2} constant acceleration.

a. Locate where they going to meet between 'A' and 'B'? (8 marks)
b. The time taken to meet each other? (8 marks)

2.

2.1 What is center of pressure for a surfaced immersed in a liquid vertically. (4 marks)

2.2 A square plate of radius 5m is vertically immersed on fresh water, top edge touching free surface. Calculate;

a. Total pressure force acting on one side of the plate (6 marks)
b. The position of center of pressure of plate (10 marks)

(hint: area moment of inertia of a rectangular cross-section about an axis passing its center (I) is $\frac{bd^3}{12}$)

3.

3.1 Define Energy. What is the relationship between Energy and Power? (4 marks)

3.2 A trolley of 125MT pulled by means of a train engine of weight 25 metric ton (MT) up an inclined plane having a 40° degree inclination to the horizontal. Engine and trolley travels with uniform speed of 45 km/h and the road traction experience by both is 60N per MT. Find;

a. Kinetic energy of the engine (8 marks)
b. The power exerted by the engine. (8 marks)

4.

4.1 Write down the equation which interrelates following linear and angular motion terms.

a. Torque and Force (2 marks)
b. Linear and Angular Velocity (2 marks)
c. Linear and Angular acceleration (2 marks)

4.2 Convert the following angular velocities in to rads^{-1} measurements.

a. 90 round per minute (2 marks)
b. 15 rounds per second (2 marks)
c. 200 revolutions within 3 minutes (2 marks)

4.3 A pulley starting from rest is given an acceleration of 0.5 rads^{-2}. Calculate its angular speed in r.p.m. at the end of 2 minutes.

(4 marks)

4.4 If then it is uniformly decelerated at the rate of 0.3 rads^{-2}, in how many minutes the pulley will come to rest.

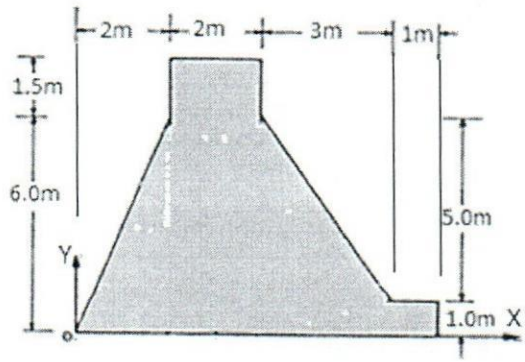
(4 marks)

5.

5.1 Define "Center of Gravity"

(4 Marks)

5.2 A cross section of an engineering object is given in the following diagram. Determine the centroid of the section according to the given axes. (All measurements are in meters)
(16 Marks)



6.

6.1 A bus travels in a straight road passes points **A, B, C, D,** with 18 km/h constant velocity. A passenger in a bus, rings the bell at point **A** expecting to get-off from the bus at the point **D**. Point **D** is 6.25 m away from the place where he rings the bell (Point A). Without delay the driver apply the brakes as soon as he hears the sound of the bell. Then the bus decelerates with f, $2f$, $3f$ ms^{-2} between points AB, BC & CD where AB=BC=CD. Find the value f in this motion. (20 Marks)

7.

7.1 A train engine weighing 150 Metric tons (MT) has two passenger compartments attached with it each having 25MT of mass. The train starts at *rest* and uniformly accelerate to achieve 20Km/h velocity within 10 seconds. If the friction traction ½ kg per 1MT for engine and that for compartments is ¼ kg per 1MT find;

a. The force exerted by train during this acceleration. (10 Marks)
b. The coupling tension between engine and the first compartment. (10 Marks)

8.

8.1 A shaft is uniformly accelerated from 10 rev/s to 18 rev/s in 4 seconds. The Shaft continues with this accelerate for 8 **more** seconds and reach its maximum angular speed. Find the total time the shaft will take to complete 400 revolutions starting from rest. (10 Marks)

8.2 A 30kg flywheel, revolving at 5.24rad/s has 1.5m radius of Gyration. Calculate the torque which must be applied to bring the flywheel to rest in 10 Seconds. ($I=mk^2$ where k is radius of gyration) (10 Marks)

9.

9.1 Using a suitable sketch and usual notations, show that,
Minimum force required on an object to move upward and downward on an inclined plane is given by;
$F_{up}=W(\mu\cos\alpha+\sin\alpha)$ and $F_{down}=W(\mu\cos\alpha-\sin\alpha)$ respectively. (6 Marks)

9.2 An object of 200kg mass is to be pulled up on a rough inclined with an acceleration of 2 ms^{-2}. The inclination of the plane is 30° to the horizontal. Find the total force required parallel to the plane that should apply if the friction coefficient between the surfaces is given as 0.3. (14 Marks)

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COURSE CODE: ED 0350 PI (BATCH NO 44)

1ST SEMESTER EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2022.05.25 *Pass mark 50%* *Time allocated: 03 Hrs*

1.

1.1 What is center of pressure? (4 marks)

1.2 A circular manhole door is fitted in a ballast tank filled with sea water. The door is 1.6m in diameter and the top of the door is 5m below the level of the water. Find;

a. The total force on the door from the hydrostatic pressure (6 marks)
b. Center of pressure from the level of the water (10 marks)

(hint: area moment of inertia of a circular cross-section about an axis through diameter (d) (I) is $\frac{\pi d^4}{64}$)

2.

2.1 Derive from basics, four equations of linear motion with constant acceleration. (4 marks)

2.2 'A' and 'B' are two points on a straight road 100 m away from each other. An object starts at rest from 'A' travel towards 'B' with 1⁄3 ms^{-2} constant acceleration. At the same time another object starts with 4 ms^{-1} initial velocity from 'B' travel toward 'A' with 1⁄2 ms^{-2} constant acceleration.

a. Locate where they going to meet between 'A' and 'B'? (8 marks)
b. The time taken to meet each other. (8 marks)

3.

3.1 Define Energy. What is the relationship between Energy and Power? (4 marks)

3.2 A trolley of 125MT pulled by means of a train engine of weight 25 metric ton (MT) up an inclined plane having a 40° degree inclination to the horizontal. Engine and trolley travels with uniform speed of 45 km/h and the road traction experience by both is 60N per MT. Find;

a. Kinetic energy of the engine (8 marks)

(b) Explain the meaning of M 14 marked on a bolt. (2 marks)

(c) Name the type of drilling machines use for small jobs? (6 marks)

(d) What is the meaning of BSP and M thread? (2 marks)

Q3.

a. Name various type of manufacturing processes widely used in industry. You may use sketches for explaining each type of above-mentioned method (4 marks)

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(i) With regard to properties of materials explain following terms. (2 marks each)

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(8 marks)

(iii) List down 4 welding faults in an arc welding joint. (4 marks)

Q6. With an aid of a suitable graph (strain against stress) identify ranges of following physical properties of material. (9 marks)

a. Yield strength and yield point. (1 mark)

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c. Strain hardening. (1 mark)

d. Necking. (1 mark)

e. Failing point (fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

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COURSE CODE: ED 0350 PI

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 43)

- *This question paper consists of six questions.*
- *Answer All questions*

Date: 2022.05.26 *Pass mark 50%* *Time allocated: 03 Hrs*

Q 1. Briefly explain following workshop tools and their uses with suitable sketches where necessary. (2 marks each)

(i) Surface- plate

(ii) Depth gauge

(iii) Dial gauge

(iv) V block

(v) Scriber

(vi) Filler gauge

(vii) Thread gauge

(viii) Out- side and inside calipers

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c. Strain hardening. (1 mark)

d. Necking. (1 mark)

e. Failing point (fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

g. Proportional limit. (1 mark)

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Faculty of Marine Engineering
Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER EXAMINATION REPEAT QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: ~~2022.01.10~~ 2022/05/25 *Pass mark 50%* *Time allocated: 03 Hrs*

1.

1.1 Derive from basics, four equations of linear motion with constant acceleration. (4 marks)

1.2 'A' and 'B' are two points on a straight road 100 m away from each other. An object starts at rest from 'A' travel towards 'B' with 1/3 ms^{-2} constant acceleration. At the same time another object starts with 4 ms^{-1} initial velocity from 'B' travel toward 'A' with 1/2 ms^{-2} constant acceleration.

a. Locate where they going to meet between 'A' and 'B'? (8 marks)
b. The time taken to meet each other? (8 marks)

2.

2.1 What is center of pressure for a surfaced immersed in a liquid vertically. (4 marks)

2.2 A square plate of radius 5m is vertically immersed on fresh water, top edge touching free surface. Calculate;

a. Total pressure force acting on one side of the plate (6 marks)
b. The position of center of pressure of plate (10 marks)

(hint: area moment of inertia of a rectangular cross-section about an axis passing its center (I) is $\frac{bd^3}{12}$)

3.

3.1 Define Energy. What is the relationship between Energy and Power? (4 marks)

3.2 A trolley of 125MT pulled by means of a train engine of weight 25 metric ton (MT) up an inclined plane having a 40° degree inclination to the horizontal. Engine and trolley travels with uniform speed of 45 km/h and the road traction experience by both is 60N per MT. Find;

a. Kinetic energy of the engine (8 marks)
b. The power exerted by the engine. (8 marks)

4.

4.1 Write down the equation which interrelates following linear and angular motion terms.

a. Torque and Force (2 marks)
b. Linear and Angular Velocity (2 marks)
c. Linear and Angular acceleration (2 marks)

4.2 Convert the following angular velocities in to rads^{-1} measurements.

a. 90 round per minute (2 marks)
b. 15 rounds per second (2 marks)
c. 200 revolutions within 3 minutes (2 marks)

4.3 A pulley starting from rest is given an acceleration of 0.5 rads^{-2}. Calculate its angular speed in r.p.m. at the end of 2 minutes.

(4 marks)

4.4 If then it is uniformly decelerated at the rate of 0.3 rads^{-2}, in how many minutes the pulley will come to rest.

(4 marks)

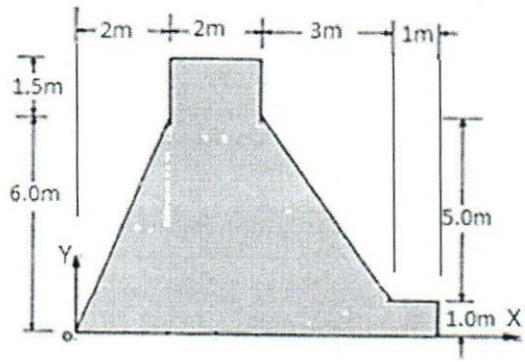
5.

5.1 Define "Center of Gravity"

(4 Marks)

5.2 A cross section of an engineering object is given in the following diagram. Determine the centroid of the section according to the given axes. (All measurements are in meters)

(16 Marks)



6.

6.1 A bus travels in a straight road passes points **A, B, C, D,** with 18 km/h constant velocity. A passenger in a bus, rings the bell at point **A** expecting to get-off from the bus at the point **D**. Point **D** is 6.25 m away from the place where he rings the bell (Point A). Without delay the driver apply the brakes as soon as he hears the sound of the bell. Then the bus decelerates with f, $2f$, $3f$ ms^{-2} between points AB, BC & CD where AB=BC=CD. Find the value f in this motion. (20 Marks)

7.

7.1 A train engine weighing 150 Metric tons (MT) has two passenger compartments attached with it each having 25MT of mass. The train starts at *rest* and uniformly accelerate to achieve 20Km/h velocity within 10 seconds. If the friction traction ½ kg per 1MT for engine and that for compartments is ¼ kg per 1MT find;

a. The force exerted by train during this acceleration. (10 Marks)
b. The coupling tension between engine and the first compartment. (10 Marks)

8.

8.1 A shaft is uniformly accelerated from 10 rev/s to 18 rev/s in 4 seconds. The Shaft continues with this accelerate for 8 **more** seconds and reach its maximum angular speed. Find the total time the shaft will take to complete 400 revolutions starting from rest. (10 Marks)

8.2 A 30kg flywheel, revolving at 5.24rad/s has 1.5m radius of Gyration. Calculate the torque which must be applied to bring the flywheel to rest in 10 Seconds. ($I=mk^2$ where k is radius of gyration) (10 Marks)

9.

9.1 Using a suitable sketch and usual notations, show that,
Minimum force required on an object to move upward and downward on an inclined plane is given by;
$F_{up}=W(\mu\cos\alpha+\sin\alpha)$ and $F_{down}=W(\mu\cos\alpha-\sin\alpha)$ respectively. (6 Marks)

9.2 An object of 200kg mass is to be pulled up on a rough inclined with an acceleration of 2 ms^{-2}. The inclination of the plane is 30° to the horizontal. Find the total force required parallel to the plane that should apply if the friction coefficient between the surfaces is given as 0.3. (14 Marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 44)

1ST SEMESTER EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2022.05.25 *Pass mark 50%* *Time allocated: 03 Hrs*

1.

1.1 What is center of pressure? (4 marks)

1.2 A circular manhole door is fitted in a ballast tank filled with sea water. The door is 1.6m in diameter and the top of the door is 5m below the level of the water. Find;

a. The total force on the door from the hydrostatic pressure (6 marks)
b. Center of pressure from the level of the water (10 marks)

(hint: area moment of inertia of a circular cross-section about an axis through diameter (d) (I) is $\frac{\pi d^4}{64}$)

2.

2.1 Derive from basics, four equations of linear motion with constant acceleration. (4 marks)

2.2 'A' and 'B' are two points on a straight road 100 m away from each other. An object starts at rest from 'A' travel towards 'B' with 1/3 ms^{-2} constant acceleration. At the same time another object starts with 4 ms^{-1} initial velocity from 'B' travel toward 'A' with 1/2 ms^{-2} constant acceleration.

a. Locate where they going to meet between 'A' and 'B'? (8 marks)
b. The time taken to meet each other. (8 marks)

3.

3.1 Define Energy. What is the relationship between Energy and Power? (4 marks)

3.2 A trolley of 125MT pulled by means of a train engine of weight 25 metric ton (MT) up an inclined plane having a 40° degree inclination to the horizontal. Engine and trolley travels with uniform speed of 45 km/h and the road traction experience by both is 60N per MT. Find;

a. Kinetic energy of the engine (8 marks)

b. The power exerted by the engine. (8 marks)

4.

4.1 Write down the equation which interrelates following linear and angular motion terms.

a. Torque and Force (2 marks)
b. Linear and Angular Velocity (2 marks)
c. Linear and Angular acceleration (2 marks)

4.2 Convert the following angular velocities in to $rads^{-1}$ measurements.

a. 90 round per minute (2 marks)
b. 15 rounds per second (2 marks)
c. 200 revolutions within 3 minutes (2 marks)

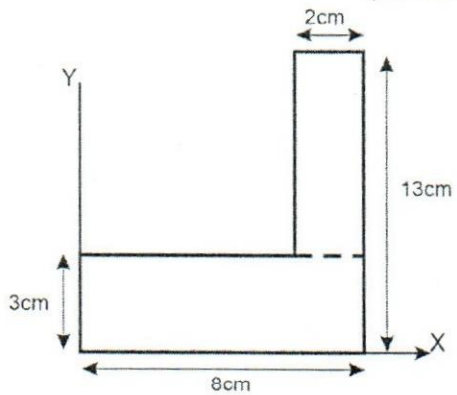
4.3 A pulley starting from rest is given an acceleration of 0.5 $rads^{-2}$. Calculate its angular speed in r.p.m. at the end of 2 minutes. (4 marks)

4.4 If then it is uniformly decelerated at the rate of 0.3 $rads^{-2}$, in how many minutes the pulley will come to rest. (4 marks)

5.

5.1 Differentiate between center of mass, center of gravity and centroid (4 marks)

5.2 Below diagram shows a cross section of a structural beam made out of metal. Find the centroid of the compound section according to the given *X* and *Y* axes. (16 marks)



6.

6.1. Derive Bernoulli's equation for liquid flowing in a pipe considering conservation of mass. (4 marks)

6.2 Fresh water is flowing in a smooth pipe of *uniform diameter* 100 cm. A 55 kPa of pressure is recorded at '*A*' which is at an elevation of 15 m. The section '*B*' is at an elevation of 25m and its pressure recorded to have 30 KPa. If the flow rate through the pipe is 1000 liters per second, determine:

a. The speed of water flow (4 marks)
b. The direction of flow between *A* and *B* (6 marks)
c. The total head loss. (6 marks)

7.

7.1 A train engine weighing 150 Metric tons (MT) has two passenger compartments attached with it each having 25MT of mass. The train starts at *rest* and uniformly accelerate to achieve 20Km/h velocity within 10 seconds. If the friction traction ½ kg per 1MT for engine and that for compartments is ¼ kg per 1MT find

a. The force exerted by train during this acceleration. (10 Marks)
b. The coupling tension between engine and the first compartment. (10 Marks)

8.

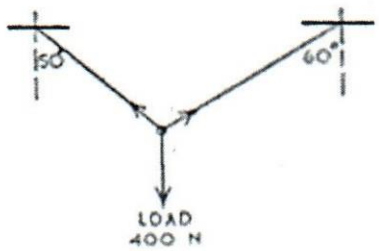
8.1 A shaft is uniformly accelerated from 10 rev/s to 18 rev/s in 4 seconds. The Shaft continues with this accelerate for 8 **more** seconds and reach its maximum angular speed. Find the total time the shaft will take to complete 400 revolutions starting from rest. (10 Marks)

8.2 A 30kg flywheel, revolving at 5.24rad/s has 1.5m radius of Gyration. Calculate the torque which must be applied to bring the flywheel to rest in 10 Seconds. ($I=mk^2$ where k is radius of gyration) (10 Marks)

9.

9.1 Write Lami's theorem with the help of a suitable diagram (4 marks)

9.2 Two ropes are hung from a horizontal beam and their lower ends are connected by a hook from which a load 400 N hangs. The ropes make angles of 50^0 and 60^0 degrees respectively to the vertical as shown in the diagram. With the help of a force triangle, find the tension in each rope. (16 marks)



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Department of Navigation
EDUCATION & TRAINING COURSE : *Navigation Officer Cadet Training Course – Phase 1*
COURSE CODE : *ND- 0100 P1 - BATCH 40/41*

FINAL EXAMINATION – QUESTION PAPER

METEOROLOGY

- *Answer all questions.*
- *Total Marks : 100*
- *Diagrams should be shown wherever possible*

Date: 21/05/2022 *Pass mark 60%* *Time allocated: 3 Hours*

1. i. Define Atmospheric pressure. (04 marks)

   ii. With an aid of a diagram, explain the principle and construction of Aneroid barometer. (10 marks)

   iii. Explain how you find Relative Humidity using Hygrometer. (06 marks)

2. Define following where applicable with suitable diagram.
   a. Precipitation (04 marks)
   b. High-level clouds (04 marks)
   c. Orographic Lifting (04 marks)
   d. Green House effect (04 marks)
   e. Coriolis force (04 marks)

3. i. What is Beaufort scale . (05 marks)

   ii. The Forces which Determine Wind Direction & Strength. (08 marks)

   iii. Explain with a diagram Coriolis force. (07 marks)

4. A vessel is steering on a Course of 050^0 at 18 knots. The Apparent wind is 120^0 at 20 knots. Estimate the direction and the speed of true wind. (20 marks)

5. i. What is Visibility . (04 marks)

ii. List conditions favorable for formation of fog . (08 marks)

iii. What is difference between Advection and Radiation fog. (08 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

- *This question paper consists of Nine questions.*
- *Answer any SIX questions*

Date: 2022.05.27 *Pass mark 50%* *Time allocated: 03 Hrs*

For air c_p = ***1.005kJ/kg K***, c_v = ***0.717kJ/kg K***, γ = ***1.4***

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

Specific heat capacity of water ***4.2 kJ/kg K,*** Latent heat of evaporation of water ***2.256 MJ/kg***

Specific heat capacity of ice ***2.1 kJ/kg K,*** Latent heat of fusion of ice ***336 kJ/kg***

1.

a. Describe the three type of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of superficial expansion and coefficient of volumetric expansion using the coefficient of linear expansion of solid materials (4 marks)

c. In an experiment to find the coefficient of linear expansion of copper, a rod of copper at ***0 ^{0}C*** is ***0.5 m*** in length. Raising the temperature of the rod from ***25 ^{0}C*** to ***45 ^{0}C*** produces an extension of ***0.17 mm***. Find

   i. The coefficient of linear expansion. (2 marks)

   ii. The length of the rod at ***25 ^{0}C*** and ***45 ^{0}C*** (4 marks)

d. A sample of oil is filled in a copper can of ***100 m***l at ***25 ^{0}C*** and it is heated to ***50 ^{0}C*** and ***0.12 ml*** of oil is spilt during the heating. Using the coefficient of linear expansion of copper is the value determined in part c, estimate the coefficient of volumetric expansion of oil. (6 marks)

2.

a. Describe the followings

   i. Specific heat capacity of a substance

   ii. Latent heat of fusion

   iii. Latent heat of evaporation (6 marks)

b. An electric heater of ***2 kW*** is used to heat ***0.5 kg*** of water in a kettle of heat capacity ***400 J/K***. the initial water temperature is ***20 ^{0}C***. Neglecting hat losses,

i. How long will it take to heat the water to its boiling point, ***100 ^{0}C*** ? (6 marks)

ii. Starting from ***20 ^{0}C***, what mass of water is boiled away in ***5 min*** ? (8 marks)

3.

a. Describe the ***Non-flow energy equation*** (4 marks)

b. During working stroke, an engine rejects ***800kJ/kg*** of heat of the working substance. The internal energy of the working substance also decreases by ***1350kJ/kg***. Determine the work done by engine. (8 marks)

c. The temperature of ***4.5 kg*** of air in a piston connected cylinder is cooled from ***127^{0}C*** to ***78^{0}C*** under constant pressure. Calculate change in internal energy, heat transfer and work transfer for the air. (8 marks)

4. An internal combustion engine uses ***6 kg*** of fuel, having calorific value (i.e. heat generated by complete combustion of 1 kg of fuel under controlled condition) ***48 MJ/kg***, in ***one hour***. The temperature of ***10 kg*** of cooling water was found to rise through ***10 ^{0}C per minute***. The temperature of ***5 kg*** per minute of exhaust gas with specific heat ***1.3 kJ/kg K*** was found to rise through ***150 ^{0}C***. Calculate

a. Thermal power generated by burning of fuel (5 marks)

b. Power lost to the cooling water (5 marks)

c. Power lost to the Exhaust gases (5 marks)

d. Unaccounted power lost if The ***Brake power*** (useful power) developed is ***22 kW*** (5 marks)

5.

a. Describe the heat transfer, change in internal energy and work transfer for cyclic process (5 marks)

b. A closed system having a cycle of four processes, heat and work interactions are follows:

Process 1 – 2 : adiabatic compression $Q_{12} = 0$, $W_{12} = -900$ kJ

Process 2 – 3 : constant volume heating $Q_{23} = +3000$ kJ, $W_{23} = 0$

Process 3 – 4 : adiabatic expansion $Q_{34} = 0$, $W_{34} = +2200$ kJ

Process 4 – 1 : constant volume heat rejection Q_{41}, $W_{41} = 0$

i. Draw the ***PV diagram*** for the cycle (5 marks)

ii. Calculate the ***rejection of heat (Q_{41})*** and net heat transfer (5 marks)

iii. Draw the TS diagram for the cycle (5 marks)

6.

a. Describe the ***First law*** in thermodynamics. (3 marks)

b. Derive an expression for the ***specific heat capacity*** of a gas under constant pressure and constant volume. (4 marks)

c. A ***2 kg*** of gas sample is heating under ***5 bar*** of constant pressure from ***25 ^0C*** to ***100 ^0C***. The volume of the gas is changed by ***0.15 m^3*** and internal energy has increased by ***130 kJ***. Determine

i. The ***specific heat capacity*** of the gas under ***constant volume.*** (3 marks)

ii. ***Work transfer*** during the expansion (3 marks)

iii. ***Heat transfer*** (3 marks)

iv. The ***specific heat capacity*** of the gas under ***constant pressure.*** (4 marks)

7.

a. State the ***Zero law*** in thermodynamics and discuss the sign convention for the heat transfer and work transfer (5 marks)

b. ***0.01kg*** of fuel A is completely burned and the heat energy is given to a closed system of fixed mass of fluid of ***12 kg***. During the process ***120 kW*** power is obtained from the system. The system internal energy is increased from ***750kJ*** to ***2250 kJ*** during the process. If the process has been taken place for ***25*** seconds, Determine,

i. Change in ***specific internal energy*** of the system (4 marks)

ii. ***Heat absorbed*** by the system (6 marks)

iii. Heat generated by the combustion of 1 kg of fuel A if the heat transfer process has an efficiency of ***58 %*** (5 marks)

8.

a. Some thermodynamic and transport properties of ***refrigerant -404a*** contain in the table below. Using the properties of vapour complete the table

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
2.864	*-22*	*170.2*	*181.7*	.....
2.974	*-21*	*171.5*	.....	*355.9*
3.087	*-20*	.....	*183.8*	*356.5*
13.926	*29*	*244.5*	.....	*381.9*
14.150	*30*	.....	*136.1*	*382.2*
14.654	*31*	*247.9*	*134.7*	.....

(12 marks)

b. ***Refrigerant - 404a*** uses to operate refrigerant in a reefer container plant. The saturated refrigerant liquid at ***14.150 bar*** in a receiver expands to a wet vapour at ***2.974 bar*** by a throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (3 marks)

ii. Find the enthalpy after the expansion (2 marks)

iii. Estimate the dryness fraction after the expansion (3 marks)

Hint: Use the properties in the table given in the ***part a***

9.

a. Write expressions for the ***entropy change*** during process at constant volume and constant pressure. (4 marks)

b. In a reversible process ***0.3 m^3*** of Nitrogen at a pressure of ***1.2 bar*** and temperature of ***25 ^0C*** is heated at constant volume to a pressure of ***4.8 bar***. It is then cooled at constant pressure back to the original temperature. For Nitrogen ***Cv = 0.743 kJ/kg K, Cp = 1.04 kJ/kg K***.

i. Sketch the process on ***P-V*** and ***T-S diagram*** (4 marks)

Calculate

ii. The ***net flow of heat*** during the process (6 marks)

iii. The ***net entropy change*** (6 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER EXAMINATION QUESTION PAPER
MARITIME LAW

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2021.01.14 *Pass mark 50%* *Time allocated: 03 Hrs*

1) As per **MARPOL annex I,**
   a) Describe the procedure of pumping out Engine Room Bilges outside special areas? **(05 marks)**
   b) What is the certificate which has to be carried onboard as per MARPOL annex I and what is the validity period of it. **(02 marks)**
   c) State the information which must be entered in the Oil Record Book when pumping out bilges. **(03 marks)**
   d) list the 6 annexures of MARPOL 73/78 **(06 marks)**

2) With reference to UNCLOS define the followings
   a) Internal waters **(04 marks)**
   b) Territorial waters **(04 marks)**
   c) Contiguous zone **(04 marks)**
   d) Exclusive Economic Zone **(04 marks)**

3) With reference to ISM code
   a) Explain why ISM is necessary? **(06 marks)**
   b) Who is a designated person? **(06 marks)**
   c) What are the certificates to be carried on board? **(04 marks)**

4) According to IMO

a) What is the IMO briefly Explain **(06 marks)**

b) Explain the Procedure Of making law **(06 marks)**

c) What is the Tacit Acceptance? **(04 marks)**

5) With regards to MLC 2006

a) What does MLC stands for **(02 marks)**

b) Name the 5 titles of the MLC 2006. **(05 Marks)**

c) Briefly explain the conditions for the minimum age, working hours and rest hours on board **(09 Marks)**

6) With related to MARPOL

a) List the 6 Annexes of MARPOL **(06 marks)**

b) Define Special Areas **(04 marks)**

c) Name the Special Areas Under MARPOL Annex1 **(04 marks)**

d) What is the meaning Of IOPP? **(02 marks)**

7)

a) Explain how ships ballast water can pollute the sea, with examples **(08 marks)**

b) Name the convention which have been introduced by IMO to minimize this **(02 marks)**

c) What are the methods proposed to achieve the performance standard? **(06 marks)**

8) With relevant to the knowledge of SOLAS

a) What is the purpose of SOLAS **(02 marks)**

b) Write down All the SOLAS Chapters **(14 marks)**

9) Explain (in –short) the followings

a) LOADLINE **(02 marks)**

b) STCW code **(02 marks)**

c) ORB (Oil Record Book) **(02 marks)**

d) Garbage record book **(02 marks)**

e) ILO **(02 marks)**

f) IMDG code **(02 marks)**

g) ISPS code **(02 marks)**

h) **SSO** with reference to the ISM CODE **(02 marks)**

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COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER EXAMINATION QUESTION PAPER
Thermodynamics

- This question paper consists of Nine questions.
- Answer any SIX questions

Date: 2022.01.12 Pass mark 50% Time allocated: 03 Hrs

For air c_p = ***1.005kJ/kg K***, c_v = ***0.717kJ/kg K***, γ = ***1.4***

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

Specific heat capacity of water ***4.2 kJ/kg K,*** Latent heat of evaporation of water ***2.256 MJ/kg***

Specific heat capacity of ice ***2.1 kJ/kg K,*** Latent heat of fusion of ice ***336 kJ/kg***

1.

a. Describe the three types of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of linear expansion and coefficient of superficial expansion using the coefficient of volumetric expansion of solid materials (4 marks)

c. An aluminum-alloy rod has a length of ***10.000 cm*** at ***25 ^{0}C*** and length of ***10.015 cm*** at ***100 ^{0}C***. Assume that there is no bending or twisting of the rod during the expansion

   i. What is the coefficient of linear expansion of the alloy? (4 marks)

   ii. What is the length of the rod at the freezing point of water? (4 marks)

   iii. What is the temperature if the length of the rod is ***10.009 cm***? (4 marks)

2.

a. Describe the followings

   i. Specific heat capacity of a substance
   ii. Latent heat of fusion
   iii. Latent heat of evaporation (6 marks)

b. An electric heater of ***2 kW*** is used to heat ***0.5 kg*** of water in a kettle of heat capacity ***400 J/K***. the initial water temperature is ***20 ^{0}C***. Neglecting hat losses,

   i. How long will it take to heat the water to its boiling point, ***100 ^{0}C*** ? (6 marks)
   ii. Starting from ***20 ^{0}C***, what mass of water is boiled away in ***5 min*** ? (8 marks)

3.

a. State the ***Fourier law in heat transfer***. (3 marks)

b. A side wall of reefer container consists with ***1.2 mm*** thick stainless Steel sheet for outer cladding and ***0.7 mm*** thick Aluminum sheet for inner lining. The gap between the outer cladding and inner lining is filled with ***20 mm*** thick Polyurethane. If the ambient temperature is ***32 ^{0}C*** and the inside temperature is ***4 ^{0}C***. Estimate

i. The overall heat transfer coefficient (4 marks)

ii. The heat transfer per hour from unit area of the side wall (5 marks)

iii. The temperature difference across the each material of the wall (8 marks)

Thermal conductivities of Stainless steel, Aluminum and Polyurethane are ***14.4***, ***237*** and ***0.025 W/m K*** respectively.

4.

a. State the ***Boyle's law*** and ***Charles' law*** for perfect gases (6 marks)

b. Taking characteristic gas constant R for Nitrogen as ***0.297 kJ/kg K***, Calculate

i. The mass of ***0.05 m^3*** of nitrogen at ***550 kPa*** and ***28 ^{0}C*** (4 marks)

ii. The volume of ***1 kg*** of Nitrogen at ***1 MPa*** and ***0 ^{0}C*** (4 marks)

c. ***0.25 m^3*** of Nitrogen gas at ***21^{0}C*** is heated at constant pressure to a temperature of ***315 ^{0}C***. calculate the initial pressure and the final volume (6 marks)

5.

a. Describe the heat transfer, change in internal energy and work transfer for cyclic process (5 marks)

b. A closed system having a cycle of four processes, heat and work interactions are follows:

Process 1 – 2 : adiabatic compression $Q_{12} = 0$, $W_{12} = -900$ kJ

Process 2 – 3 : constant pressure heating $Q_{23} = +3000$ kJ, $W_{23} = +200$ kJ

Process 3 – 4 : adiabatic expansion $Q_{34} = 0$, $W_{34} = +2200$ kJ

Process 4 – 1 : constant volume heat rejection Q_{41}, $W_{41} = 0$

i. Draw the ***PV diagram*** for the cyclic process (5 marks)

ii. Calculate the ***rejection of heat (Q_{41})*** (5 marks)

iii. Determine the ***cycle efficiency*** (5 marks)

6.

a. Describe the ***First law*** in thermodynamics. (3 marks)

b. Derive an expression for the ***specific heat capacity*** of a gas under constant pressure and constant volume. (4 marks)

c. A ***2 kg*** of gas sample is heating under ***5 bar*** of constant pressure from ***25 ^{0}C*** to ***100 ^{0}C***. The volume of the gas is changed by ***0.15 m^3*** and internal energy has increased by ***130 kJ***. Determine

i. The ***specific heat capacity*** of the gas under ***constant volume.*** (3 marks)

ii. ***Work transfer*** during the expansion (3 marks)

iii. ***Heat transfer*** (3 marks)

iv. The ***specific heat capacity*** of the gas under ***constant pressure***. (4 marks)

7. 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
   i. The ***calorific value*** of the fuel (5 marks)
   ii. 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 (5 marks)
   iii. The ***actual mass of air*** if it is supplied with 70% excess (5 marks)
   iv. The ***percentage mass analysis of the products*** of combustion (5 marks)

8.
   a. Some thermodynamic and transport properties of ***refrigerant -404a*** contain in the table below. Using the properties of vapour complete the table

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
2.864	*-22*	*170.2*	*181.7*	.....
2.974	*-21*	*171.5*	.....	*355.9*
3.087	*-20*	.....	*183.8*	*356.5*
13.926	*29*	*244.5*	.....	*381.9*
14.150	*30*	.....	*136.1*	*382.2*
14.654	*31*	*247.9*	*134.7*	.....

(12 marks)

   b. ***Refrigerant - 404a*** uses to operate refrigerant in a reefer container plant. The saturated refrigerant liquid at ***14.150 bar*** in a receiver expands to a wet vapour at ***2.974 bar*** by a throttling valve.
      i. Draw the Temperature-Enthalpy diagram for the expansion (3 marks)
      ii. Find the enthalpy after the expansion (2 marks)
      iii. Estimate the dryness fraction after the expansion (3 marks)

      Hint: Use the properties in the table given in the ***part a***

9.
   a. Describe ***Dolton's partial pressure law*** (2 marks)
   b. A closed vessel of ***1.5 m^3*** capacity contains air and dry steam at a total pressure of ***0.12 bar*** and temperature ***40 ^0C***. Due to air leakage into the vessel, the pressure raises to ***0.25 bar*** and the temperature falls to ***36 ^0C***. Taking ***R*** for air = ***0.287 kJ/kgK***. Determine
      i. The initial partial pressure of steam and air in the vessel (6 marks)
      ii. The final partial pressure of steam and air in the vessel (6 marks)
      iii. The mass of air leaked into the vessel (6 marks)

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COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER REPAT EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2022.04.02 *Pass mark 50%* *Time allocated: 03 Hrs*

Q: 1

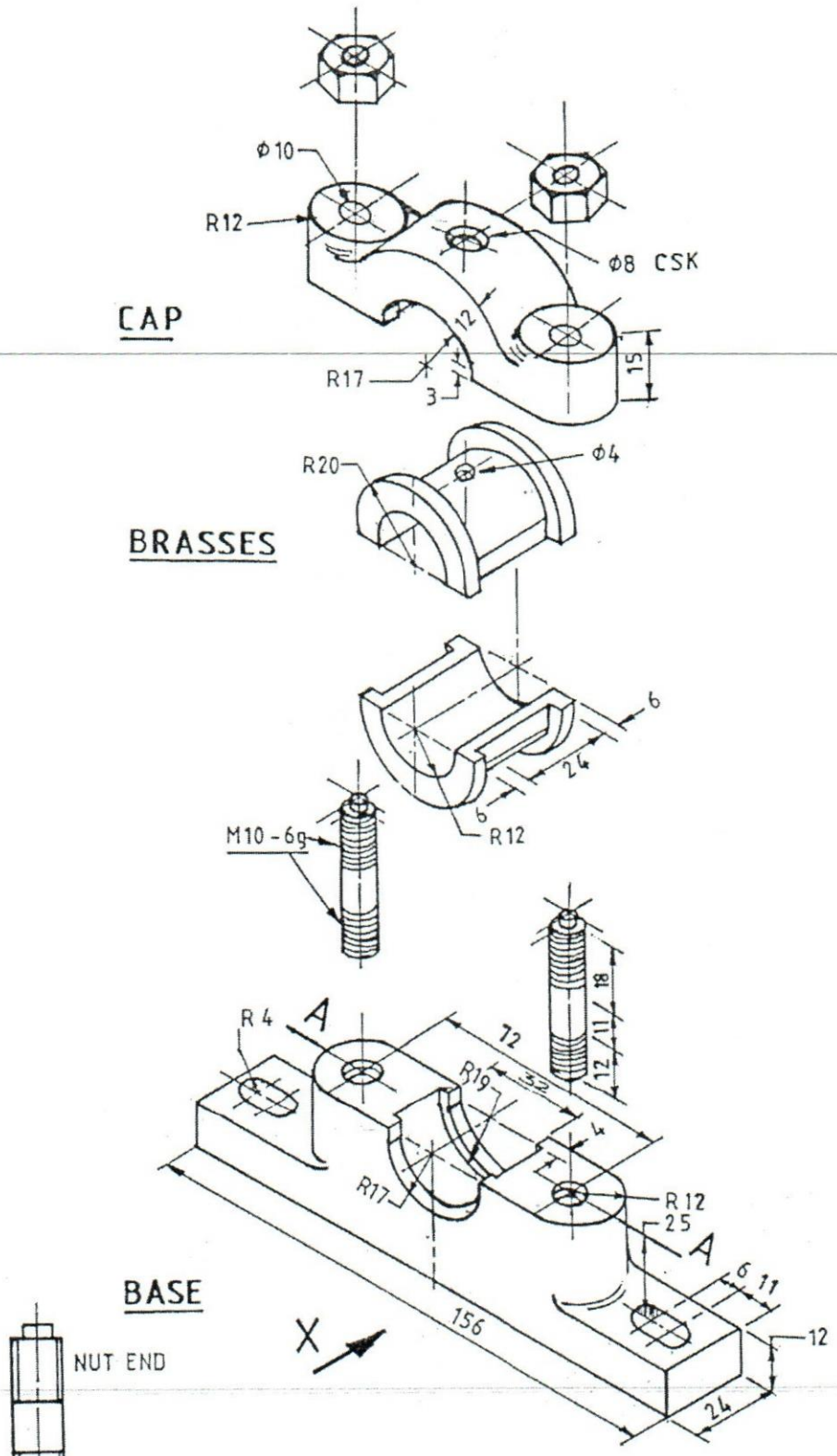
Below figure shows the exploded view of a Plummer block bearing housing with Brasses. Assemble the different parts in their correct positions and draw to full size using ***first angle projection*** with the following views.

i. Sectional front elevation looking in the direction of arrow **X**
ii. End elevation projected to the left of front elevation view
iii. Plan projected from front elevation view.

**Assume any missing dimensions*

Marking System

Q: 1	View in Question (i)	:	40 Marks
	View in Question (ii)	:	20 Marks
	View in Question (iii)	:	20 Marks
	Dimensions (at least 6 dimensions distributed)	:	10 Marks
	Titles and letters	:	05 Marks
	Boundaries Lines and over all neatness	:	05 Marks



PLUMMER BLOCK dimensions in mm.

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1ST SEMESTER EXAMINATION QUESTION PAPER
Workshop Theory (Batch 43)

- *This question paper consists of six questions.*
- *Answer All questions*

Date: 2022.01.11 *Pass mark 50%* *Time allocated: 03 Hrs*

Q1. Briefly explain following workshop tools and their uses with suitable sketches where necessary. (2 marks each)

(i) Dial gauge

(ii) Depth gauge

(iii) V block

(iv) Face- plate

(v) Outside and inside calipers.

(vi)Filler gauge

(vii) Thread gauge

(viii) Scriber

(ix) Centre punch

(x) Taps and dies

Q2. (a) (i) How to classify materials used for engineering work? (4 marks)

(ii) List down 4 types of properties inherent in any material (4 marks)

(b) You are given a steel plate of 122mm long, 94 mm wide and 5mm thick.

Explain step by step, with suitable sketches, how to make a 4mm hole at the centre of that plate (8 marks)

Q3. a. What is the main difference between plastic limit and elastic limit. (4 marks)

b. Plane carbon steels are mainly of iron with small quantities of carbon.

Explain with examples following type of steel with their uses. Your answer should include the percentage of carbon in each type of steel.

i. Low carbon steel (3 marks)

ii. Medium carbon steel (3 marks)

iii. High carbon steel (3 marks)

iv. What is meant by cast iron? Give some example of engineering component manufactured by cast iron. What are the advantages and disadvantage of using cast iron? (3 marks)

Q4.

(i) With regard to properties of materials explain following terms. (2 marks each)

a) Hardness b) Toughness c) Brittleness d) Ductility

(ii) Explain the different between hot rolling and cold rolling of steel. (4 marks)

(iii) Explain the following heat treatment methods. (2 marks each)

a) Normalizing b) Annealing

Q5.

(i) Briefly explain TIG welding and MIG welding procedures. (8 marks)

(ii) Explain various position of manual electric arc welding positions. Use Sketches where necessary. (8 marks)

Q6. With an aid of a suitable graph (strain against stress) explain following physical properties of a material. (9 marks)

a. Yield strength and yield point. (1 mark)

b. Ultimate strength . (1 mark)

c. Strain hardening . (1 mark)

d. Necking . (1 mark)

e. Failing point(fracture point) . (1 mark)

f. Area of elastic behavior and plastic behavior. (1 mark)

g. Proportional limit . (1 mark)

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COURSE CODE: ED 0350 PI (BATCH 42)

02ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

Date: 2022.02.27 *Pass mark 70%* *Time allocated: 03Hrs*

- *Answer any **Six** questions*

01. Briefly explain the following situations

a) Crank case explosion (4 Marks)
b) Scavenge fire (4 Marks)
c) Exhaust gas uptake fire (4 Marks)
d) Starting air pipeline explosion (4 Marks)

02.

a) Sketch and describe an air starting system suitable for a 2-stroke marine engine (8 Marks)
b) What is the purpose of turning gear interlock? (2 Marks)
c) What are the safety devices fitted in the starting air system? (6 Marks)

03.

a) Sketch and describe the 4-stroke timing cycle of a compression ignition engine. (8 Marks)
b) What is meant by overlap period of the system? (2 Marks)
c) Describe with the aid of sketches various scavenging methods of 2-stoke diesel engines. (6 Marks)

04. Describe with the aid of sketch **ONE** of the following operations systems in large 2-stroke marine diesel engines. (16 Marks)

a) Engine jacket cooling water system
b) Fuel oil supply system from D.B. tank to main engine
c) Lubricating oil system

05. Sketch and describe a piston of a large 2-stroke marine diesel engine (8 Marks)

a) What are the types of piston cooling systems, mention their advantages and disadvantages? (4 Marks)
b) What is the function of piston rings in a marine diesel engine? (4 Marks)

06. Briefly explain the purpose of following equipment of a marine diesel engine.

a) Bed plate (4 Marks)
b) Cylinder relief valve (4 Marks)
c) Crank shaft (4 Marks)
d) Cam shaft (4 Marks)

07. Sketch and name the parts of a turbo charger (9 Marks)

a) What are the causes of turbo charger surging? (5 Marks)
b) What is the action to be taken if turbo charger surges? (2 Marks)

08. Sketch an auxiliary boiler fitted in a motor vessel and mark all the mountings. (8 Marks)

a) What are the dangers involved with high water level of boiler? (4 Marks)
b) What are the dangers involved with low water level of boiler? (4 Marks)

09. a) State the reasons for fitting a crank case oil missed detector in an engine. (4 Marks)

a) Sketch and briefly explain the operating principles. (10 Marks)
b) What is the action to be taken if the detector alarm goes? (2 Marks)

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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Electrotechnology

- *This question paper consists of eight questions.*
- *Answer any six (06) Questions*
- *Date: 2022.03.27* *Pass mark 50%* *Time allocated: 03 Hrs*

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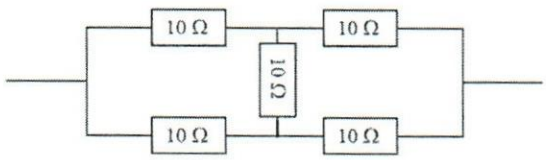
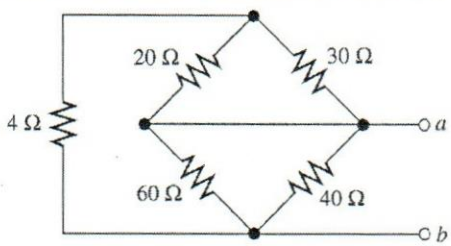
1. a) State Ohm's law. (04 marks)

   b) i. Five 10 Ω resistors are connected as shown in the diagram. Find equivalent resistance of the circuit. (05 marks)



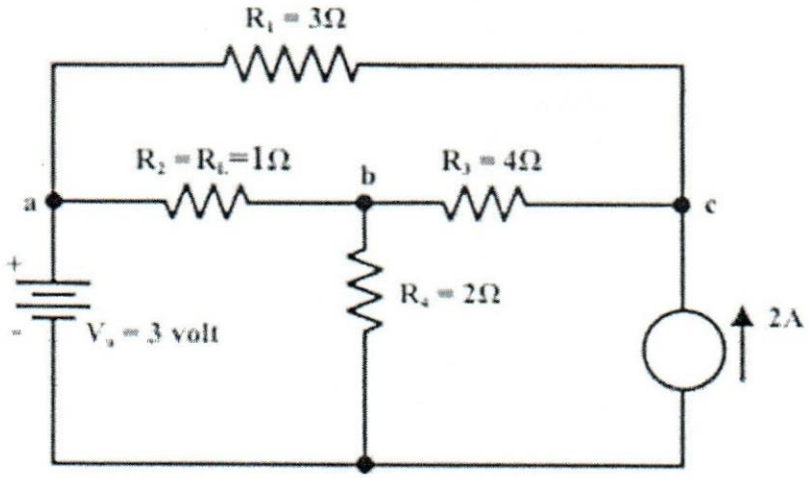
   ii. Find resistance between 'a' and 'b'. (05 marks)



   c) Calculate the resistance of a 100 m roll of 2.5mm^2 copper wire if the resistivity of copper at 20°C is 1.72 x 10^{-8} Ω m. (06 marks)

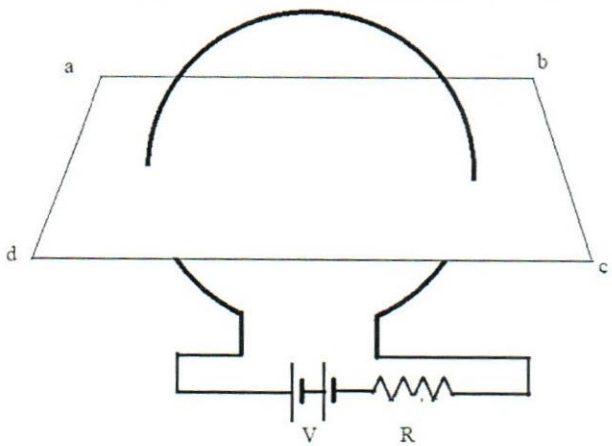
2. a) State Kirchhoff current law and Kirchhoff voltage law. (06 marks)
   b) The figure below shows currents in a part of electric circuit. Find value of current *'i'*. (04 marks)

c) Find the current through $R_L = R_2 = 1\Omega$ resistor (I_{a-b} branch) using Thevenin's theorem or otherwise and hence calculate the voltage across the current source. (10 marks)



3. a) Define the terms magnetic flux density and magnetic intensity. (06 marks)

b) Draw the magnetic field generated by the current wire on 'abcd' rectangular plane.



(04 marks)

c) A magnetic circuit of common cross-sectional area 0.4 cm^2 consists of one part 3 cm long, of material having relative permeability 1200, and a second part 2 cm long of material having relative permeability 750. With a 100 turn coil carrying 2 A, find the value of flux existing in the circuit. ($\mu_0 = 4\pi \times 10^{-7}\, H.m^{-1}$) (10 marks)

4. a) i. Sketch and describe the construction and operation of fluorescent tube light.

ii. Write advantages of fluorescent tube light over incandescent lamp. (14 marks)

b) Give 3 methods to alleviate a "stroboscopic" problem. (6 marks)

5. a) Draw the three phase balanced power systems to show star and delta connected inductive loads. (04 marks)

   b) Compare and list the voltage, current and power of star and delta systems. (06 marks)

   c) Three resistors, each having a resistance of 2k Ω are connected in star across 400V, 3-phase, 50 Hz supply. Calculate line current, power factor and power taken from the mains. (10 marks)

6. a) Explain the IR test for three-phase nine terminals (9) slip-ring induction motor. (15 marks)

   b) Explain the meter indication on clamp meter which is clipped around 3 core cable that is carrying 30A AC to a three-phase induction motor. (5 marks)

7. a) Describe how does rotor direction reversed of three-phase induction motor. (4 marks)

   b) Draw "POWER" and "CONTROL" circuit for D.O.L. magnetic contactor starter circuit. (Mark all terminal numbers and devices identification letters)

   Specification: - Electric power supply – 3 ∿ 440V-60Hz (Insulated system)

   Control circuit supply – 24V ∿ - 60Hz

   Motor – 3 ∿ 440V/ 5.5kW – 60Hz

   Indicating lamps – "GREEN" for motor running

   "RED" for motor O/L

   "ORANGE" control circuit OK!

   (16 arks)

8. A 230 V, 50 Hz ac supply is applied to a coil of 1.33 H inductance and 200 Ω resistance connected in series with a 10 μF capacitor. Calculate

   a) Impedance (06 marks)
   b) Current (04 marks)
   c) Phase angle between current and voltage (06 marks)
   d) power factor. (04 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 43)

1ST SEMESTER EXAMINATION QUESTION PAPER
APPLIED MECHANICS

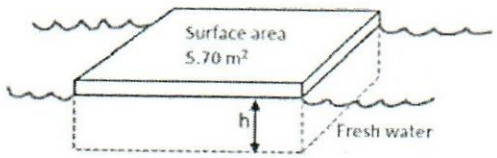
- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2022.01.10 *Pass mark 50%* *Time allocated: 03 Hrs*

1.

1.1. Briefly describe Archimedes' law with the help of a diagram (4 marks)

1.2 A rectangular raft is constructed of wood having a density of $6X10^2$ kg/m^3. Its surface area of the top surface of the raft is 5.70 m^2, and its total volume is 0.60 m^3. When the raft is placed in fresh water to float, to what depth **(h)** is the raft submerged? (8 marks)
1.3 If the raft is placed in salt water, which has a density of 1025 kg/m^3 calculate the new submerged depth of the raft. (8 marks)



2.

2.1 Write four equations that could describe the motion of an object in a straight line experiencing uniform acceleration.

(4 marks)

2.2. Object **A** is released from the top of a building with unknown height and falls toward earth. Object **B** is released from the same location exactly one second after object **A** is released. Find the separation between object **A** and **B** after two seconds of the release of the ***object B***. (8 marks)

2.3 Object **C** is projected upward from ground exactly when the object **A** is released from the building. During its upward motion object **C** meet the object **B** after 3 seconds. If the height of the building is 80m, find the projecting velocity of object **C**. (8 marks)

3.

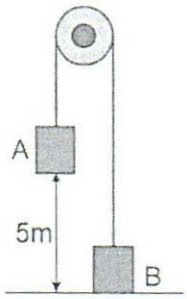
3.1 Write three newton laws and hence derive the equation $F = ma$ (4 marks)

3.2 Two boxes **A** and **B**, of masses 0.6 kg and 0.4 kg respectively, are connected by a light inextensible string which passes over a smooth fixed pulley. The boxes hang freely, as shown in the diagram, and are released from rest.

a. Find the acceleration of the system and the tension in the string. (4 marks)
b. Find the time it will take box **A** to hit the ground. (4 marks)
c. Calculate the velocity of boxes when box **A** hit the ground (4 marks)

3.3 Assume the string is cut after 2 seconds of releasing from rest and in the subsequent motion both boxes move freely under gravity.

d. Find the height of both particles at the instant that the string is cut. (2 marks)
e. Find the maximum height Box **B** will reach measured from floor (2 marks)



4.

4.1 A ball is thrown **horizontally** at 5 ms^{-1} out of the second floor of a building resulting a projectile motion. The point of projection is 4 m above the ground level.

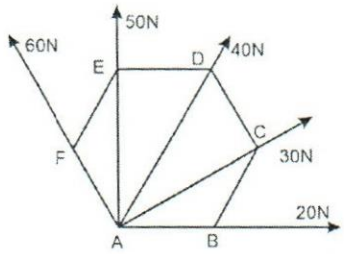
a. How long does it take the ball to reach the ground? (4 marks)
b. How far from the building does the ball land? (4 marks)
c. What is its speed just before it lands (4 marks)
d. Just before lands, at what angle to the ground is it moving? (4 marks)
e. If the ball is projected 30^0 to horizontal what is the maximum height the ball will reach? (4 marks)

5.

5.1 Briefly describe the idea of resultant force (3 marks)

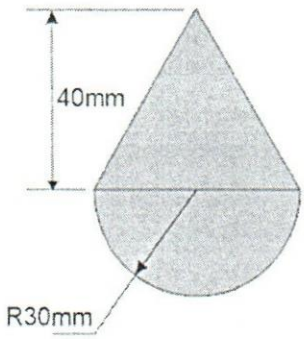
5.2 The forces 20 N, 30 N, 40 N, 50 N and 60 N are acting at one of the angular points of a regular hexagon, towards the other five angular points, taken in order, as shown in the figure below. Find the magnitude and direction of the resultant force created by these forces. (Hint: Internal angle of a regular hexagon is equal to 120^0) (12 marks)

5.3 If one side of the hexagon is equal to 2m, and if it is fixed about the point B shown in the figure, calculate the moment created by the resulting force about this point.
(5 marks)



6.

6.1 A body consists of a right circular cone of height 40mm and radius 30mm placed on a solid hemisphere of radius 30mm of the same material. Find the position of center of gravity of the body. (Clearly indicate the reference axes x and y)
(Hint: Volume of a Hemisphere $= \frac{2}{3}\pi r^3$ and volume of a right circular Cone$= \frac{1}{3}\pi r^2 h$ with standard notations) (20 marks)

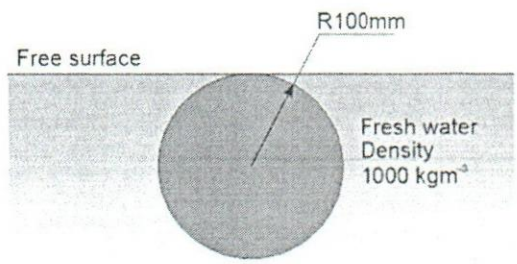


7.

7.1 What is center of pressure? (4 marks)
7.2 A circular plate of radius 100 mm is vertically immersed on fresh water touching free surface (see diagram). Calculate;

a. Total pressure force acting on one side of the plate (8 marks)
b. The position of center of pressure of plate (8 marks)

(hint: area moment of inertia of a circular cross-section about an axis passing its center (I) is $\frac{\pi D^4}{64}$)



8.

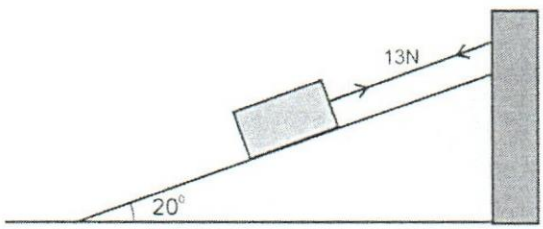
8.1 Write brief notes on advantages and disadvantages of "friction" in engineering (4 marks)

8.2 During a simple experiment, a block of mass 8 kg is placed on a rough plane inclined at 20^0 to the horizontal and is connected to a string as shown in the figure below. The string is fixed firmly to a vertical wall at the top of the plane and is parallel to a line of greatest slope of the plane.

a. The block is seen at rest and in equilibrium showing a 13N tension in the string, find the frictional force acting on the block under this condition. (10 marks)

8.3 After that, the string is cut carefully. However, the block remains at rest even after this due to friction. This time the block is observe to be on the point of slipping down the plane;

b. Find the coefficient of friction between the block and the plane. (6 marks)



9.

9.1 A bullet of mass 20 g, fired in to a wooden post and had penetrated 16 cm into it. The speed for the bullet just before hitting the post is 80 ms^{-1}.

a. Find the kinetic energy of the bullet before it entered the post. (8 marks)

b. Calculate the resistive force on the bullet, assuming it to be constant. (6 marks)

9.2 A second bullet is fired to the same wooden post and this time bullet had penetrated 20 cm into the post.

c. Estimate the new speed of the bullet just before it hit the post. (6 marks)

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EXAMINATION QUESTION PAPER
THERMODYNAMICS

- This question paper consist 09 questions.
- Answer **any 06** questions only.

Date: 2022.02.08 | Pass mark 50% | Time allocated: 03Hrs

For air c_p = ***1.005kJ/kg K***, c_v = ***0.717kJ/kg K***

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

Specific heat capacity of water ***4.2 kJ/kg K***

1.

a. Describe the three type of expansion of solid materials. (04 Marks)

b. Write expressions for coefficient of superficial expansion and coefficient of volumetric expansion using the coefficient of linear expansion of solid materials (04 Marks)

c. In an experiment to find the coefficient of linear expansion of copper, a rod of copper at ***0*** ^{0}***C*** is ***0.5 m*** in length. Raising the temperature of the rod from ***25*** ^{0}***C*** to ***45*** ^{0}***C*** produces an extension of ***0.17 mm***. Find

   i. The coefficient of linear expansion. (02 Marks)

   ii. The length of the rod at ***25*** ^{0}***C*** and ***45*** ^{0}***C*** (04 Marks)

d. A sample of oil is filled in a copper can of ***100 ml*** at ***25*** ^{0}***C*** and it is heated to ***50*** ^{0}***C*** and ***0.12 ml*** of oil is spilt during the heating. Using the coefficient of linear expansion of copper is the value determined in part c, estimate the coefficient of volumetric expansion of oil.

(06 Marks)

2.

a. Describe the heat transfer, change in internal energy and work transfer for cyclic process (05 Marks)

b. A closed system having a cycle of four processes, heat and work interactions are follows:

Process 1 – 2 : adiabatic compression $Q_{12} = 0$, $W_{12} = -900$ ***kJ***

Process 2 – 3 : constant pressure heating $Q_{23} = +3000$ ***kJ*** , $W_{23} = +200$ ***kJ***

Process 3 – 4 : adiabatic expansion $Q_{34} = 0$, $W_{34} = +2200$ ***kJ***

Process 4 – 1 : constant volume heat rejection Q_{41}, $W_{41} = 0$

6.

a. Describe the ***adiabatic index, γ*** of a gas. (02 Marks)

b. ***0.12 m³*** of gas at ***300 kPa*** and ***97 ^{0}C*** is compressed adiabatically in a close system to ***one fourth of its original volume***. The gas is then cooled at constant volume until its pressure is ***300 kPa***.

i. Draw the ***P-V*** diagram for the process (03 Marks)

Calculate the following

ii. The ***adiabatic index, γ*** (03 Marks)

iii. The ***temperature*** and ***pressure*** at the end of compression (04 Marks)

iv. The ***temperature*** at the end of heat rejection (04 Marks)

v. The ***work transfer*** during compression and constant volume cooling (04 Marks)

Hint: specific heat capacities of the gas under constant pressure, ***Cp*** and constant volume, ***Cv*** are ***0.7075*** and ***0.6261 kJ/kg K*** respectively.

7.

a. State the ***Fourier law in heat transfer***. (02 Marks)

b. Describe the ***overall heat transfer coefficient*** (02 Marks)

c. A A cold storage compartment is covered with outer surface by ***3 mm*** of Aluminum foil and inner surface by ***5 mm*** of Fiberglass and ***150 mm*** of insulating material is sandwiched between them. The coefficient of thermal conductivity of Aluminum, Fiberglass and insulating material are ***180, 0.045*** and ***5.8 × 10^{-2} W/m K.*** The outside and inside face temperatures of the material is ***15 ^{0}C*** and ***– 5 ^{0}C***. Determine

i. The overall heat transfer coefficient (04 Marks)

ii. Rate of heat transfer trough the wall per unit area (04 Marks)

iii. The intermediate temperature (04 Marks)

iv. Draw the temperature variation through the wall (04 Marks)

8.

a. Some thermodynamic and transport properties of ***refrigerant -404a*** contain in the table below. Using the properties of vapour complete the table (06 Marks)

Pressure, bar	*Saturation temperature, ^{0}C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
2.864	*-22*	*170.2*	*181.7*	.....
2.974	*-21*	*171.5*	.....	*355.9*
3.087	*-20*	.....	*183.8*	*356.5*
13.926	*29*	*244.5*	.....	*381.9*
14.150	*30*	.....	*136.1*	*382.2*
14.654	*31*	*247.9*	*134.7*	.....

b. ***Refrigerant - 404a*** uses to operate refrigerant plant in the temperature range between ***30 ^0C*** and ***-21 ^0C***. Saturated liquid at ***30 ^0C*** expands to a wet vapour at ***2.974 bar*** by the throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (05 Marks)

ii. Find the enthalpy after the expansion (03 Marks)

iii. Estimate the dryness fraction after the expansion (06 Marks)

9.

a. Draw the Temperature -enthalpy diagram for water and steam to represent the following states on it

i. Saturated liquid line, Wet vapour region, Saturated dry vapour line, Superheated vapour region and Critical point (05 Marks)

ii. Saturated water at ***250.3 ^0C***, wet steam at ***40 bar*** with ***0.95 dry, dry*** steam at ***20 bar*** and steam at ***20 bar*** and ***300 ^0C*** (05 Marks)

b. Steam enters to a super-heater at a pressure of ***20 bar*** and dryness ***0.8*** and steam leaves the super-heater at ***300 ^0C***. Using the steam tables, find

i. The specific enthalpy of change of steam in the super-heater (05 Marks)

ii. The specific volume change of steam (05 Marks)

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COURSE CODE : EED -0475/ B009/P1/M1

EXAMINATION QUESTION PAPER
ENGINEERING SCIENCE

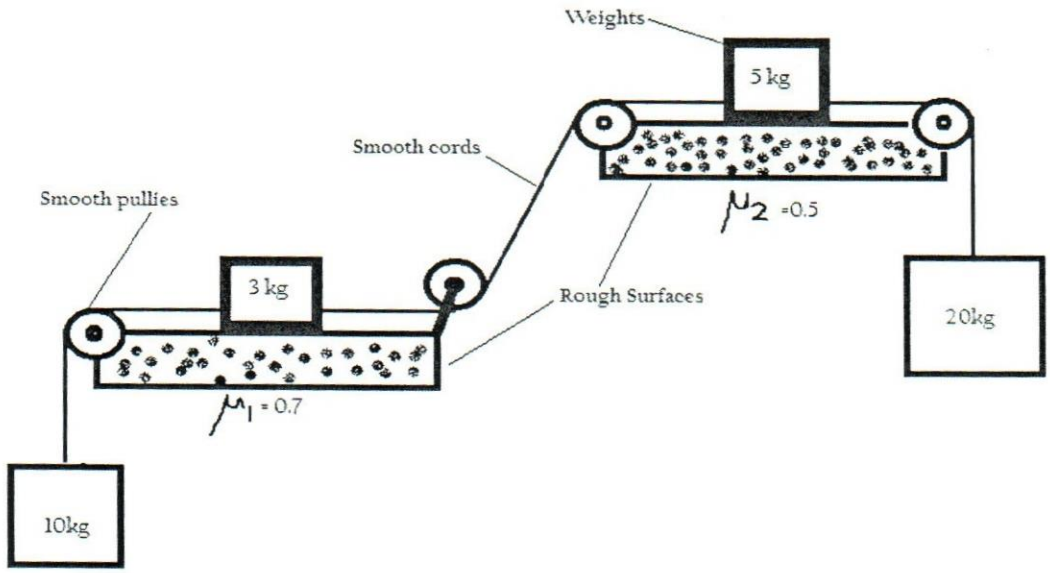
- *This question paper consist 05 questions.*
- *Answer* all questions.

Date: 2022.02.10 *Pass mark 50%* *Time allocated: 03 Hrs*

1. With regards to the friction in linear movements,

   a. Define the Static and Dynamic frictions (04 Marks)

   b. Consider following arrangement, the dynamic friction coefficients are given for the two surfaces.



   Find,

   i. The acceleration of the total system (08 Marks)
   ii. Tensions of each and every cord (08 Marks)

2. With regards to heat transfer,

   i Define specific latent heat. (04 Marks)

   ii The heater in an electric kettle has a power of 3 kW. When the water in the kettle is boiling at a steady rate, the mass of water evaporated in 2.5 minutes is 100 g. The specific latent heat of vaporization of water is 2260 Jg^{-1}. Calculate the rate of loss of thermal energy to the surroundings of the kettle during the boiling process.

   (16 Marks)

3. a. Briefly explain about velocity-time graphs. What are the important facts that can be obtained from velocity-time graphs. (04 Marks)

   b. A particle moves along a straight line with an acceleration of $-4mS^{-2}$. It starts its motion from a certain point with a velocity of $20mS^{-1}$.

      i Write down **equations** for its **position** and **velocity** at time "t ". (05 Marks)

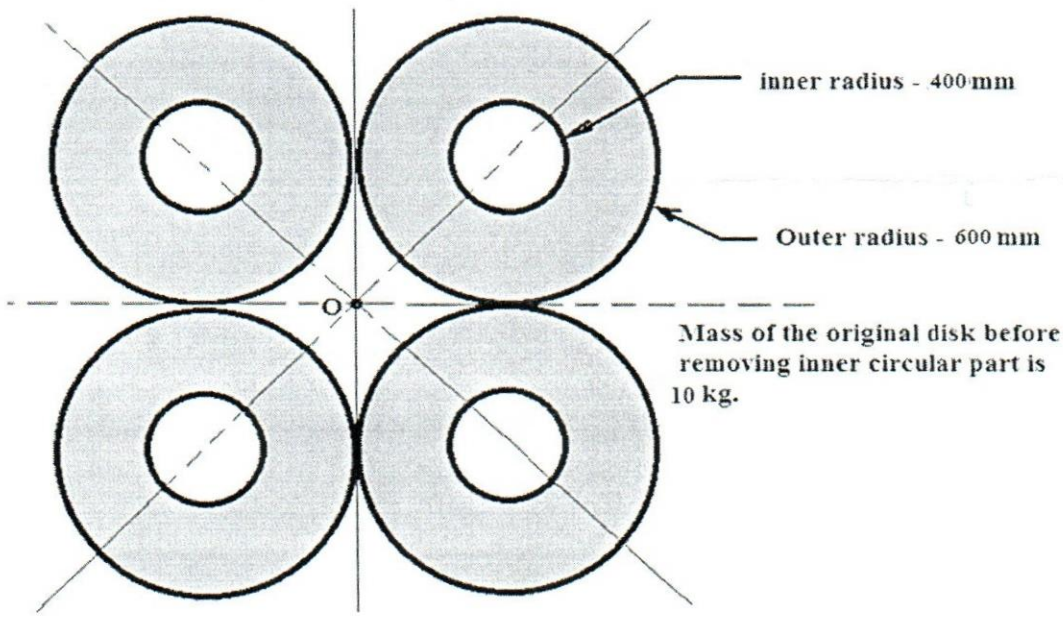
      ii Find the time "t" when the velocity is zero. (03 Marks)

      iii Sketch the **position-time** and **velocity-time** graphs for the interval $0 \leq t \leq 5$ (08 Marks)

4. With regard to angular dynamics,

   a. Briefly describe the moment of inertia of an object. (05 Marks)

   b. 4 no.of 10 kg circular disks are connected as per the following figure. Thereafter small circular parts of each and every disk has been removed. Find the moment of inertia along axis "O" of the final object. (15 Marks)



5. With regards to the expansion of fluids

   a. Define "Boyles", "Charles" and "Combined Gas" Laws (4x3 Marks)

   b. A rigid container of internal volume 1 m^3 contains a gas at a pressure of 300 kPa and temperature 15°C. What will be the pressure of the gas in the container if an additional 2 kg of the gas is pumped into the container at the same temperature? The gas has a characteristic gas constant of 290 J kg^{-1} K^{-1}.

   (8 Marks)

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COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Naval Architecture

- This question paper consists of eight questions.
- Answer Any Six (06) Questions

Date: 2022.03.26 Pass mark 50% Time allocated: 03 Hrs

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1. A ship 150m long has half widths of water plane of 0.3, 3.8, 6.0, 7.7, 8.3, 9.0, 8.4, 7.8, 6.9, 4.7, and 0 respectively, calculate

(i) Water plane area (9 Marks)

(ii) TPC (4 Marks)

(iii) Water plane area coefficient (3 Marks)

2. (i) Define the term centre of gravity of an object. (4 marks)

ii) A vessel of 6000 tonne displacement is composed of masses of 300, 1200, and 2000 tonne at distances 60, 35, and 11m aft of mid-ship, and 1000, 1000, 500 tonne at distances 15, 30, and 50m forward of mid-ships. Calculate the distance of the centre of gravity of the ship from mid-ship. (12 marks)

3. The TPC values for a ship at 1.5 m intervals of draught commencing at the keel, are 4.0, 6.1, 7.8, 9.1, 10.3, 11.4 and 12.0 respectively. Calculate the displacement at 9 m draught. (16 Marks)

4. 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) Cm (c) Cb (d) Cp (16 Marks)

5. 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. (6 Marks)

6. (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)

7. Explain with suitable sketches of following ship construction features with regarding ship building.

I) Solid Plate Floors (5 marks)

ii) Racket floors (5 Marks)

iii) Duct keel (6marks)

8. Briefly explain the purpose of following features included in ship structure. You may use suitable sketches where necessary.

i) Double bottom tank (4 marks)

ii) Collision bulkhead (4 marks)

iii) Longitudinal girders and shell plating (4 marks)

iv) Corrugated bulkhead (4 marks)

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COURSE CODE : EED -0475/ B009/P1/M1

EXAMINATION QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *This question paper consist of Part A (20 Multiple Choice Questions) and Part B (04 questions).*
- *Answer all the questions.*

DATE: 2022.02.14 *Pass Mark : 50%* *Time Allocated: 03 Hrs*

Part A (01 Mark for each)

01. Select the statement that defines an atom
    (i) An atom is smallest particle in an element that has the properties of the element.
    (ii) It is not possible to breakdown the atom further retaining the properties of the element.
    (iii) Atoms are not visible to the naked eye and are the basic building blocks.
    (iv) All of above.

02. A chemical reaction is
    (i) A process that leads to the transformation of one set of substances to another.
    (ii) A process that leads to the transformation of one atom of substances to another atom.
    (iii) A process that leads to the transformation of one molecule of substances to another molecule.
    (iv) All above statements are incorrect.

03. pH value equal to
    (i) $-\log[H_3O^-]$
    (ii) $-\log[H^-]$
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect.

04. pH indicator
    (i) Shows one colour in acidic medium.
    (ii) Shows one colour in basic medium.
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect.

05. Select the correct statement
    (i) Litmus paper turns red under acidic conditions.
    (ii) Litmus paper turns blue under basic condition
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect

06. Any corrosion processes that occur are
    (i) A result of anodic currents.
    (ii) A result of cathodic currents.
    (iii) A result of both anodic and cathodic currents.
    (iv) All of above are incorrect.

07. Select the correct statement
    (i) Dissolved oxygen is more corrosive to steel than water.
    (ii) Oxygen is more corrosive to steel than water.
    (iii) Above (i) and (ii).
    (iv) All of above are incorrect.

08. What are the factors that cause corrosion?
    (i) Reactivity of the metal
    (ii) Presence of impurities
    (iii) Presence of electrolytes
    (iv) All of above.

09. Method is used for the protection of materials from corrosion
    (i) Cathodic protection
    (ii) Corrosion inhibitors
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect.

10. Corrosion may occur in the feed-water system
    (i) As a result of low pH water
    (ii) Presence of dissolved oxygen
    Ppresence of dissolved carbon dioxide
    (iii) All of Above

11. Zinc is generally used as
    (i) A sacrificial anode.
    (ii) A anodic dissolution current.
    (iii) A coating.
    (iv) All of above .

12. What is the material provides good protection against corrosion?
    (i) Fluro-polymer.
    (ii) Epoxy materials
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect.

13. Impressed current used for protect
    (i) The pipelines of a ship.
    (ii) The hull of a ship.
    (iii) Above (i) & (ii).
    (iv) All of above are incorrect.

14. Sacrificial anodes are especially used for
    (i) Ships.
    (ii) Offshore oil production platform.
    (iii) Off shore gas production platform
    (iv) All of the above.

15. For a metal M, anode reaction of the corrosion
    (i) $M^{2+} + 2e \longrightarrow M$
    (ii) $M - 2e \longrightarrow M^{2+}$
    (iii) $M \longrightarrow M^{2+} + 2e$
    (iv) Above (ii) & (iii)

16. Cathode reaction of the corrosion
    (i) $2H^{2+} + 2e \longrightarrow H_2$
    (ii) $H_2 - 2e \longrightarrow 2H^{2+}$
    (iii) Above (i) & (ii).
    (iv) **All of above are incorrect.**

17. Oxidation occurs at
    (i) Anode
    (ii) Cathode
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect.

18. Reduction occurs at
    (i) Anode
    (ii) Cathode
    (iii) Above (i) & (ii)
    (iv) All of above are incorrect

19. What are the essential requirements for the electrochemical corrosion reaction to occur?
    (i) Anode.
    (ii) Cathode.
    (iii) Electrolyte.
    (iv) All of above.

20. Basic corrosion in boilers may be primarily due to
    (i) Acid conditions in water
    (ii) Alternative current
    (iii) Reaction of the metal with oxygen
    (iv) Above (i) & (iii)

Part B

01. With reference to corrosion

    a. Write the activity series. (06 Marks)
    b. How do you protect base metal such as **Iron(Fe)** from corrosion. Relate your answer to (a) (04 Marks)
    c. Write the equations for chemical reactions taking place at the anode and cathode with their physical status. (06 Marks)
    d. What are the essential requirements for the electrochemical corrosions? (04 Marks)

02. With reference to corrosion protection
    a. State the factors which improve corrosion. (04 Marks)
    b. What are the methods used for the protection of materials from the corrosion? (04 Marks)
    c. Briefly explain the followings
        i Impressed current – Cathodic protection (04 Marks)
        ii Sacrificial anodes (04 Marks)
    d. List the anti corrosive coatings that helps against corrosion of metals (04 Marks)

03. With reference to water treatment

a. List the objective of water treatment. (06 Marks)

b. What is the importance of controlling pH value in water (04 Marks)

c. Write two types of water hardness and explain them. (04 Marks)

d. Fill the following table for common boiler feed water contaminants, their effect and possible treatment. (06 Marks)

	Impurity	**Resulting in**	**Got rid of by**	**Comments**
Soluble Gas				
Suspended Solid				
Dissolved Colloidal Solid				

04. With reference to fuel and lubricants

a. In relation to fire traingle, how do you classifify the fuel with their classes? (05 Marks)

b. Write composition of petrolum with their elements. (05 Marks)

c. State the three types of lubricants. (06 Marks)

d. What are the properties of lubricants? (04 Marks)

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COURSE CODE : EED -0475/ B009/P1/M1

EXAMINATION QUESTION PAPER
MATHEMATICS.

- *This question paper consist 06 questions.*
- *Answer* all questions.

Date: 2022.02.11 *Pass mark 50%* *Time allocated: 03 Hrs*

01

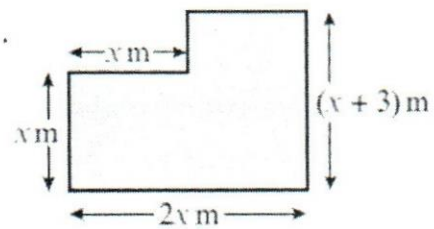
a. In a paint shop, a mix of red and white paint is used. Paints are mixed in a ratio of 1: 12.

i How much white paint will be needed to mix with 1.4 liters of red paint?
ii If a total of 15.5 liters of paint is mixed, calculate the amount of white paint and the amount of red paint used.
iii Each liter of white paid can cover a wall area of $6m^2$, calculate the area that can be covered by 200ml of paint in square centimeters. **(02X3 Marks)**

b. A bricklayer lays 1500 bricks in an 8 hour day. Assuming he continue to work at the same rate;

i Calculate how many bricks he would expect to lay in five days
ii Calculate how long it would take him to lay 10000 bricks
iii If he was supported by another bricklayer who has only half the speed, calculate the time it would take to lay the 10000 bricks by both of them simultaneously **(02X3 Marks)**

c. The shape shown has an area of $44m^2$. Find the value of x. **(03 Marks)**



02

a. Factorize completely:

i $x^3 - 25x$
ii $x^3 + 3x^2 - 10x$ **(02X2 Marks)**

b. Solve the following equations using suitable method:

i $6x^2 + 13x - 5 = 0$
ii $x^2 - 5x + 18 = 2 + 3x$
iii $2x^2 - 8x + 7 = 0$ **(02X3 Marks)**

c. On the same axes, sketch graphs of; $2x + y = 3$ and $y = x^2 - 3x + 1$ and identify all important points including the intersection points.

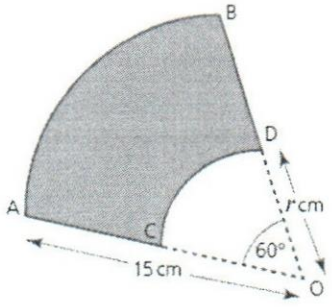
(05 Marks)

03.

a. Two circular sectors AOB and COD share the same center O. The area of AOB is three times the area of COD.

i Find the peripheral length of AOB

ii Calculate the radius r cm of sector COD. **(03X2 Marks)**



b. Prove below identities

i $\frac{1}{cosA} - cosA = sinAtanA$

ii $tanx + \frac{1}{tanx} = \frac{1}{sinxcosx}$

iii $sin^2xcos^2y - cos^2xsin^2y = sin^2x\text{-}sin^2y$ **(02X3 Marks)**

c. In the triangle ABC, $a=9cm$, $c=7cm$, and $B = 75^0$. Find the length of b, and the angles A and C.

(03 Marks)

04.

a. Find $\frac{dy}{dx}$;

i $y = 8x^2 - 7x + 12$

ii $y = \frac{1}{5}x^4 + 12x$

(02X2 Marks)

b. Considering the function $y = 4x^2 - 8x + 3$,

i Find the gradient of y at the point $(\frac{1}{2}, 0)$

ii Find the coordinates of the point on the graph of y where the gradient is 8.

iii Find the gradient of y at the points where the curve meets the line $y = 4x - 5$.

(02X3 Marks)

c. Evaluate below definite integrals

i $\int_0^1 (x^{\frac{1}{3}} - 1)^2\, dx$

ii $\int_1^8 (x^{-\frac{1}{3}} + 2x - 1)dx$

iii $\int_1^4 \frac{2+\sqrt{x}}{x^4} dx$

(02X3 Marks)

d. find the area of the finite region bounded by the curve with equation $y = x^2 - 4$ and the x axis.

(04 Marks)

5.

a. Z is a complex number, find Z in each case.

i. $(1+i)z = 3+i$
ii. $(2+i)(z-7+3i) = 15-10i$
iii. $(3+5i)(z+2-5i) = 6+3i$

(02X3 Marks)

b. Given that $z = 4+I$ and $w = 7-3i$ (z and w are complex numbers), find;

i. $z-w$
ii. $4w$
iii. $2z+5w$

(02X3 Marks)

c. If $z = \frac{26}{2-3i}$ find;

i z in the form $a+ib$
ii z^2 in the form $a+ib$
iii $|z|$
iv $\arg(z^2)$

(02X4 Marks)

06.

a. Given that;

$A = [2 \quad -1 \quad 3], B = \begin{bmatrix} 5 & -2 \\ 2 & 1 \end{bmatrix}, C = \begin{bmatrix} 4 & 3 \\ 0 & 6 \end{bmatrix}, D = [5 \quad -3 \quad 4],$

Find if possible;

i $0.5C$
ii D^T
iii CB
iv $3B+5AC^T$

(02X4 Marks)

b. Find the value of a, b, c, d from the equation

$$\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$$

(03 Marks)

c. Use matrices to solve the simultaneous equations **(04 Marks)**

$2x+5y=3$

$X+3y=1$

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EXAMINATION QUESTION PAPER
MECHANICAL SCIENCE.

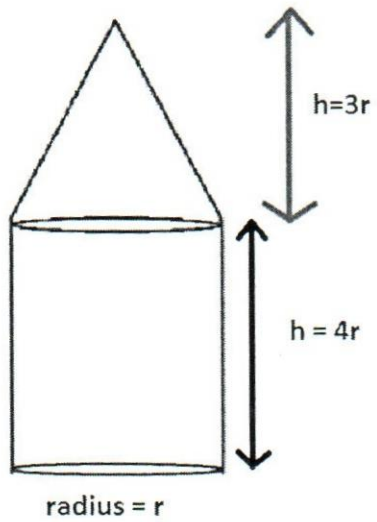
- *This question paper consist 05 questions.*
- *Answer* all questions.

Date: 2022.02.09 *Pass mark 50%* *Time allocated: 03 Hrs*

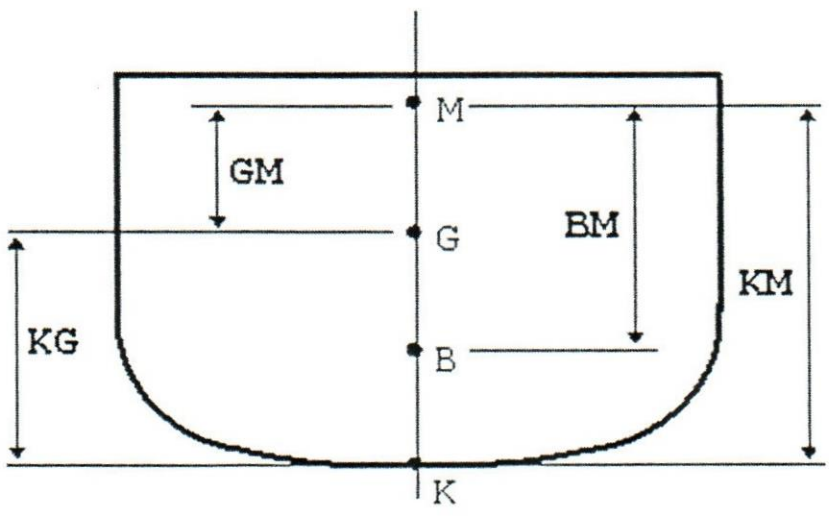
01. Regarding stability of a ship and center of gravity

a. A uniform solid composite body consists of a right circular cone of base radius **r** and height **3r** and a rigid circular cylinder of radius **r** and height **4r** fixed together as shown in the figure. Find the center of mass of the composite body from the vertex of the cone.

(10 Marks)

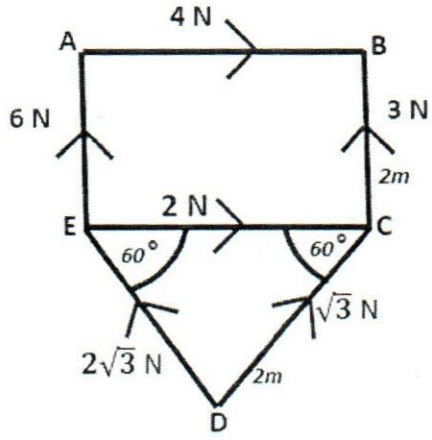


b. Consider the following cross section of a hull (10 Marks)



i. Name the points M, G, B and K
ii. Briefly describe the following linear measurements in stability of a ship
GM, BM, KG and KM
iii. Define the following types of stabilities by using diagrams
- Positive stability
- Negative stability
- Neutral stability

02. Regarding System of Forces



a. Find the resultant force of the system (05 Marks)
b. Find the angle of the resultant force (05 Marks)
c. What is the point (X value) where resultant force meets CE produced (Take E as the origin (0,0)) (05 Marks)
d. Get an equation for the line of action (05 Marks)

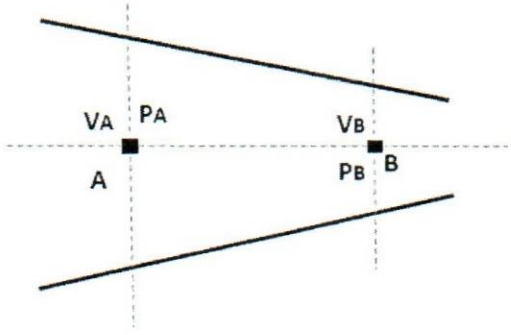
03. Regarding Hydraulics

a. Define following terms (06 Marks)
i Turbulent flow
ii Laminar flow
iii Uniform flow
iv Steady flow

b. State Bernoulli equation and define each part of it (02 Marks)

c. What is the formula to get the mass flow rate. State with respective units of it. (02 Marks)

d. Consider the following water pipe and find (10 Marks)

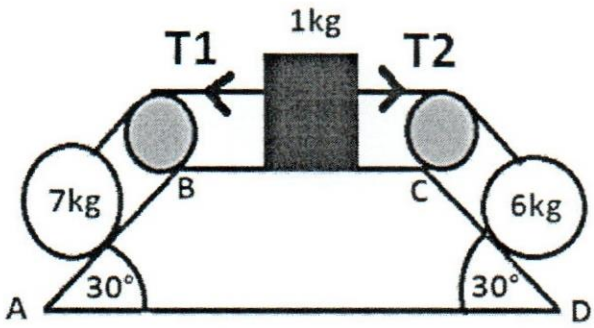


i Velocity at point A
ii Velocity at point B
iii Mass flow rate

Details:

- Diameter at point A = 500 mm
- Diameter at point B = 250 mm
- Pressure difference of point A and B = 2 kPa

04. Regarding Friction and linear motion



a. If we remove the system (Take AB,BC and CD planes are smooth)
   i What is the acceleration of the system? (04 Marks)
   ii Find the tension T1 and T2 (04 Marks)
   iii If the BC plane is rough with a coefficient of friction (μ) 0.5 what will happen to the system? (04 Marks)

b. Pahalagama throws a ball vertically. He notices it reaches a maximum height of 10 meters. What was the initial velocity of the ball? (08 Marks)

05. Regarding Hydrostatics

a. State two applications of pascal's law and describe one of them using diagrams (04 Marks)
b. What is the difference between gauge pressure and absolute pressure? (04 Marks)
c. What is the usage of following meters? (04 Marks)
   i Manometer
   ii Barometer

d. Calculate the pressure and force on an inspection hatch of 3 m diameter located on the bottom of a tank when it is filled with oil of density 900 kg/m3 to a depth of 20m. (04 Marks)

e. State the relationship between gauge pressure, atmospheric pressure and absolute pressure of a fluid in a pipe (04 Marks)

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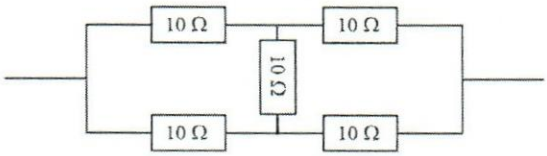
COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER EXAMINATION QUESTION PAPER
Electrotechnology

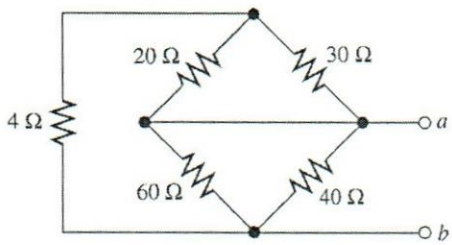
- *This question paper consists of eight questions.*
- *Answer any six (06) Questions*
- *Date: 2021.11.30* *Pass mark 50%* *Time allocated: 03 Hrs*

1. a) State Ohm's law. (04 marks)

   b) i. Five 10 Ω resistors are connected as shown in the diagram. Find equivalent resistance of the circuit. (05 marks)



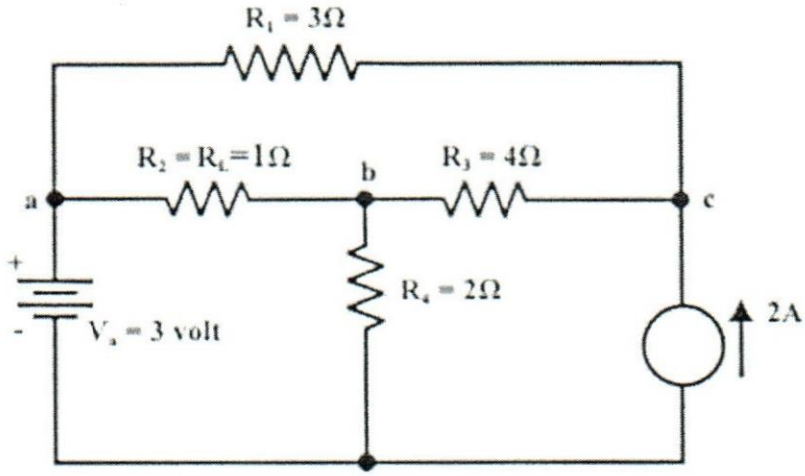
   ii. Find resistance between 'a' and 'b'. (05 marks)



   c) Calculate the resistance of a 100 m roll of 2.5mm² copper wire if the resistivity of copper at 20°C is 1.72 x 10^{-8} Ω m. (06 marks)

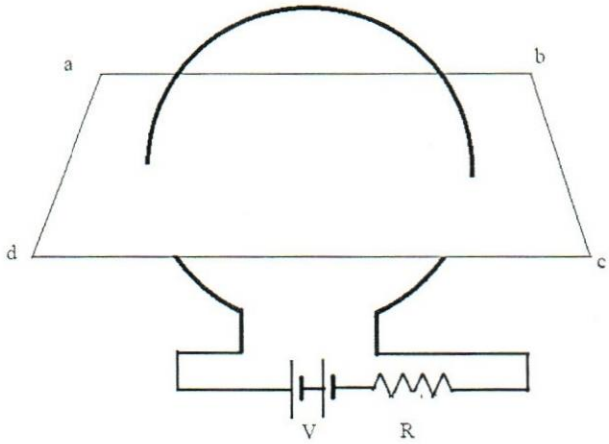
2. a) State Kirchhoff current law and Kirchhoff voltage law. (06 marks)
   b) The figure below shows currents in a part of electric circuit.
   Find value of current *'i'*. (04 marks)

c) Find the current through $R_L = R_2 = 1\Omega$ resistor (I_{a-b} branch) using Thevenin's theorem or otherwise and hence calculate the voltage across the current source. (10 marks)



3. a) Define the terms magnetic flux density and magnetic intensity. (06 marks)

b) Draw the magnetic field generated by the current wire on 'abcd' rectangular plane.



(04 marks)

c) A magnetic circuit of common cross-sectional area 0.4 cm^2 consists of one part 3 cm long, of material having relative permeability 1200, and a second part 2 cm long of material having relative permeability 750. With a 100 turn coil carrying 2 A, find the value of flux existing in the circuit. ($\mu_0 = 4\pi \times 10^{-7}\, H.m^{-1}$) (10 marks)

4. a) i. Sketch and describe the construction and operation of fluorescent tube light.

ii. Write advantages of fluorescent tube light over incandescent lamp. (14 marks)

b) Give 3 methods to alleviate a "stroboscopic" problem. (6 marks)

5. a) Draw the three phase balanced power systems to show star and delta connected inductive loads. (04 marks)

   b) Compare and list the voltage, current and power of star and delta systems. (06 marks)

   c) Three resistors, each having a resistance of 2k Ω are connected in star across 400V, 3-phase, 50 Hz supply. Calculate line current, power factor and power taken from the mains. (10 marks)

6. a) Explain the IR test for three-phase nine terminals (9) slip-ring induction motor. (15 marks)

   b) Explain the meter indication on clamp meter which is clipped around 3 core cable that is carrying 30A AC to a three-phase induction motor. (5 marks)

7. a) Describe how does rotor direction reversed of three-phase induction motor. (4 marks)

   b) Draw "POWER" and "CONTROL" circuit for D.O.L. magnetic contactor starter circuit. (Mark all terminal numbers and devices identification letters)

   Specification: - Electric power supply – 3 ∿ 440V-60Hz (Insulated system)

   Control circuit supply – 24V ∿ - 60Hz

   Motor – 3 ∿ 440V/ 5.5kW – 60Hz

   Indicating lamps – "GREEN" for motor running

   "RED" for motor O/L

   "ORANGE" control circuit OK!

   (16 arks)

8. A 230 V, 50 Hz ac supply is applied to a coil of 1.33 H inductance and 200 Ω resistance connected in series with a 10 μF capacitor. Calculate

   a) Impedance (06 marks)
   b) Current (04 marks)
   c) Phase angle between current and voltage (06 marks)
   d) power factor. (04 marks)

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COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER EXAMINATION QUESTION PAPER
Naval Architecture

- *This question paper consists of eight questions.*
- *Answer Any Six (06) Questions*

Date: 2021.11.29 *Pass mark 50%* *Time allocated: 03 Hrs*

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1. A ship 180m long has half widths of water plane of 1,7.5, 12, 13.5, 14,14,14,13.5,12,7 and 0 respectively, calculate
   (i) Water plane area (09 Marks)
   (ii) TPC (04 Marks)
   (iii) Water plane area coefficient (03 Marks)

2. (i) Define the term "Virtual loss of metacentric height " (04 marks)

   (ii) A vessel of 10,000 tone displacement has a second moment of the water plane around the centerline of 60 X 10^3 m4. 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)

3. The TPC values for a ship at 1.2 m intervals of draught commencing at the keel, are 8.2, 16.5, 18.7, 19.4, 20.0, 20.5, and 21.1 respectively. Calculate the displacement at 7.2 m draught. (16 Marks)

4. 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)

5. 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)

6. (a) Explain the meaning of freshwater allowance. (04 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)

7. Explain with suitable sketches of following ship construction features with regarding ship building.
   (i) Solid Plate Floors (05 marks)
   (ii) Bracket floors (05 Marks)
   (iii) Duct keel (06marks)

8. Briefly explain the purpose of following features included in ship structure. You may use suitable sketches where necessary.
   (i) Double bottom tank (04 marks)
   (ii) Bilge keel (04 marks)
   (iii) Longitudinal girders and shell plating (04 marks)
   (iv) Collision bulk head (04 marks)

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2ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

- *This question paper consists of eight questions.*
- *Answer Any Six (06) Questions*

Date: 2021.11.30 *Pass mark 50%* *Time allocated:* *03 Hrs*

➢ ***Some helpful Data:***

* Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* Resistor Colour Codes: Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

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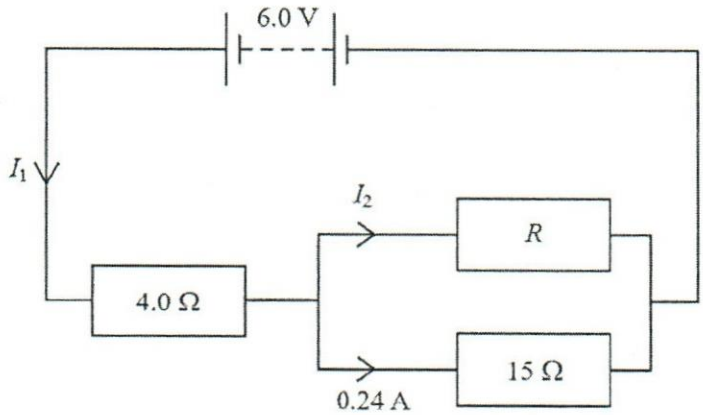
1. a) i. State Ohm's law (3 marks)
   ii. Define the term current. (3 marks)

   b) The circuit consists of a battery with an insignificant internal resistance connected to three resistors.



   i. Calculate the potential difference across the 15 Ω resistor.
   ii. Calculate the current I_1 in the 4.0 Ω resistor.
   iii. Calculate the current I_2 and the resistance R. (9 marks)

   c) Calculate the generated power of above 6 V battery. (5 marks)

2. a) i. Define resistance and resistivity. (4 marks)

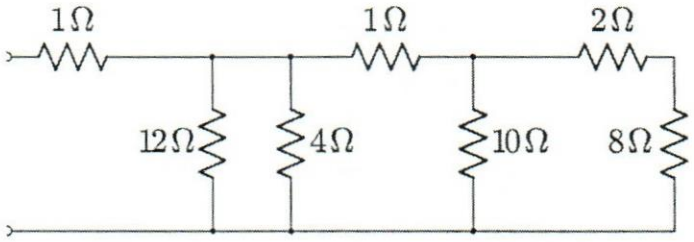
ii. If 10 m of cylindrical manganin wire, 0.14 cm in diameter has a resistance of 3.4 Ω, find the specific resistance of the material. (4 marks)

b) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)

i. red, red, red, gold

ii. orange, black, green, gold

c) Find the equivalent resistance of following resistor networks. (6 marks)



3. a) Draw schematic diagrams of npn and pnp transistors. (4 marks)

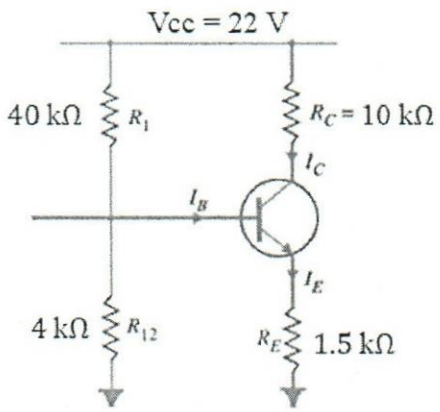
b) i. What are the transistor configuration methods? (4 marks)

ii. The base current in a transistor is 0.01 mA and emitter current is 1 mA. Calculate the value of α and β. (4 marks)

c) In the circuit in below shows the voltage divider bias method and Silicon transistor $V_{BE} = 0.7V$. (8 marks)

i. What is the operating point

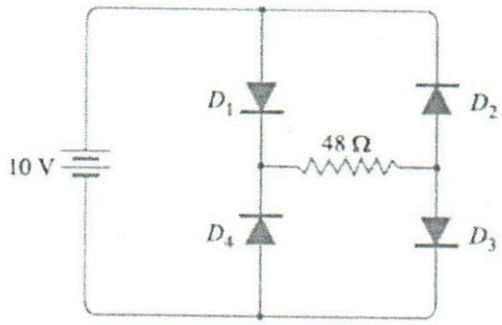
ii. Draw the load line



4. a) Explain forward biasing of diode. (6 marks)

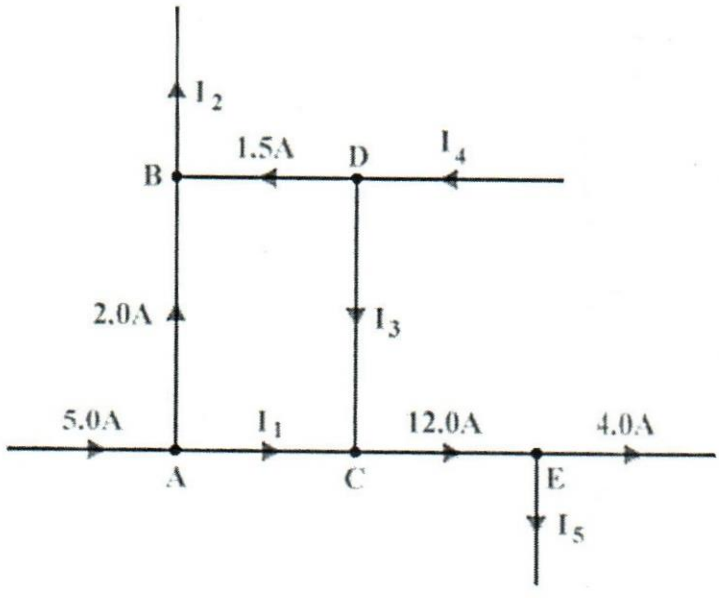
   b) Draw the circuit diagram of full wave rectifier. (6 marks)

   c) Calculate the current through 48 Ω resistor in the circuit shown in below. Assume the diodes to be of silicon and forward resistance of each diode is 1 Ω. (8 marks)



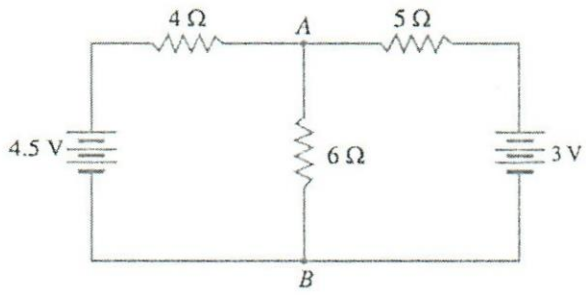
5. a) Express Kirchhoff current and voltage laws. (4 marks)

   b) In the diagram below, circuit nodes A through E each have one or more current flows into and out of them. Find values of currents from I_1 to I_5.



(5 marks)

   c) Consider the DC circuit below and all voltage sources are ideal,



i. Find each branch current. (3 marks)

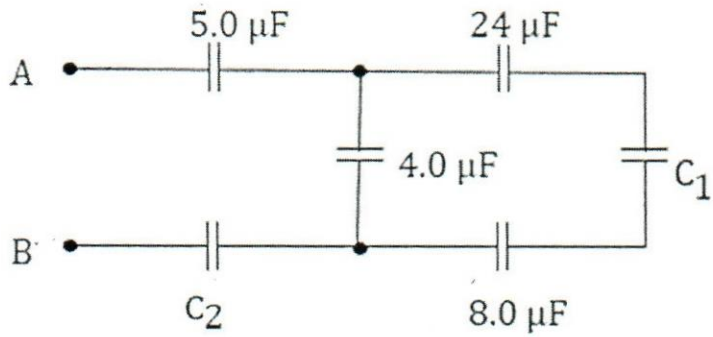
ii. What is the direction of the current through 5 Ω resistor? (from A to B or from B to A) (3 marks)

iii. Determine the potential difference of V_{AB} , with the appropriate sign. (3 marks)

6. a) i. Define the term capacitance. (4 marks)

ii. Express two applications of capacitor and explain one. (4 marks)

b) Determine the equivalent capacitance between A and B for the group of capacitors in the drawing. Let C_1=12 μF and C_2=6.0 μF. (6 marks)

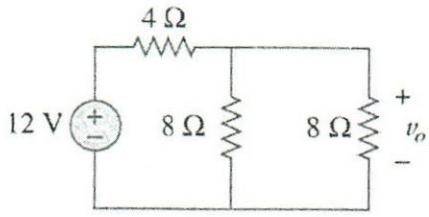


c) Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2mm thick and relative permittivity 6. ($\varepsilon_0 = 8.854\times10^{-12}$ F·m^{-1}) (6 marks)

7. a) What is the difference between ideal voltage source and real voltage source. (4 marks)

b) Explain transformation of real voltage source and real current source. (6 marks)

c) Using source transformation, determine V_o. (10 marks)



8. a) i. Classify materials according to electric conductivity. (2 marks)

   ii. Name two semiconductor materials. (2 marks)

   b) Explain intrinsic semiconductor and extrinsic semiconductor. (6 marks)

   c) i. What is the majority carriers in n-type semiconductor? (2 marks)

   ii. What is the majority carriers in p-type semiconductor? (2 marks)

   d) Explain the behaviour of p-n junction under forward and reverse biasing. (6 marks)

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COURSE CODE: ED 0350 PI (BATCH 42)

02ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2021.12.01 *Pass mark 50%* *Time allocated: 03Hrs*

Marking System

Q: 1

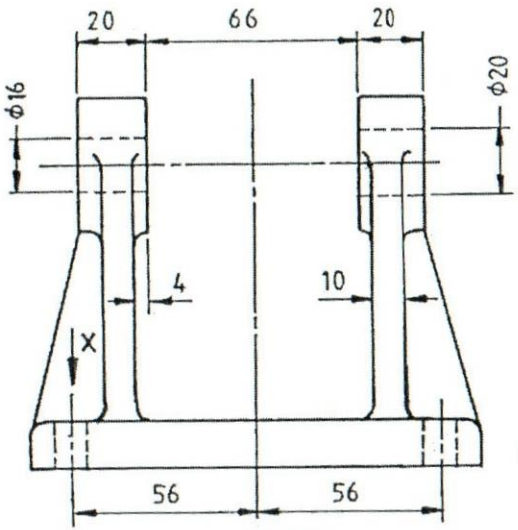
a.	Sectional front elevation	:	30 Marks
b.	End elevation	:	25 Marks
c.	Plan	:	20 Marks
	Titles and lettering	:	10 Marks
	Dimensioning (Mark minimum 6 dimensions)	:	10 Marks
	Boundaries Lines and over all neatness	:	05 Marks

Q: 1

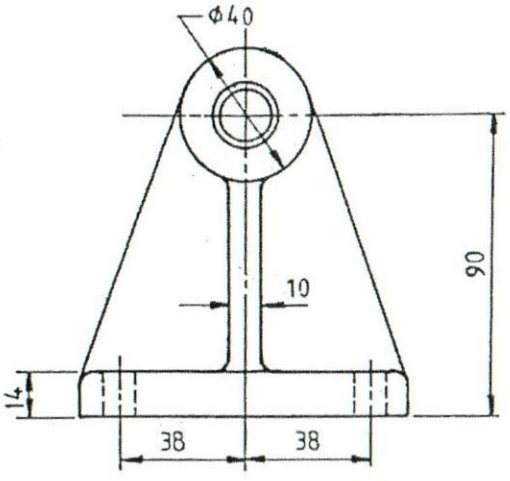
The figure shows the components of a "Pulley bracket". Assemble the different parts in their correct positions and draw to full size in first angle projection the following views

a. Sectional front elevation corresponding to the given elevation of the bracket
b. End elevation projected in the right of view 'a'
c. Plan projected from 'a'

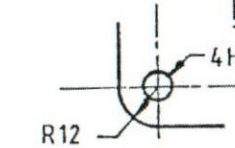
**Print main title "*PULLEY BRACKET*", scale and dimensions on your drawing. Estimate any missing dimensions*



ELEVATION

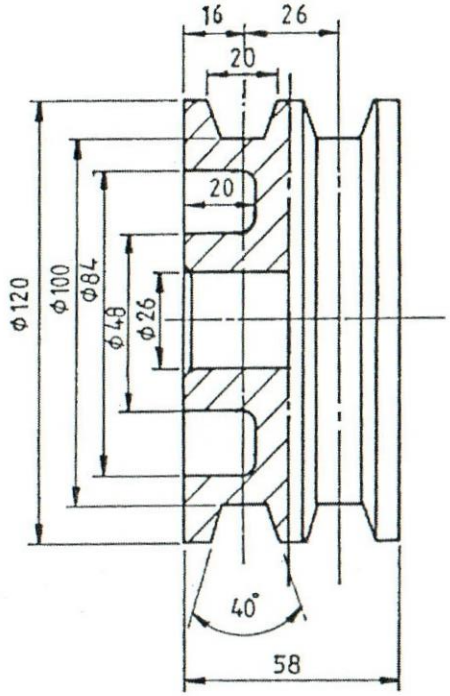


END ELEVATION



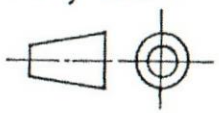
4PLACES View-X

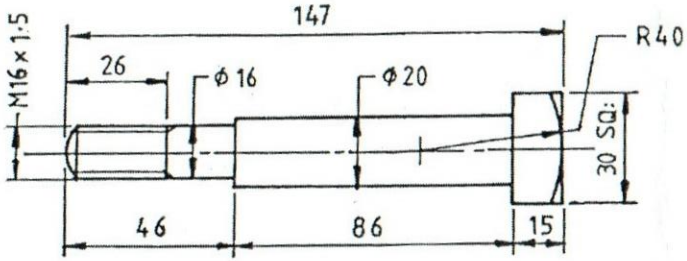
BRACKET ①



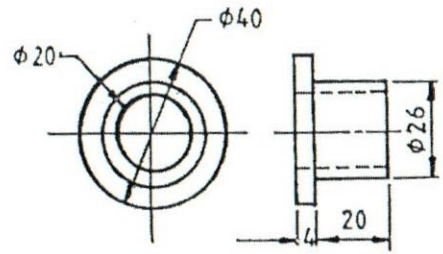
PULLEY ②

Projection

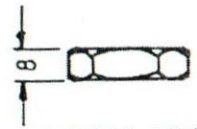




AXLE BOLT ④



BUSH 2Nos ③



LOCK NUT ⑤

PULLEY BRACKET

all dimensions in millimeters

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COURSE CODE: ED 0350 PI (BATCH 42)

2ND SEMESTER EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2021.12.01 Pass mark 50% Time allocated: 03 Hrs

1. a) Find the value of x and y if $2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$. (4 marks)

b) If $A=\begin{bmatrix}1 & 1 & 2\\ 0 & 2 & 1\end{bmatrix}$ $B=\begin{bmatrix}3 & 1\\ 1 & 0\\ 3 & 3\end{bmatrix}$ and $C=\begin{pmatrix}1 & 3\\ 2 & 0\end{pmatrix}$

Find i. $A+B^T$ (6 marks)

ii. A^T+BC

b) Solve, with the help of matrices, the simultaneous equations. (10 marks)

$4x-5y+z=2$
$3x+y-2z=9$
$x+4y+z=5$

2. a) Prove that (6 marks)

$$\frac{1-\cos\alpha}{\sin\alpha}=\frac{\sin\alpha}{1+\cos\alpha}$$

b) Solve the trigonometric equation $\sin\left(3x-\frac{\pi}{12}\right)=\frac{1}{2}$ (6 marks)

c) Hence, sketch the periodic graph $f(x)=\sin\left(3x-\frac{\pi}{12}\right)-\frac{1}{2}$ (8 marks)

3. a) Give that $\alpha(4+3i)+\beta(2-3i)-6+2i=0$; find α and β if α, β are both real. (6 marks)

b) Express $\frac{50}{3+4i}$ in form of $(a+ib)$. (8 marks)

c) Hence, evaluate $\sqrt{\left(\frac{50}{3+4i}\right)}$ (6 marks)

4. a) If p and q are real numbers, determine the nature of roots of quadratic equation

$px^2 - qx - p = 0$. (6 marks)

b) Determine the range of value of ***k*** for which the quadratic equation $kx^2 + 6(k-2)x + 3(k+2) = 0$ has real distinct roots. (7 marks)

c) Prove that $kx^2 + 2x - (k-2) = 0$ has real roots for any value of k. (7 marks)

5. a) Evaluate (6 marks)

i. *i.* $\lim_{x\to 2} \frac{x^5 - 32}{x-2}$ *ii.* $\lim_{x\to 0} \frac{x\tan x}{1-\cos x}$

b) Differentiate following expressions with respect to x. (6 marks)

i. $\frac{x^3}{1-x}$ *ii.* $(1+x^2)\sin x^2$ *iii.* $\sin(e^x \tan x)$

c) If $y = \frac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2)\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} = 0$. (8 marks)

6. a) If $z = e^{xy}$, Find $\frac{\partial^2 z}{\partial x \partial y}$ (6 marks)

b) If $z = e^{ax+by}.f(ax-by)$, prove that $b\frac{\partial z}{\partial x} + a\frac{\partial z}{\partial y} = 2abz$ (8 marks)

c) A balloon is in the form of right circular cylinder of radius 1.5 m and length 4 m. If the radius is increased by 0.01 m and the length by 0.05 m, find the percentage change in the volume of the balloon. (6 marks)

(Hint: volume of cylinder $V = \pi r^2 h$ and total derivative of $z = f(x,y)$ is $dz = \frac{\partial z}{\partial x}dx + \frac{\partial z}{\partial y}dy$)

7. a) Evaluate $(243)^{\frac{3}{5}}$ (6 marks)

b) Simplify $\frac{1}{1+a^{x-y}} + \frac{1}{1+a^{y-x}}$ (6 marks)

c) The equation has $x^{\left[(\log_5 x)^2 - \frac{9}{2}(\log_5 x)+5\right]} = 5\sqrt{5}$ exactly three real roots. (8 marks)

i. Substituting $\log_5 x = q$, express above equation in term of q

ii. Hence, Determine the value of x.

8. a) Find A, B, C and D such that $\frac{2x^3+x-1}{x(x-1)(x^2+1)} = \frac{A}{x} + \frac{B}{x-1} + \frac{Cx+D}{x^2+1}$ (4 marks)

b) Hence, find the integral $\int \frac{2x^3+x-1}{x(x-1)(x^2+1)} dx$ (4 marks)

c) i. Show that $\int_0^1 \frac{1}{1+x^2} dx = \frac{\pi}{4}$ (4 marks)

ii. Use 1/3 Simpson's rule to interpolate a value for the integration $\int_0^1 \frac{1}{1+x^2} dx$ for ten ordinates (n = 10). (6 marks)

iii. Hence, determine the value of π for four decimal places. (2 marks)

9. Graph $f(x) = \frac{5x+1}{2x-4}$

a) Determine the coordinates of i. Y- intercept
ii. x- intersect
iii. Vertical Asymptote (6 marks)

b) Determine i. dy/dx, (8 marks)
ii. find turning point coordinate

c) Hence, plot $f(x) = \frac{5x+1}{2x-4}$ on the cartesian plane. (6 marks)

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02ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

Date: 2021.12.05 *Pass mark 70%* *Time allocated: 03Hrs*

- *Answer any **Six** questions*

01. a) Make a line diagram of the fuel oil system of a large vessel fitted with a slow speed diesel engine (8 Marks)

b) State the function of

(i) Mixing tank (2 Marks)

(ii) Viscometer (2 Marks)

(iii) Quick closing valves (2 Marks)

(iv) Settling tanks (2 Marks)

02. a) Sketch and explain the working principle of a fuel oil injector of a large bore slow speed diesel engine. (10 Marks)

b) Explain how injection pressure is adjusted. (3 Marks)

c) What is Penetration, Turbulence and Swirl? (3 Marks)

03. a) Briefly explain the purpose of a Turbo charger fitted to a large marine diesel engine. (4 Marks)

b) Sketch and name the parts of a Turbo charger. (8 Marks)

c) State the purpose of the following.

(i) The Labyrinth glands (2 Marks)

(ii) Lacing wire on the blades (2 Marks)

04. a) Briefly describe the conditions which create dangerous oil mists in crank cases. (6 Marks)

b) Sketch and describe the principle operation of oil mist detector used to monitor crank case conditions. (10 Marks)

05. a) Sketch and describe an air starting system suitable for a marine two stroke engine. (8 Marks)

b) Sketch an air reservoir, identifying all of the fittings. (4 Marks)

c) What are the safe guards against the risk of explosion in air starting lines (4 Marks)

06.

a) Make a detailed sketch of a hydraulically operated exhaust valve suitable for a two-stroke diesel engine. (12 Marks)

b) Describe the operation method of the above valve. (4 Marks)

07.

a) Sketch and describe the operation of a 2-stage air compressor. (10Marks)

b) What are the safety devices fitted to an air compressor? (3 Marks)

c) Explain why intercoolers and aftercoolers are fitted. (3 Marks)

08.

a) Sketch an auxiliary boiler fitted in a motor vessel and mark all the mountings. (8 Marks)

b) Briefly explain what is "water hammering" on ships steam system. (2 Marks)

c) Describe the correct procedure for "blowdown gauge glass" of an auxiliary boiler. (6 Marks)

09.

a) Sketch and describe the two stroke timing cycle of a compression ignition engine. (8 Marks)

b) What is meant by valve overlap period of the system. (2 Marks)

c) Describe with the aid of sketches various scavenging methods of two stroke diesel engines. (6 Marks)

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2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge General

- Answer any **Six** questions

Date: 2021.12.03 Pass mark 70% Time allocated: 03 Hrs

1) With reference to mechanical properties of metals describe in simple terms

a) Elasticity

b) Brittleness

c) Hardness

d) Toughness **(08 marks)**

b) Name three types of steels commonly used in engineering and the carbon percentages **(04 marks)**

c) State for what purposes they are used **(04 marks)**

2)

a) Draw a simple diagram of a refrigeration system and show the high pressure and low pressure areas and also the state of the refrigerant in each part of the circuit. **(08 marks)**

b) List the safety cut offs found on a refrigeration compressor. **(04 marks)**

c) What is the effect on a refrigeration system if there is air in the circuit? **(04 marks)**

3)

a) Name the two types of heat exchangers found on ships and list their advantages and disadvantages. **(08 marks)**

b) Sketch and describe the arrangement of shell and tube type of your choice. **(08 marks)**

4)

a) Sketch and describe a four ram steering system. **(08 marks)**

b) Explain the function of the floating lever. **(04 marks)**

c) Explain with the aid of a sketch the operation of the tele motor transmitter and receiver. **(04 marks)**

5)

a) State the two modes or configurations how a separator could be run. **(02 Marks)**

b) What would be separated in each of the modes stated in (a). **(02 Marks)**

c) Sketch insides of the bowl for each of the modes in (a). **(06 Marks)**

d) Sketch and describe the gear case arrangement and the clutch. **(06 Marks)**

6) With reference to plate type fresh water generator,

a) Draw and explain the function **(10 marks)**

b) Explain start and stop procedure **(06 marks)**

7)

a) Oily water separator is a very important piece of equipment on board a ship. For what purpose is it used? **(02 Marks)**

b) Sketch and describe an oily water separator. **(14 Marks)**

8)

a) State 4 types of pumps used on ships. **(04 Marks)**

b) Sketch a double acting resciprocating pump & name it. **(06 Marks)**

c) Draw a cross section of a centrifugal pump and briefly explain the working process. **(06 Marks)**

9) Sketch and describe a biological sewage plant used on ships. **(16 Marks)**

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Faculty of Marine Engineering
Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
MARITIME LAW

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2021.10.17 *Pass mark 50%* *Time allocated: 03 Hrs*

1. UNCLOS three was introduced to minimize disputes among coastal states and to clearly define rights and responsibilities of coastal states, vessels and the flag states.

   Under UNCLOS describe following:

   a) Inland waters (4 marks)
   b) Territorial waters (4 marks)
   c) High seas (4 marks)
   d) Archipelagic waters (4 marks)

2. With reference to ISM code –

   a) Explain why ISM is necessary? (6 marks)

   b) Who is a designated person? (6 marks)

   c) What are the certificates to be carried on board? (4 marks)

3. a) list the 6 annexures of MARPOL 73/78 (6 marks)

   b) according to MARPOL annex II noxious liquid substances have been divided into 4 categories what are they and how they have been categorized? (4 marks)

   c) what are the entries to be made on cargo record book on a chemical tanker (6 marks)

4. a) Explain how ships ballast water can pollute the sea, with examples (8 marks)

   b) Name the convention which have been introduced by IMO to minimize this (2 marks)

   c) What are the methods proposed to achieve the performance standard? (6 marks)

5. As per the SOLAS chapter 2 Part 2

   a) What are the basic principles used to prevents fires (6 marks)
   b) Define a noncombustible material? (4 marks)
   c) What are "A" class divisions. (6 marks)

6. With regards to MLC 2006,

   a) Name the 5 titles of the MLC 2006. (5 Marks)

   b) Identify 5 areas that will be attended by the port state Inspectors with regards to MLC 2006 (5 Marks)

   c) Briefly explain the conditions for the minimum working and rest hours on board (6 Marks)

7. as per the ISPS code

   a) Explain the reason for the code to be introduced (6 marks)

   b) Explain ships security alert system (10 marks)

8. a) IMO is the present originator of international maritime law, give a brief description about IMO and why it is needed. (8 marks)

   b) What is TACIT approval and the advantages of it. (8 marks)

9. As per MARPOL annex 1

   a) what are the requirements of pumping out machinery space bilges for ships over 400 GT outside special areas (8 marks)

   b) What are the operations to be entered in the oil record book (part 1 – machinery space operations) (8 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

Density of water – 1000 kgm^{-3} Gravitational acceleration – 9.81 ms^{-2}
Density of sea water – 1025 kgm^{-3}

1.

1.1 Define "radian" and derive equations for angular displacement, angular velocity, and angular acceleration. (6 Marks)

1.2 A flywheel used in a rolling mill is making 180rpm during its usual operation. It was noted that, after 20s its angular velocity has reduced to just 120 revolutions per minute. Calculate the revolutions it will make and the time it will take before it completely stops if the retardation is considered to be uniform. (14 Marks)

2.

2.1 Write the equations for the velocity and characteristic acceleration equation for simple harmonic motion. (4 marks)

2.2 The piston of a steam engine moves with simple harmonic motion. The crank rotates at 100 r.p.m. with a stroke of 180cm. Find the velocity and acceleration of the piston, when it is at a distance of 60 cm from the center. (16 marks)

3.

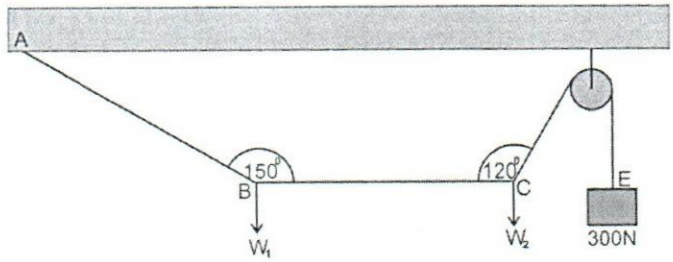
3.1 State and Archimedes' principle (4 marks)

3.2 A wooden block 2mx1mx0.5m and of specific gravity 0.76 is floating in water. What load may be placed on the block, so that it may completely immerse in water. (8 marks)

3.3 If the object is removed from water and allowed to float on a type of oil having a specific gravity of 0.88, calculate the volume percentage of the block that would be completely immerse inside oil. (8 marks)

4.

4.1 An inextensible cable ABCDE is attached with loads as in the given figure, and passes through small peg caring a load of 300N. Find the tension in each component of the cable and unknown weight of w_1 and w_2. Take BC component of the cable is horizontal. (20 marks)



5.

5.1 State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation considering energy conservation of a liquid flowing through a pipe. Further to that state the assumptions made for such a derivation. (8 marks)

5.2 The water is flowing through a taper of length 100m having diameter 600mm at the upper end and 300mm at the lower end, at the rate of 50 liters/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. (12 marks)

6.

6.1 Using basic laws in kinetics show that *the change in kinetic energy is equal to the work done* for a partial accelerating in a straight horizontal line. (6 marks)

6.2 A particle of mass 2kg is projected with speed 8m/s up along a slope of a rough plane inclined at 450 to the horizontal. The coefficient of the friction between the particle and the plane is 0.4. Using principles derived in 6.1, calculated the distance the particle travel up the plane before coming to instantaneous rest. (14 marks)

7.

7.1 In a construction site, an elevator is used to transport goods to the top of a building and is supported by one single steel cable connected to the pulley. During its operation, the elevator and its goods were measured to have a total mass of 400 kg. Find the tension in the cable supporting the elevator when

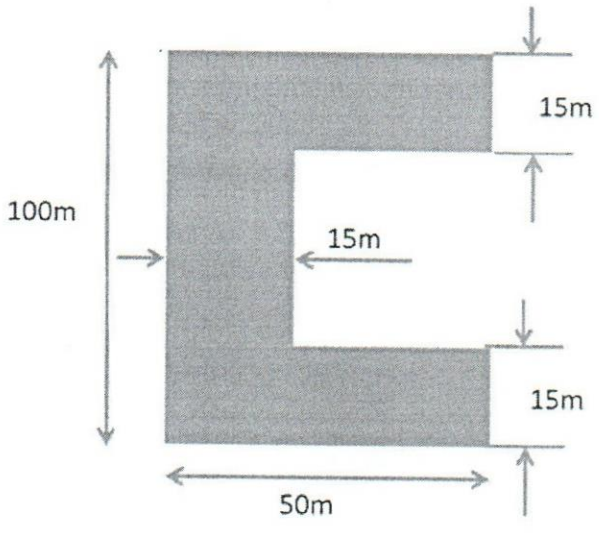
a. the elevator is at rest (2 marks)
b. the elevator is moving at constant speed (2 marks)
c. the elevator is accelerating upwards at 0.8 m s^{-2} (4 marks)
d. the elevator is accelerating downwards at 0.6 m s^{-2} (4 marks)

7.2 If the goods on the elevator weighs 70 kg and placed on a scale on the lift floor, what would be the scale reading when the elevator is ascending (moving upward) with an acceleration of 3 m/s^2.

(8 marks)

8.

8.1 Below diagram shows a channel section of 100mm X 50mm X 15mm used in a mechanical construction site. Find the centroid of the channel section. (20 marks)



9.

9.1 Obtain the "$F = ma$" equation from Newton's second law. (4 marks)

9.2 A car is seen to travel freely at a speed of 36km/h down a slope of 1 in 40. Due to the resistance of the road at this speed the car shows no acceleration and the resistance is just being sufficient to maintain a uniform velocity. If the car weighs 6000N, find the road resistance per kN weight of car. (8 marks)

9.3 What power will the engine of the have to exert to run up the same slope at double the speed when the road resistance remains the same as calculated in part 9.2? (8 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

- *This question paper consists of Nine questions.*
- *Answer any SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

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

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

Specific heat capacity of water ***4.2 kJ/kg K***

1.

a. Describe the three type of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of linear expansion and coefficient of superficial expansion using the coefficient of volumetric expansion of solid materials (4 marks)

c. A Nickel-alloy rod has a length of ***10.000 cm*** at ***15 ^0C*** and length of ***10.020 cm*** at ***100 ^0C***. Assume that there is no bending or twisting of the rod during the expansion

i. What is the coefficient of linear expansion of the alloy? (4 marks)

ii. What is the length of the rod at the freezing point of water? (4 marks)

iii. What is the temperature if the length of the rod is ***10.011 cm***? (4 marks)

2. A cold storage compartment is covered with a thickness of ***150 mm*** with insulating material which has a coefficient of thermal conductivity of ***5.8×10^{-2} W/m K*** and a thickness of ***50 mm*** with metal which has a coefficient of thermal conductivity of ***50 W/m K***. The outside and inside face temperatures of the material is ***15 ^0C*** and ***– 5 ^0C***. Determine

i. The overall heat transfer coefficient (5 marks)

ii. Rate of heat transfer trough the wall (5 marks)

iii. The intermediate temperature (5 marks)

iv. Draw the temperature variation through the wall (5 marks)

3.

a. Describe ***Dolton's partial pressure law*** (5 marks)

b. A vessel of volume ***14 m^3*** contains air and wet steam having ***0.96*** dryness fraction at a total pressure of ***0.16 bar*** and temperature ***42 ^0C***. Taking ***R*** for air = ***0.287 kJ/kg K***. Determine

i. The ***partial pressure of steam*** in the vessel (3 marks)

ii. The ***partial pressure of air*** in the vessel (3 marks)

iii. The ***specific volume of wet steam*** in the vessel (3 marks)

iv. The ***mass of air*** in the vessel (3 marks)

v. The ***mass of steam*** in the vessel (3 marks)

4.

a. Briefly explain the following terms

i. Boyle's law

ii. Charles' law

iii. Avogadro's law (6 marks)

b. Write an expression for the gas constant by using the molecular mass and universal gas constant. (4 marks)

c. The analysis by mass of sample of air is ***23.14 % Oxygen***, ***75.53% Nitrogen***, ***1.28% Argon*** and ***0.05 % carbon dioxide***. Estimate the gas constant for air.

Taking the molecular weights of ***O_2, N_2, Ar, CO_2*** as ***32, 28, 40*** and ***44*** respectively, and the universal gas constant ***8.314 kJ/ k-mol K***. (10 marks)

5.

a. Write down the ***characteristic gas equation*** and name each term in its (4 marks)

b. Describe the specific capacity of gas under constant pressure (***Cp***) and constant volume (***Cv***). Hence, write an expression for ***gas constant*** using specific heat capacities(***Cp*** and ***Cv***) (6 marks)

c. An air reservoir contains ***20 kg*** of air at ***3.2 MPa*** and ***16 ^0C***. If the air is heated to ***65 ^0C*** , calculate

i. The volume of the air reservoir (3 marks)

ii. The new pressure (3 marks)

iii. The heat energy transfer and internal energy change (4 marks)

Neglect any expansion of the reservoir

6. In an air compressor, air is compressed according to the law $PV^{1.25} = constant$. The initial conditions of the air is ***1.013 bar***, and ***27 ^0C***. The compressor has a bore of ***300 mm*** and the stroke 0f ***450 mm***. the clearance volume is ***4%*** of the swept volume. If the final pressure is ***12 bar***, calculate

   i. For what length of the stroke air is delivered (5 marks)

   ii. The volume of air delivered per stroke (5 marks)

   iii. The final temperature (5 marks)

   iv. The mass of the air in the cylinder before the compression (5 marks)

7.

   a. A gas follows a ploltropic process according to the law $PV^n = constant$. Where n is the polytropic index. Write down expressions for

      i. The temperature ratio (T_2/ T_1) using volume ratio (v_2/ v_1) and pressure ratio (P_2/ P_1). (2 marks)

      ii. Work done (3 marks)

   b. ***0.20 kg*** of air at a pressure of ***100 kPa*** occupies ***0.12 m^3*** and from this condition it is compressed to ***1.5 MPa*** according to the law $PV^{1.3} = constant$. Determine

      i. The change of internal energy of the air (5 marks)

      ii. The work done on or by the air (5 marks)

      iii. The heat received or rejected by the air (5 marks)

8.

   a. Draw the Temperature -enthalpy diagram for water and steam to represent the following states on it

      i. Saturated liquid line, Wet vapour region, Saturated dry vapour line, Superheated vapour region and Critical point (5 marks)

      ii. Saturated water at ***250.3 ^0C***, wet steam at ***40 bar*** with ***0.95 dry, dry*** steam at ***20 bar*** and steam at ***20 bar*** and ***300 ^0C*** (5 marks)

   b. Steam enters to a super-heater at a pressure of ***20 bar*** and dryness ***0.8*** and steam leaves the super-heater at ***300 ^0C***. Using the steam tables, find

      i. The specific enthalpy of change of steam in the super-heater (5 marks)

      ii. The specific volume change of steam (5 marks)

9.

a. Some thermodynamic and transport properties of ***refrigerant -134a*** contain in the table below. Using the properties of vapour complete the table (6 marks)

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
1.640	*-15*	*31.97*	*209.54*	.....
2.94	0	51.83	.....	250.50
7.706	*30*	.....	*173.13*	*266.71*

b. Refrigerant -134a uses to operate refrigerant plant in the temperature range between ***25 ^0C*** and ***-15 ^0C***. Saturated liquid at ***30 ^0C*** expands to a wet vapour at ***1.640 bar*** by the throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (5 marks)

ii. Find the enthalpy after the expansion (3 marks)

iii. Estimate the dryness fraction after the expansion (6 marks)

Hint: Use the properties in the table given in the ***part a***

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COURSE CODE: ED 0350 PI

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 42)

- *This question paper consists of six questions.*
- *Answer All SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

1. With an aid of a suitable graph(strain against stress) explain following physical properties of a material. (9 marks)
   a. Yield strength and yield point. (1 mark)
   b. Ultimate strength. (1 mark)
   c. Strain hardening. (1 mark)
   d. Necking. (1 mark)
   e. Failing point (fracture point) . (1 mark)
   f. Area of elastic behavior and plastic behavior. (1 mark)
   g. Proportional limit. (1 mark)

2. a. How to classify metallic and non-metallic material? (4 marks)

   b. Plane carbon steels are mainly of iron with small quantities of carbon. Explain with examples following type of steel with their uses. Your answer should include the percentage of carbon in each type of steel.
      i. Low carbon steel (3 marks)
      ii. Medium carbon steel (3 marks)
      iii. High carbon steel (3 marks)
      iv. What is meant by cast iron? Give some example of engineering component manufactured by cast iron. What are the advantages and disadvantage of using cast iron? (3 marks)

3. a. Using tap and die set explain, step by step how to make internal and external thread for a given work piece. (8marks)
   b. Explain the meaning of M 12 marked on a die nut? (2 marks)
   c. Name the type of drilling machines use for small jobs? (6 marks)

4. a) Explain how ships ballast water can pollute the sea, with examples (8 marks)

   b) Name the convention which have been introduced by IMO to minimize this (2 marks)

   c) What are the methods proposed to achieve the performance standard? (6 marks)

5. As per the SOLAS chapter 2 Part 2

   a) What are the basic principles used to prevents fires (6 marks)
   b) Define a noncombustible material? (4 marks)
   c) What are "A" class divisions. (6 marks)

6. With regards to MLC 2006,

   a) Name the 5 titles of the MLC 2006. (5 Marks)

   b) Identify 5 areas that will be attended by the port state Inspectors with regards to MLC 2006 (5 Marks)

   c) Briefly explain the conditions for the minimum working and rest hours on board (6 Marks)

7. as per the ISPS code

   a) Explain the reason for the code to be introduced (6 marks)

   b) Explain ships security alert system (10 marks)

8. a) IMO is the present originator of international maritime law, give a brief description about IMO and why it is needed. (8 marks)

   b) What is TACIT approval and the advantages of it. (8 marks)

9. As per MARPOL annex 1

   a) what are the requirements of pumping out machinery space bilges for ships over 400 GT outside special areas (8 marks)

   b) What are the operations to be entered in the oil record book (part 1 – machinery space operations) (8 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

Density of water – 1000 kgm^{-3} Gravitational acceleration – 9.81 ms^{-2}
Density of sea water – 1025 kgm^{-3}

1.

1.1 Define "radian" and derive equations for angular displacement, angular velocity, and angular acceleration. (6 Marks)

1.2 A flywheel used in a rolling mill is making 180rpm during its usual operation. It was noted that, after 20s its angular velocity has reduced to just 120 revolutions per minute. Calculate the revolutions it will make and the time it will take before it completely stops if the retardation is considered to be uniform. (14 Marks)

2.

2.1 Write the equations for the velocity and characteristic acceleration equation for simple harmonic motion. (4 marks)

2.2 The piston of a steam engine moves with simple harmonic motion. The crank rotates at 100 r.p.m. with a stroke of 180cm. Find the velocity and acceleration of the piston, when it is at a distance of 60 cm from the center. (16 marks)

3.

3.1 State and Archimedes' principle (4 marks)

3.2 A wooden block 2mx1mx0.5m and of specific gravity 0.76 is floating in water. What load may be placed on the block, so that it may completely immerse in water. (8 marks)

3.3 If the object is removed from water and allowed to float on a type of oil having a specific gravity of 0.88, calculate the volume percentage of the block that would be completely immerse inside oil. (8 marks)

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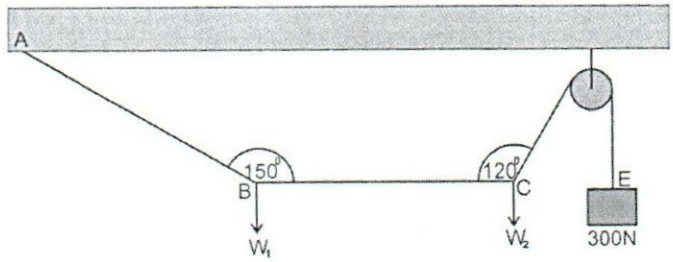
4.1 An inextensible cable ABCDE is attached with loads as in the given figure, and passes through small peg caring a load of 300N. Find the tension in each component of the cable and unknown weight of w_1 and w_2. Take BC component of the cable is horizontal. (20 marks)



5.

5.1 State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's equation considering energy conservation of a liquid flowing through a pipe. Further to that state the assumptions made for such a derivation. (8 marks)

5.2 The water is flowing through a taper of length 100m having diameter 600mm at the upper end and 300mm at the lower end, at the rate of 50 liters/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. (12 marks)

6.

6.1 Using basic laws in kinetics show that *the change in kinetic energy is equal to the work done* for a partial accelerating in a straight horizontal line. (6 marks)

6.2 A particle of mass 2kg is projected with speed 8m/s up along a slope of a rough plane inclined at 450 to the horizontal. The coefficient of the friction between the particle and the plane is 0.4. Using principles derived in 6.1, calculated the distance the particle travel up the plane before coming to instantaneous rest. (14 marks)

7.

7.1 In a construction site, an elevator is used to transport goods to the top of a building and is supported by one single steel cable connected to the pulley. During its operation, the elevator and its goods were measured to have a total mass of 400 kg. Find the tension in the cable supporting the elevator when

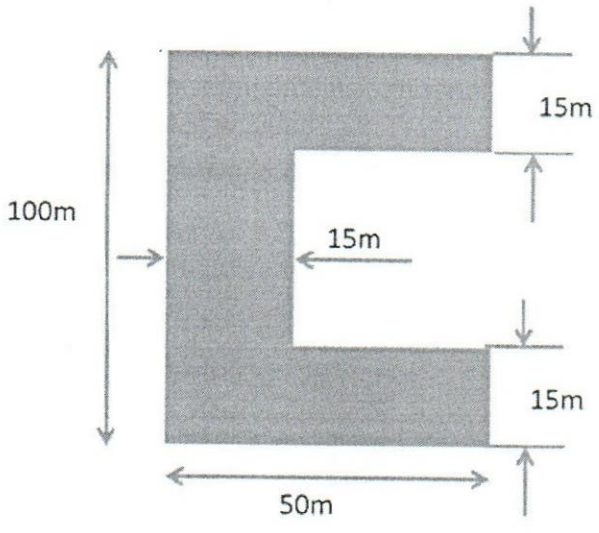
a. the elevator is at rest (2 marks)
b. the elevator is moving at constant speed (2 marks)
c. the elevator is accelerating upwards at 0.8 m s^{-2} (4 marks)
d. the elevator is accelerating downwards at 0.6 m s^{-2} (4 marks)

7.2 If the goods on the elevator weighs 70 kg and placed on a scale on the lift floor, what would be the scale reading when the elevator is ascending (moving upward) with an acceleration of 3 m/s^2.

(8 marks)

8.

8.1 Below diagram shows a channel section of 100mm X 50mm X 15mm used in a mechanical construction site. Find the centroid of the channel section. (20 marks)



9.

9.1 Obtain the "$F = ma$" equation from Newton's second law. (4 marks)

9.2 A car is seen to travel freely at a speed of 36km/h down a slope of 1 in 40. Due to the resistance of the road at this speed the car shows no acceleration and the resistance is just being sufficient to maintain a uniform velocity. If the car weighs 6000N, find the road resistance per kN weight of car. (8 marks)

9.3 What power will the engine of the have to exert to run up the same slope at double the speed when the road resistance remains the same as calculated in part 9.2? (8 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

- *This question paper consists of Nine questions.*
- *Answer any SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

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

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

Specific heat capacity of water ***4.2 kJ/kg K***

1.

a. Describe the three type of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of linear expansion and coefficient of superficial expansion using the coefficient of volumetric expansion of solid materials (4 marks)

c. A Nickel-alloy rod has a length of ***10.000 cm*** at ***15 ^0C*** and length of ***10.020 cm*** at ***100 ^0C***. Assume that there is no bending or twisting of the rod during the expansion

i. What is the coefficient of linear expansion of the alloy? (4 marks)

ii. What is the length of the rod at the freezing point of water? (4 marks)

iii. What is the temperature if the length of the rod is ***10.011 cm***? (4 marks)

2. A cold storage compartment is covered with a thickness of ***150 mm*** with insulating material which has a coefficient of thermal conductivity of ***5.8×10^{-2} W/m K*** and a thickness of ***50 mm*** with metal which has a coefficient of thermal conductivity of ***50 W/m K***. The outside and inside face temperatures of the material is ***15 ^0C*** and ***– 5 ^0C***. Determine

i. The overall heat transfer coefficient (5 marks)

ii. Rate of heat transfer trough the wall (5 marks)

iii. The intermediate temperature (5 marks)

iv. Draw the temperature variation through the wall (5 marks)

3.

a. Describe ***Dolton's partial pressure law*** (5 marks)

b. A vessel of volume ***14 m^3*** contains air and wet steam having ***0.96*** dryness fraction at a total pressure of ***0.16 bar*** and temperature ***42 ^0C***. Taking ***R*** for air = ***0.287 kJ/kg K***. Determine

i. The ***partial pressure of steam*** in the vessel (3 marks)

ii. The ***partial pressure of air*** in the vessel (3 marks)

iii. The ***specific volume of wet steam*** in the vessel (3 marks)

iv. The ***mass of air*** in the vessel (3 marks)

v. The ***mass of steam*** in the vessel (3 marks)

4.

a. Briefly explain the following terms

i. Boyle's law

ii. Charles' law

iii. Avogadro's law (6 marks)

b. Write an expression for the gas constant by using the molecular mass and universal gas constant. (4 marks)

c. The analysis by mass of sample of air is ***23.14 % Oxygen***, ***75.53% Nitrogen***, ***1.28% Argon*** and ***0.05 % carbon dioxide***. Estimate the gas constant for air.

Taking the molecular weights of ***O_2, N_2, Ar, CO_2*** as ***32, 28, 40*** and ***44*** respectively, and the universal gas constant ***8.314 kJ/ k-mol K***. (10 marks)

5.

a. Write down the ***characteristic gas equation*** and name each term in its (4 marks)

b. Describe the specific capacity of gas under constant pressure (***Cp***) and constant volume (***Cv***). Hence, write an expression for ***gas constant*** using specific heat capacities(***Cp*** and ***Cv***) (6 marks)

c. An air reservoir contains ***20 kg*** of air at ***3.2 MPa*** and ***16 ^0C***. If the air is heated to ***65 ^0C*** , calculate

i. The volume of the air reservoir (3 marks)

ii. The new pressure (3 marks)

iii. The heat energy transfer and internal energy change (4 marks)

Neglect any expansion of the reservoir

6. In an air compressor, air is compressed according to the law $PV^{1.25} = constant$. The initial conditions of the air is ***1.013 bar***, and ***27 ^0C***. The compressor has a bore of ***300 mm*** and the stroke 0f ***450 mm***. the clearance volume is ***4%*** of the swept volume. If the final pressure is ***12 bar***, calculate

   i. For what length of the stroke air is delivered (5 marks)

   ii. The volume of air delivered per stroke (5 marks)

   iii. The final temperature (5 marks)

   iv. The mass of the air in the cylinder before the compression (5 marks)

7.

   a. A gas follows a ploltropic process according to the law $PV^n = constant$. Where n is the polytropic index. Write down expressions for

      i. The temperature ratio (T_2/ T_1) using volume ratio (v_2/ v_1) and pressure ratio (P_2/ P_1). (2 marks)

      ii. Work done (3 marks)

   b. ***0.20 kg*** of air at a pressure of ***100 kPa*** occupies ***0.12 m^3*** and from this condition it is compressed to ***1.5 MPa*** according to the law $PV^{1.3} = constant$. Determine

      i. The change of internal energy of the air (5 marks)

      ii. The work done on or by the air (5 marks)

      iii. The heat received or rejected by the air (5 marks)

8.

   a. Draw the Temperature -enthalpy diagram for water and steam to represent the following states on it

      i. Saturated liquid line, Wet vapour region, Saturated dry vapour line, Superheated vapour region and Critical point (5 marks)

      ii. Saturated water at ***250.3 ^0C***, wet steam at ***40 bar*** with ***0.95 dry, dry*** steam at ***20 bar*** and steam at ***20 bar*** and ***300 ^0C*** (5 marks)

   b. Steam enters to a super-heater at a pressure of ***20 bar*** and dryness ***0.8*** and steam leaves the super-heater at ***300 ^0C***. Using the steam tables, find

      i. The specific enthalpy of change of steam in the super-heater (5 marks)

      ii. The specific volume change of steam (5 marks)

9.

a. Some thermodynamic and transport properties of ***refrigerant -134a*** contain in the table below. Using the properties of vapour complete the table (6 marks)

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
1.640	*-15*	*31.97*	*209.54*	.....
2.94	0	51.83	.....	250.50
7.706	*30*	.....	*173.13*	*266.71*

b. Refrigerant -134a uses to operate refrigerant plant in the temperature range between ***25 ^0C*** and ***-15 ^0C***. Saturated liquid at ***30 ^0C*** expands to a wet vapour at ***1.640 bar*** by the throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (5 marks)

ii. Find the enthalpy after the expansion (3 marks)

iii. Estimate the dryness fraction after the expansion (6 marks)

Hint: Use the properties in the table given in the ***part a***

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COURSE CODE: ED 0350 PI

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 42)

- *This question paper consists of six questions.*
- *Answer All SIX questions*

Date: 2021.10.16 *Pass mark 50%* *Time allocated: 03 Hrs*

1. With an aid of a suitable graph(strain against stress) explain following physical properties of a material. (9 marks)
   a. Yield strength and yield point. (1 mark)
   b. Ultimate strength. (1 mark)
   c. Strain hardening. (1 mark)
   d. Necking. (1 mark)
   e. Failing point (fracture point) . (1 mark)
   f. Area of elastic behavior and plastic behavior. (1 mark)
   g. Proportional limit. (1 mark)

2. a. How to classify metallic and non-metallic material? (4 marks)

   b. Plane carbon steels are mainly of iron with small quantities of carbon. Explain with examples following type of steel with their uses. Your answer should include the percentage of carbon in each type of steel.
      i. Low carbon steel (3 marks)
      ii. Medium carbon steel (3 marks)
      iii. High carbon steel (3 marks)
      iv. What is meant by cast iron? Give some example of engineering component manufactured by cast iron. What are the advantages and disadvantage of using cast iron? (3 marks)

3. a. Using tap and die set explain, step by step how to make internal and external thread for a given work piece. (8marks)
   b. Explain the meaning of M 12 marked on a die nut? (2 marks)
   c. Name the type of drilling machines use for small jobs? (6 marks)

4. a. Explain various position of manual electric arc welding positions. Use diagrams to explain each position. (8 marks)

   b. List down the advantages and disadvantages of arc welding. (4 marks)

   c. List down the list of PPE use for welding. (4 marks)

5. Briefly explain following workshop tools with their respective uses. You may use diagrams for explaining. (2.5 marks each)
   a. Face plate
   b. V block
   c. Centre punch
   d. Depth micrometer
   e. Vanier caliper
   f. Scriber
   g. Divider
   h. Dial gauge

6. (i) Explain the following heat treatment methods. (2 marks each)
   a. Normalizing b. Annealing c. Hardening d. Tempering

   (ii) With regard to properties of materials explain following terms. (2 marks each)

   b. Ductility b. Hardness c. Toughness d. Brittleness

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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I

COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER EXAMINATION QUESTION PAPER

MARITIME LAW

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2021.01.23 *Pass mark 50%* *Time allocated: 03 Hrs*

1. a) IMO is the present originator of international maritime law, give a brief description about IMO and why it is needed. (8 marks)

   b) What is TACIT approval and the advantages of it. (8 marks)

2. As per MARPOL annex 1

   a) what are the requirements of pumping out machinery space bilges for ships over 400 GT outside special areas (8 marks)

   b) What are the operations to be entered in the oil record book (part 1 – machinery space operations) (8 marks)

3. UNCLOS three was introduced to minimize disputes among coastal states and to clearly define rights and responsibilities of coastal states, vessels and the flag states.

   Under UNCLOS describe following:

   a) Inland waters (4 marks)
   b) Territorial waters (4 marks)
   c) High seas (4 marks)
   d) Archipelagic waters (4 marks)

4. With reference to ISM code –

   a) Explain why ISM is necessary? (6 marks)

   b) Who is a designated person? (6 marks)

   c) What are the certificates to be carried on board? (4 marks)

5. a) list the 6 annexures of MARPOL 73/78 (6 marks)

b) according to MARPOL annex II noxious liquid substances have been divided into 4 categories what are they and how they have been categorized? (4 marks)

c) what are the entries to be made on cargo record book on a chemical tanker (6 marks)

6. a) Explain how ships ballast water can pollute the sea, with examples (8 marks)

b) Name the convention which have been introduced by IMO to minimize this (2 marks)

c) What are the methods proposed to achieve the performance standard? (6 marks)

7. As per the SOLAS chapter 2 Part 2

a) What are the basic principles used to prevents fires (6 marks)
b) Define a noncombustible material? (4 marks)
c) What are "A" class divisions. (6 marks)

8. With regards to MLC 2006,

a) Name the 5 titles of the MLC 2006. (5 Marks)

b) Identify 5 areas that will be attended by the port state Inspectors with regards to MLC 2006 (5 Marks)

c) Briefly explain the conditions for the minimum working and rest hours on board (6 Marks)

9. as per the ISPS code

a) Explain the reason for the code to be introduced (6 marks)

b) Explain ships security alert system (10 marks)

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COURSE CODE: ED 0350 PI (BATCH 41)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTROTECHNOLOGY

- ***Answer any FOUR (4) Questions from Part A***
- ***Answer any TWO (2) Questions from Part B***
- *Date: 2021.01.16* *Pass mark 50%* *Time allocated: 03 Hrs*

Part A

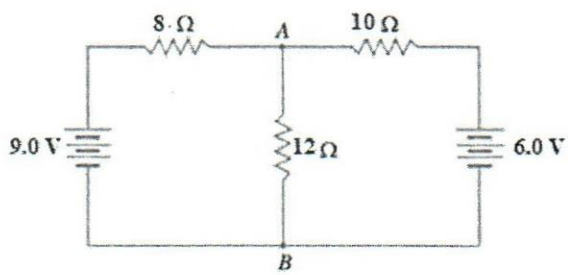
1. A 250 V, 50 Hz ac supply is applied to a coil of 1.90 H inductance and 300 Ω resistance connected in series with a 1.6 μF capacitor. Calculate

   a) Impedance (06 marks)
   b) Current (04 marks)
   c) Phase angle between current and voltage (06 marks)
   d) power factor. (04 marks)

2. a) A rectangular copper strip is 2 m long, 0.1 cm wide and 0.4 cm thick. Determine the resistance between each opposite end. The resistivity of copper is $2.0 \times 10^{-6} \Omega$. (06 marks)

   b) State Kirchhoff's laws for an electrical circuit. (06 marks)

   c) Find the current in AB branch. (08 marks)



3. a) Draw the diagrams to show star and delta connected systems. (04 marks)

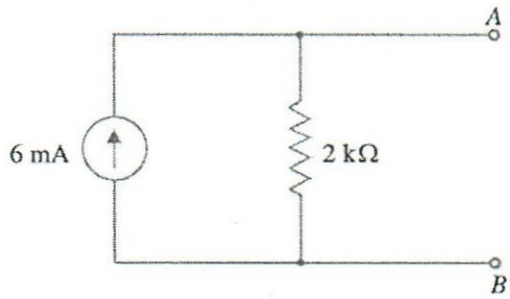
   b) Compare and list the voltage, current and power of star and delta systems. (04 marks)

   c) Three coils, each having a resistance of 40 Ω and inductive reactance of 30 Ω, are connected in star across 400V, 3-phase,50 Hz supply. Calculate line current, power factor and power taken from the mains. (12 marks)

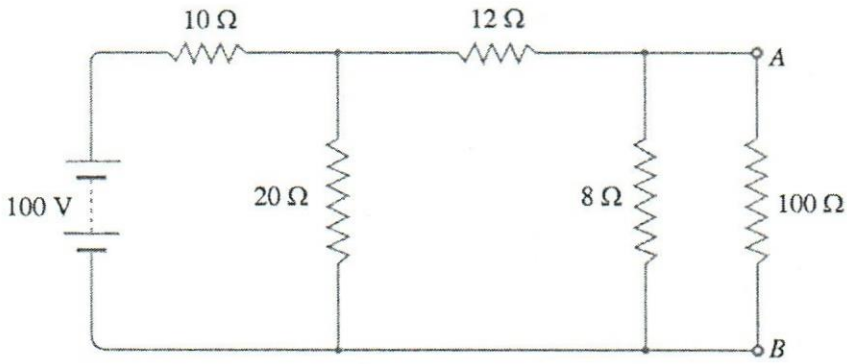
4. a) Define magnetic flux density and magnetic intensity. (08 marks)

   b) An iron ring has a cross-sectional area of 400 mm^2 and mean diameter of 14 cm. It is wound with 500 turns. If the value of relative permeability is 250, find the total magnetic flux set up in the ring. The coil resistance is 400 Ω and the supply voltage is 100 V. (12 marks)

5. a) Convert the following constant current source into equivalent voltage source. Hence, find current from A to B, if 1 kΩ resistance is connected in A and B. (8 marks)



   b) Using Thevenin's theorem, find the current through 100 Ω resistance connected across terminals A and B in the following circuit. (12 marks)



Part B

6.

a) Why testing of insulation resistance of electrical motors is important? (5 Marks)

b) How insulation resistance of a three phase motor is tested? (10 Marks)

c) State five factors cause deterioration of insulation resistance. (5 Marks)

7.

a) What are the two basic types of batteries (cells)? (4 Marks)

b) How the state of charge of lead acid batteries are determined? (6 Marks)

c) What are the routine and emergency serviced supplied by batteries? (6 Marks)

d) How the Ah capacity and the voltage are calculated, when the batteries are connected parallel and series? (4 Marks)

8. a) What is the working principal of a D.C. motor? (7 Marks)

b) What are basic three types of D.C. motors? (4 Marks)

c) State the properties of above motors? (4 Marks)

d) How current is supplied to a rotor of a D.C. motor? (5 Marks)

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COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER EXAMINATION QUESTION PAPER
Thermodynamics

- *This question paper consists of Nine questions.*
- *Answer any SIX questions*

Date: 2021.01.22 *Pass mark 50%* *Time allocated: 03 Hrs*

For air c_p = ***1.005kJ/kg K***, c_v = ***0.717kJ/kg K***, γ = ***1.4***

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

Specific heat capacity of water ***4.2 kJ/kg K,*** Latent heat of evaporation of water ***2.256 MJ/kg***

Specific heat capacity of ice ***2.1 kJ/kg K,*** Latent heat of fusion of ice ***336 kJ/kg***

1.

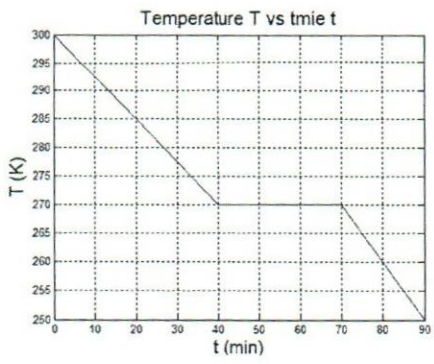
a. Describe the followings

   i. Zero law in thermodynamics

   ii. Specific heat capacity

   iii. Specific latent heat of fusion (6 marks)

b. A ***0.400 kg*** sample is placed in a cooling apparatus that removes energy as heat at a constant rate. Figure gives the temperature ***T*** of the sample versus time ***t***. The sample freezes during the energy removal. The specific heat of the sample in its liquid phase is ***3 kJ/kg K***. Estimate



   i. The rate of energy removal from the sample (4 marks)

   ii. The latent heat of fusion of the sample (5 marks)

   iii. The specific heat capacity in the frozen phase (5 marks)

   (Hint: Use the data in the figure for the estimation)

2.

a. State the First Law in thermodynamics (3 marks)

b. Discribe the specific heat capacity of a gas (5 marks)

c. ***0.5 kg*** of air initially at ***25 ^{0} C*** and ***2 bar*** is occupied in a volume of ***0.02 m^3***. The air sample is heated under constant pressure to ***100 ^{0}C***. Then it is cooled under constant volume until its temperature is back to the initial value. Determine

i. The final volume of air (3 marks)

ii. Work done during the heating process (3 marks)

iii. Heat transfer under constant pressure (3 marks)

iv. Heat transfer under constant volume (3 marks)

3.

a. State the ***Boyle's law*** and ***Charles' law*** for perfect gases (4 marks)

b. Taking characteristic gas constant, ***R*** and adiabatic index, γ for Oxygen as ***0.26 kJ/kg K*** and ***1.393*** respectively, Calculate

i. The mass of ***0.25 m^3*** of Oxygen at ***5.5 bar*** and ***30 ^{0}C*** (2 marks)

ii. The volume of ***10 kg*** of Oxygen at ***10 bar*** and ***-5 ^{0}C*** (2 marks)

c. Write an expression for the specific heat capacity of gas under constant pressure, c_p and the specific heat capacity of gas under constant volume, c_v using the adiabatic index, γ and gas constant, ***R***
(4 marks)

d. ***0.30 m^3/kg*** of Oxygen gas at ***27 ^{0}C*** is heated at constant volume to a temperature of ***200 ^{0}C***. calculate the initial pressure, the final pressure, heat transfer and enthalpy change
(8 marks)

4.

a. Describe the three type of heat transfer mechanisms (4 marks)

b. State the Fourier law in heat transfer. (3 marks)

c. A pond of water has been in cold weather, and a slab of ice ***5.0 cm*** thick has formed on its surface. The air above the ice is ***-10 ^{0}C***. Take the thermal conductivity of ice to be ***0.5023 W/m K*** and its density to be ***0.92 g/cm^3***.

i. What is the temperature of the ice and water interface? (3 marks)

ii. Estimate the rate of heat transfer from water to ice (4 marks)

iii. Calculate the rate of ice formation on the ice slab (6 marks)

5.

a. Describe the heat transfer, change in internal energy and work transfer for cyclic process (5 marks)

b. A closed system having a cycle of four processes, heat and work interactions are follows:

Process 1 – 2 : adiabatic compression $Q_{12} = 0$, $W_{12} = -600\ kJ$

Process 2 – 3 : constant volume heating $Q_{23} = +2100\ kJ$, $W_{23} = 0$

Process 3 – 4 : adiabatic expansion $Q_{34} = 0$, $W_{34} = +2200\ kJ$

Process 4 – 1 : constant pressure heat rejection Q_{41}, $W_{41} = -400\ kJ$

i. Draw the ***PV diagram*** for the cyclic process (5 marks)

ii. Calculate the ***rejection of heat (Q_{41})*** (5 marks)

iii. Determine the ***cycle efficiency*** (5 marks)

6.

a. Draw the Temperature -enthalpy diagram for water and steam to represent the following states on it

i. Saturated liquid line, Wet vapour region, Saturated dry vapour line, Superheated vapour region and Critical point (5 marks)

ii. Saturated water at ***250.3 ^0C***, wet steam at ***40 bar*** with ***0.95 dry, dry*** steam at ***20 bar*** and steam at ***20 bar*** and ***300 ^0C*** (5 marks)

b. Steam enters to a super-heater at a pressure of ***20 bar*** and dryness ***0.8*** and steam leaves the super-heater at ***300 ^0C***. Using the steam tables, find

i. The specific enthalpy of change of steam in the super-heater (5 marks)

ii. The specific volume change of steam (5 marks)

7.

a. Some thermodynamic and transport properties of ***refrigerant -404a*** contain in the table below. Using the properties of vapour complete the table (8 marks)

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
2.864	*-22*	*170.2*	*181.7*	.....
2.974	*-21*	*171.5*	.....	*355.9*
3.087	*-20*	.....	*183.8*	*356.5*
13.926	*29*	*244.5*	.....	*381.9*
14.150	*30*	.....	*136.1*	*382.2*
14.654	*31*	*247.9*	*134.7*	.....

b. ***Refrigerant - 404a*** uses to operate refrigerant in a reefer container plant. The saturated refrigerant liquid at ***14.150 bar*** in a receiver expands to a wet vapour at ***2.974 bar*** by a throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (4 marks)

ii. Find the enthalpy after the expansion (4 marks)

iii. Estimate the dryness fraction after the expansion (4 marks)

Hint: Use the properties in the table given in the ***part a***

8.

a. A gas follows an adiabatic process according to the law $pV^{\gamma} = constant$. Where γ is the adiabatic index. Write down expressions for

i. The temperature ratio (T_2/ T_1) using volume ratio (v_2/ v_1) and pressure ratio (P_2/ P_1). (2 marks)

ii. Work done (2 marks)

a. A gas compresses adiabatically from a pressure and volume of ***320 kPa*** and ***0.72 m^3***, respectively, to a volume of ***0.12 m^3***. Then it is expanded to initial volume under constant pressure.

i. Draw the process on PV diagram (4 marks)

ii. Find the pressure and the work done by the gas after the expansion. (6 marks)

iii. Find the pressure and the work done by the isothermal compression. (6 marks)

Take, $c_p = 1.06$ kJ/kg K, $\gamma = 1.36$.

9.

a. Describe Dolton's partial pressure law (3 marks)

b. A tank of volume ***5 m^3*** contains air and wet steam having ***0.92*** dryness fraction at a total pressure of ***1.013 bar*** and temperature ***27 ^0C***. Taking ***R*** for air = ***0.287 kJ/kgK***. Determine

i. The ***partial pressure of steam*** in the tank (3 marks)

ii. The ***partial pressure of air*** in the tank (3 marks)

iii. The ***specific volume of wet steam*** in the tank (3 marks)

iv. The ***mass of air*** in the tank (4 marks)

v. The ***mass of steam*** in the tank (4 marks)

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COURSE CODE: ED 0350 PI

1ST SEMESTER EXAMINATION QUESTION PAPER
Workshop Theory (Batch 42)

- *This question paper consists of six questions.*
- *Answer All SIX questions*

Date: 2021.01.21 *Pass mark 50%* *Time allocated: 03 Hrs*

1. Briefly explain following workshop tools with their respective uses. You may use diagrams for explaining. (2.5 marks each)
   a. Face plate
   b. V block
   c. Centre punch
   d. Depth micrometer
   e. Vanier caliper
   f. Scriber
   g. Divider
   h. Dial gauge

2. With an aid of a suitable graph(strain against stress) explain following physical properties of a material. (9 marks)
   a. Yield strength and yield point. (1 mark)
   b. Ultimate strength. (1 mark)
   c. Strain hardening. (1 mark)
   d. Necking. (1 mark)
   e. Failing point (fracture point) . (1 mark)
   f. Area of elastic behavior and plastic behavior. (1 mark)
   g. Proportional limit. (1 mark)

3. (i) Explain the following heat treatment methods. (2 marks each)
   a. Normalizing b. Annealing c. Hardening d. Tempering

   (ii) With regard to properties of materials explain following terms. (2 marks each)

   b. Ductility b. Hardness c. Toughness d. Brittleness

4. a. How to classify metallic and non-metallic material? (4 marks)

   b. Plane carbon steels are mainly of iron with small quantities of carbon. Explain with examples following type of steel with their uses. Your answer should include the percentage of carbon in each type of steel.

      i. Low carbon steel (3 marks)

      ii. Medium carbon steel (3 marks)

      iii. High carbon steel (3 marks)

      iv. What is meant by cast iron? Give some example of engineering component manufactured by cast iron. What are the advantages and disadvantage of using cast iron? (3 marks)

5. a. Using tap and die set explain, step by step how to make internal and external thread for a given work piece. (8marks)

   b. Explain the meaning of M 12 marked on a die nut? (2 marks)

   c. Name the type of drilling machines use for small jobs? (6 marks)

6. a. Explain various position of manual electric arc welding positions. Use diagrams to explain each position. (8 marks)

   b. List down the advantages and disadvantages of arc welding. (4 marks)

   c. List down the list of PPE use for welding. (4 marks)

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COURSE CODE: ED 0350 PI (BATCH 41)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
MATHEMATICS

Answer any SIX Questions

- *Date: 2021.01.17* *Pass mark 50%* *Time allocated: 03 Hrs*

1. a) If $A=\begin{bmatrix}-8 & 10 & 3\\ 4 & -2 & 1\end{bmatrix}$ $B=\begin{bmatrix}1 & -1\\ 0 & 0\\ 2 & 3\end{bmatrix}$ and $C=\begin{pmatrix}-1 & 0\\ 1 & 4\end{pmatrix}$

   Find i. AB (8 marks)

   ii. A^T+BC

   b) Solve, with the help of matrices, the simultaneous equations. (12 marks)

   $x+y+z=3$
   $x-3y+3z=1$
   $x+4y-8z=-3$

2. a) Prove that (6 marks)

   $(\sin x+\cos x)^2=1+\sin 2x$

   b) Solve the trigonometric equation $16\sin^2\theta+24\sin\theta\cos\theta+9\cos^2\theta-\frac{25}{4}=0$ (4 marks)

   c) Express $f(x)=16\sin^2\theta+24\sin\theta\cos\theta+9\cos^2\theta-\frac{25}{4}$ in form of $f(x)=A\sin(2\theta-B)+C$ and Hence sketch the periodic graph $f(x)$. (10 marks)

3. a) Give that $\alpha(8-5i)+\beta(2+i)+6+7i=0$; find α and, β if α & β are both real. (6 marks)

   b) Express $\frac{2+3i}{5+i}$ in form of $\mu(\alpha+i\beta)$. (8 marks)

   c) Hence, evaluate $\left(\frac{2+3i}{5+i}\right)^{-24}$ (6 marks)

4. a) Find the sum of roots and product of roots of equation of $x^2+5x-8=0$. (7 marks)

   b) Prove that $kx^2+2x-(k-2)=0$ has real roots for any value of k. (7 marks)

   c) If α and β are roots of quadratic the equation $ax^2+2bx+c=0$, prove that the quadratic equation whose roots are $\alpha+\frac{1}{\beta}$ and $\beta+\frac{1}{\alpha}$ is $acx^2+2b(a+c)x+(a+c)^2=0$ (6 marks)

5. a) Differentiate following expressions with respect to x. (6 marks)

   i. $\frac{1-x}{x^3}$ *ii.* $(1+x^2)\cos x^2$ *iii.* $\tan(e^x \sin x)$

   b) Differentiate the expression $x^2 \ln(\cos x)$ with respect to $\cos x$. (6 marks)

   c) If $y=\frac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}=0$. (8 marks)

6. a) Prove that $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$ where n is a positive integer. (6 marks)

   b) Find the following limits (6 marks)

   i. $\lim_{x\to 3}(x^2-2x+3)$ *ii.* $\lim_{x\to 2}\frac{x^5-32}{x-2}$ *iii.* $\lim_{x\to 3}\frac{x^3-27}{x-9}$

   c) Evaluate

   i. $\lim_{x\to 0}\frac{x\tan x}{1-\cos x}$ ii. $\lim_{x\to 0}\frac{\sin(\sin^2 x)}{x^2}$ (8 marks)

7. a) If $z=x^y+y^x$, Find $\frac{\partial^2 z}{\partial x \partial y}$ (6 marks)

   b) If $z=e^{ax+by}.f(ax-by)$, prove that $b\frac{\partial z}{\partial x}+a\frac{\partial z}{\partial y}=2abz$ (8 marks)

   c) A balloon is in the form of right circular cylinder of radius 1.5 m and length 4 m and is surmounted by hemispherical ends. If the radius is increased by 0.01 m and the length by 0.05 m, find the percentage change in the volume of the balloon. (6 marks)
   (Hint:
   volume of sphere $V=\frac{4}{3}\pi r^3$ and total derivative of $z=f(x,y)$ is $dz=\frac{\partial z}{\partial x}dx+\frac{\partial z}{\partial y}dy$)

8. a) Evaluate $(-128)^{\frac{3}{7}}$ (6 marks)

   b) Simplify $\frac{1}{1+x^{b-a}+x^{c-a}}+\frac{1}{1+x^{a-b}+x^{c-b}}+\frac{1}{1+x^{a-c}+x^{b-c}}$ (7 marks)

   c) Solve for x, $5(2^x)-4^x-4=0$ (7 marks)

9. a) Evaluate $\log_2 64$ (4 marks)

   b) If $\log_{10} 2 = x$, express $\log_{512} 5$ in terms of x. (6 marks)

   c) The equation has $x^{\left[(\log_5 x)^2 - \frac{9}{2}(\log_5 x)+5\right]} = 5\sqrt{5}$ exactly three real roots. (10 marks)

      i. Substituting $\log_5 x$ = q, express above equation in term of q

      ii. Hence, Determine the value of x.

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Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2021.01.17 *Pass mark 50%* *Time allocated: 03Hrs*

Marking System

Q: 1

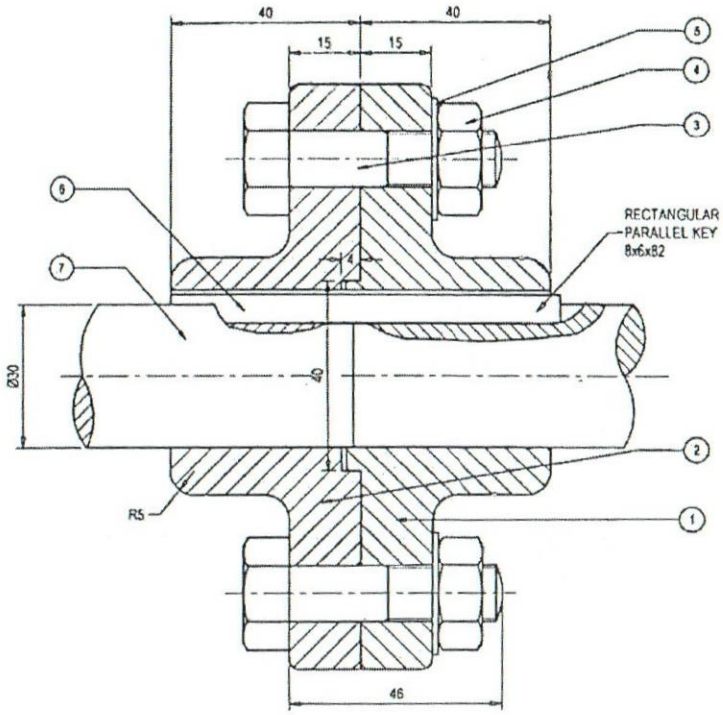
a.	Sectional front elevation	:	30 Marks
b.	End elevation	:	25 Marks
c.	Plan	:	25 Marks
	Dimensioning	:	10 Marks
	Titles and lettering	:	05 Marks
	Boundaries Lines and over all neatness	:	05 Marks

Q: 1

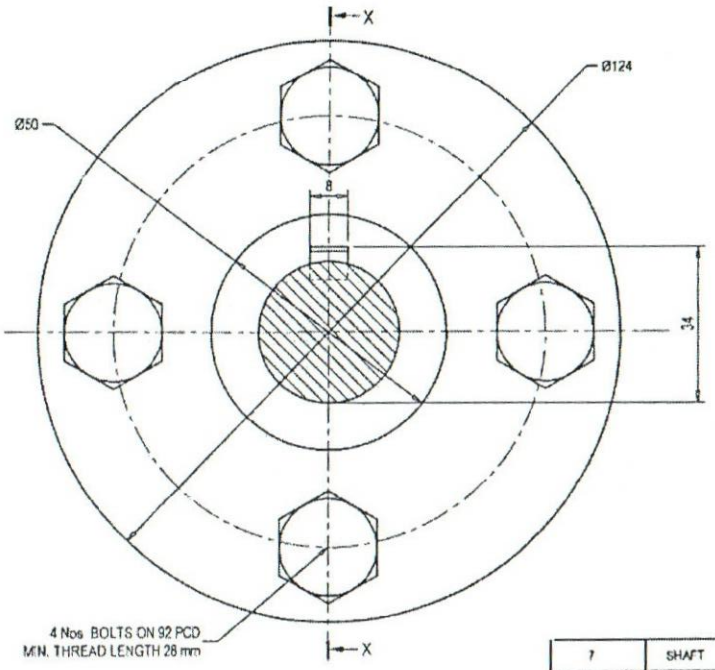
The figure shows Sectional Front Elevation of a FLANGE ASSEMBLY with all components assembled. Draw to full size in first angle projection the following views;

a. The given sectional front elevation on X-X.
b. End elevation projected in the left of view 'a'
c. Plan projected from view 'a'

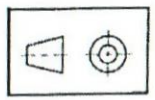
**Print main title "FLANGE ASSEMBLY", sub title, Item list, scale and dimensions on your drawing. Estimate any missing dimensions*



SECTIONAL FRONT ELEVATION ON X - X



END ELEVATION



CASTING CURVE RADII 4 MM.
ALL DIMENSIONS ARE IN MILLIMETERS.

PART No.	PART NAME	QTY
7	SHAFT	2
6	RECTANG. PARALLEL KEY	1
5	STD. WASHER	4
4	M12 STD. HEX NUT	4
3	M12 STD. HEX. BOLT	4
2	FLANGE B	1
1	FLANGE A	1

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COURSE CODE: ED 0350 PI

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

- *This question paper consists of nine questions.*
- *Answer Any SIX questions*

Date: 17/01/2021 *Pass mark 70%* *Time allocated: 03 Hrs*

1. (a) Sketch and describe the operation of a two – stage air compressor. (10 marks)
   (b) What is Bumping Clearance? (03 marks)
   (c) Explain why intercoolers and after coolers are fitted. (03 marks)

2.(a) Make a sketch of a turbocharger naming all important parts. (08 Marks)

(b) Briefly explain the purpose of following parts of the turbocharger.

a) Turbine blades. (02 Marks)
b) Compressor Impeller (02 Marks)
c) Labyrinth gland (02 Marks)
d) Nozzle ring (02 Marks)

3. i Sketch a valve timing diagram for 2-stroke CI engine (04 marks)
   ii Show the relative positions of the crank. (03 marks)
   iii Describe the cycle of operations. (05 marks)
   iv Sketch a typical indicator diagram from such an engine and insert average values of temperature and pressure at the cardinal points of such a diagram. (04 marks)

4. (a) Explain the two-stroke cycle of a marine diesel engine with the aid of valve timing diagram. (06 marks)
   (b) Explain the meaning of scavenging. (02marks)
   (c) Describe with an aid of sketches the three types of scavenging systems. (08 marks)

5. a). Make a line diagram of the fuel oil system of a large vessel fitted with a slow speed diesel Engine (10 marks)

b). State the function of,

i. Settling Tank (02 marks)

ii. Quick closing valves (02 marks)

iii. Air vents (02 marks)

6.(a) Sketch an auxiliary boiler fitted in a motor vessel and mark all the important mountings. (08 marks)

(b) Describe the procedure of removal of floating sludge and the deposits at the bottom. (04marks)

(c) Describe how to blowdown the gauge glass (04 marks)

7.a) With the aid of a sketch explain the working principle of a fuel oil injector (08 marks)

b) Explain how the injection pressure is adjusted (02 marks)

c) Briefly describe with sketches Penetration, Turbulence and Swirl (06 marks)

8. Briefly explain the following situations:

i Scavenge fire (04 Marks)

ii Crankcase explosion (04 Marks)

iii Starting air pipeline explosion (04 Marks)

iv Exhaust gas uptake fire (04 Marks)

9. Describe with an aid of a sketch the working method of a hydraulically operated exhaust valve of a two stroke diesel engine. (16 marks)

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COURSE CODE: ED 0350 PI

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Naval Architecture

- Answer any SIX questions
- Date: 2021.01.16 Pass mark 50% Time allocated: 03 Hrs

1. Describe following terminology.

1. Moulded baseline.
2. Lightship displacement.
3. What is $Aw/100$ = ?
4. Volume of displacement
5. L_{PP}
6. Displacement as a volume
7. Displacement as a weight
8. Permeability of a compartment
9. Draught moulded.
10. Dead weight
11. For what the Simpsons first rule is used?
12. MCT1cm
13. Initially unstable ship.
14. Use of Simpson's rule
15. Heel
16. List

1.1. Half breadth table of a water plane is given below. Compare full area by Simpsons 1st rule and Simpsons 2nd rule.

Ord	1	2	3	4	5	6	7
HB	0	0.5	0.6	0.8	0.5	0.25	0

(16 Marks)

2.

2.1. Define center of gravity of a ship.

2.2. A ship of 6000 tonne displacement is composed of masses of 300, 1200, and 2000 tonne at a distance of 60, 35, 11 m aft of midship, masses of 1000, 1000, and 500 tonne at distances of 15, 30, 50 m forward of midships. Calculate the distance of the centre of gravity of the ship from midships. (16 Marks)

3. A ship of 5000 tonne displacement, 96 m long, floats at drafts of 5.6 m forward and 6.3 m aft. The TPC is 11.5, GM_L 105 and the centre of floatation 2.4 m aft of midships. Calculate (i) the MCT1cm and (ii) the new end drafts when 88 tonne are added 31 m forward of midships. (16 Marks)

4. With the help of a diagram show the relationship of various terms of 'speeds'. (16 Marks)

5. A box shaped vessel has length 100m and breadth 20m, has KG at 9.0 m. draw metacentric diagram from 1m to 15m drafts. Determine the drafts at which the vessel will be unstable. (16 Marks)

6.

6.1. Explain the effect of suspended masses and compare it with free surface effect.

3.2 . A ship has a displacement of 10516 tonne, KG 8.2 m and KM 9.0 m. a weight of 86 tonne is in the lower hold, Kg 3.40 m, is lifted by the ships derrick, whose head is 22.00 m above the keel.

a. Calculate the GM when the weight is suspended.
b. Calculate the final GM when the weight is replaced in the tween deck at Kg 8.50 m. (16 Marks)

7.

7.1. Write down formula of BM and the formula for calculation of free surface effect and describe its contents.

7.2. A ship of 5000 tonne displacement has a rectangular tank 6m long and 10 m wide. calculate the virtual reduction of metacentric height if this tank is partially full of oil of relative density 0.8. (16 Marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 42)

1ST SEMESTER EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- *This question paper consists of nine questions.*
- *Answer any SIX questions*

Date: 2020.01.20 *Pass mark 50%* *Time allocated: 03 Hrs*

1

1.1 State three Newton's Laws of motion and obtain the "$F = ma$" equation from second law. (4 marks)

1.2 A truck weighing 6 kN moves freely (engine is not running) at 36km/h down a slope of 1 in 40. The road resistance at this speed is just being sufficient to prevent any acceleration of the truck. Find the road resistance per kN weight of truck. What power will the engine have to exert to run up the same slope at double the speed when the road resistance remains the same? (16 marks)

2.

2.1 Define "radian" and derive equations for angular displacement, angular velocity, and angular acceleration. (6 Marks)

2.2 A flywheel is rotating at 200 rpm and after 10 seconds of uniform retardation it was observed that the value has reduced to 160 rpm. Determine the number of revolutions made by the flywheel during this period and the time it will take for the flywheel to come to rest from the speed of 200 rpm. (14 Marks)

3.

3.1 Derive four linear motion equations and deduce them to represent the maximum height and total time taken for the vertical motion of an object under gravity. (6 marks)

3.2 A car starting at rest, travels with constant acceleration and $\frac{9}{25}$ of the total distance was covered in its last second. Find;

a. The time taken to travel the total distance. (7 marks)
b. The acceleration if the distance during the last second is given as 25 m. (7 marks)

4.

4.1 A lift and its passenger have a total mass of 400 kg. Find the tension in the cable supporting the lift when

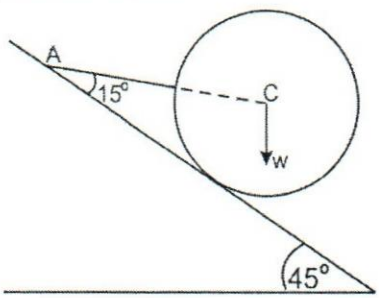
a. the lift is at rest (2 marks)
b. the lift is moving at constant speed (2 marks)
c. the lift is accelerating upwards at 0.8 m s^{-2} (4 marks)
d. the lift is accelerating downwards at 0.6 m s^{-2} (4 marks)

4.2 If the passenger weighs 70 kg and standing on a scale placed on the lift floor, what would be the scale reading when the lift is ascending (moving upward) with an acceleration of 3 m/s^2. (8 marks)

5.

5.1 State Lami's theorem and provide graphical representation of it. (4 Marks)

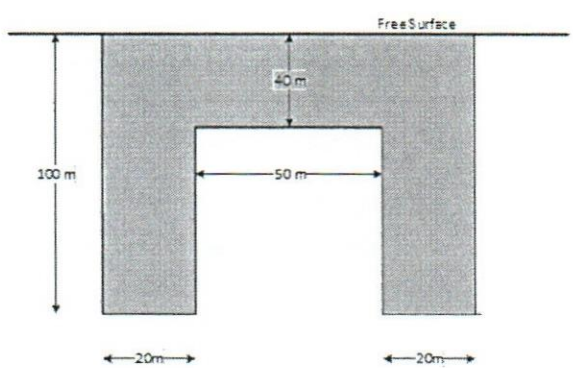
5.2 A roller of weight 1 kN rests on a smooth plane. It is kept from rolling down the plane by a string AC as shown in the figure. Find the tension in the string and the reaction at the point of contact. (16 Marks)



6.

6.1 Define "Centre of Pressure" (4 marks)

6.2 Below figure shows a flat surface which is immersed vertically in liquid. If the liquid is water having a density of 1000kg/m^3, determine the total pressure force and position of *center of pressure* of the surface. (16 marks)



7.

7.1 State Bernoulli equation and identify the variables (4 marks)

7.2 A Smooth pipe has two ends as A and B. The diameter at A is 20 cm and located at a height of 150 cm. The pressure observed at the end A is 35 kPa. Pipe diameter at the end B is 30cm and it is at an elevation of 130 cm above the reference line. Further the flow rate through the pipe is noted to be 60 m^3/s. If the total head loss between section A and B is equal to 4 m, find the value of pressure at B when the flow is from A to B. (16 marks)

8.

8.1 Derive characteristic equation for an object undergoing simple harmonic motion. (6 marks)

8.2 The piston of a steam engine moves with simple harmonic motion. The crank rotates at 100 r.p.m. with a stroke of 180cm. Find the velocity and acceleration of the piston, when it is at a distance of 60 cm from the center. (14 marks)

9.

9.1 An aircraft of mass 100 tons (100 000 kg) is flying at a constant velocity 270 m/s horizontally. Its engines are providing a horizontal driving force 350 kN.

a. Draw a free body diagram showing the driving force F, the lift force L, the air resistance (drag force) R and the weight of the aircraft and find the work done in a 10-second period by driving force $F$and lift force L. (8 marks)

9.2 At a later time the pilot increases the thrust of the aircraft's engines to 400 kN. When the aircraft has travelled a distance of 30 km, its speed has increased to 300 m/s.

b. Find the work done against air resistance during this period, and the average resistance force. (12 marks)

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COURSE CODE: ED 0350 PI

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

- *This question paper consists of nine questions.*
- *Answer Any SIX questions*

Date: 2020.10.15 *Pass mark 70%* *Time allocated: 03 Hrs*

1. a) Name two systems of turbocharging used in diesel engines and name advantages and disadvantages of each system. (4 Marks)
   b) Sketch a turbocharger and name all the parts (8 Marks)
   c) State the purpose of
      The labyrinth glands (1 Mark)
      Lacing wire on the blades (1 Mark)
   d) What is a hybrid turbocharger (2 Marks)

2. a) Describe how to prepare the engines for departure maneuvering (8 Marks)
   b) Make a list of the important checks to be carried out after starting the engine. (4 Marks)
   c) State safety slowdown and shutdown devices fitted to safeguard the main engine (2 Marks)
   d) What is "Deadman" alarm system (2 Marks)

3. Briefly explain the following situations:
   a) Scavenge fire (4 Marks)
   b) Crankcase explosion (4 Marks)
   c) Starting air pipeline explosion (4 Marks)
   d) Exhaust gas uptake fire (4 Marks)

4. a). Describe with an aid of a sketch, the Fuel oil supply system from DB tank to the main engine injector of a large two stroke marine diesel engine. (8 Marks)

   b) State three useful properties of fuel oil used in marine diesel engines (3 Marks)

   c) What are catalytic fines in fuel oil and why it has to be minimized (2 marks)

   d) State four hazards of an enclosed space (3 Marks)

5. (a) Sketch and describe the working principle of a two-stage air compressor (10 Marks)

(b) State the safety devices fitted to protect the air compressor (2 Marks)

(c) What is the importance to have "bumping clearance" at correct value and how it is measured (2 Marks)

d) As per regulation what is the minimum number of consecutive starts required in a reversible/non-reversible engine (2 Marks)

6.a) Sketch and describe the operation of a hydraulically operated exhaust valve suitable for a large bore two stroke diesel engine. (12 Marks)

b) Draw the valve timing diagram of a diesel engine operated in two stroke principles. (2 marks)

c) Explain the importance of "Tappet" clearance (2 Marks)

7. a) State the current regulation of Sulphur content of fuel can be used globally and in ECA areas (2 Marks)

b) What alternate method could be used to burn higher Sulphur content fuels on board. (2 Marks)

c) Sketch and describe a simple exhaust gas cleaning system used on board (9 Marks)

d) What factors should be monitored during the operation of such system (3 Marks)

8. a) Describe the procedure of preparation of bunkering operation and state all the safety precautions to be observed during the operation (8 Marks)

b) Explain how to obtain a sounding of a double bottom tank by "ullage" method of sounding. (4 marks)

c) Explain how to convert the sounding obtained(mm) to mass of fuel(MT) content in the tank (2 Marks)

d) During the above calculation, what factors should be taken in to consideration to obtain an accurate measurement of the quantity of fuel in the tank. (2 Marks)

9. a) Draw a heat balance chart of a large bore slow speed engine (2 marks)

b) Explain how waste heat could be recovered on board and used to generate electrical power (10Marks)

c) Explain the concept of WHRS and state what is a hybrid device (4 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 41)

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge General

- Answer any **Six** questions

Date: 2020.07.14 Pass mark 70% Time allocated: 03 Hrs

1. i. Draw a Stress / Strain curve and mark the Elastic limit, Yield point, Plastic behavior and fracture point. (8 Marks)
   ii. On a simple diagram show Tensile force, Compressive force and Shear force. (8 Marks)

2. i. Name 4 types of pumps used on ships. (4 Marks)
   ii. What are their uses on the ship? (4 Marks)
   iii. What is priming of a centrifugal pump and why is it required? (8 Marks)

3. i. Sketch a tubular heat exchanger used on a ship for cooling engine cooling water. (4 Marks)
   ii. How is expansion accommodated in the type of heat exchanger you have sketched? (4 Marks)
   iii. What are the advantages and disadvantages of this type of heat exchanger as against a plate type heat exchanger? (8 Marks)

4. i. Sketch a plate type low pressure desalinating plant and name the parts. (12 Marks)
   ii. How is the water made suitable for drinking? (4 Marks)

5. i. State the purpose of the floating lever in a hydraulic system. (4 Marks)
   ii. With the aid of sketches show the function of the floating lever as described by you above. (12 Marks)

6. i. Draw a refrigeration circuit and name the parts. (8 Marks)
   ii. What are the reasons for high pressure in the discharge side of the compressor? (4 Marks)
   iii. Describe how refrigerant in liquid for is charge to a refrigeration circuit. (4 Marks)

7. i. State what a purifier and a clarifier are. (4 Marks)
   ii. With the aid of sketches show the difference between a purifier and clarifier bowls. (12 Marks)

8. i. Why is an inert gas system used on a tanker? (4 Marks)
   ii. Sketch and name the parts of an inert gas system of a tanker. (12 Marks)

9. i. Explain what step control or on off control is. (4 Marks)
   ii. What is open loop and closed loop control? (4 Marks)
   iii. What happens when proportional action is introduced to a control system? (4 Marks)
   iv. What happens when integral action is also introduced to a control system? (4 Marks)

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COURSE CODE: ED 0350 PI

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2020.07.13 *Pass mark 50%* *Time allocated: 03Hrs*

Marking System

Q: 1

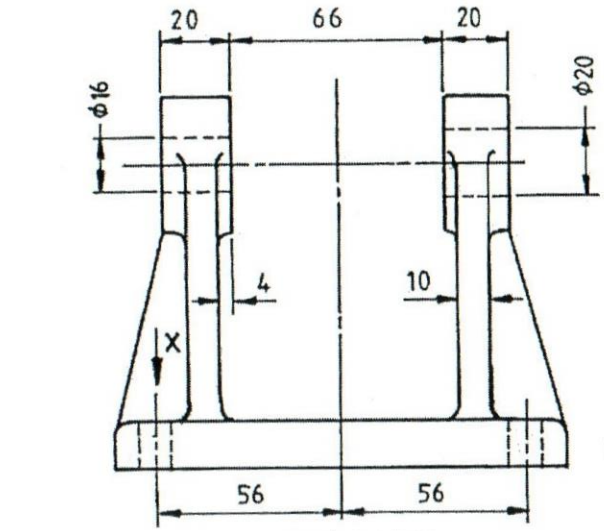
a.	Sectional front elevation	:	30 Marks
b.	End elevation	:	20 Marks
c.	Plan	:	20 Marks
	Dimensioning	:	15 Marks
	Titles and lettering	:	10 Marks
	Boundaries Lines and over all neatness	:	05 Marks

Q: 1

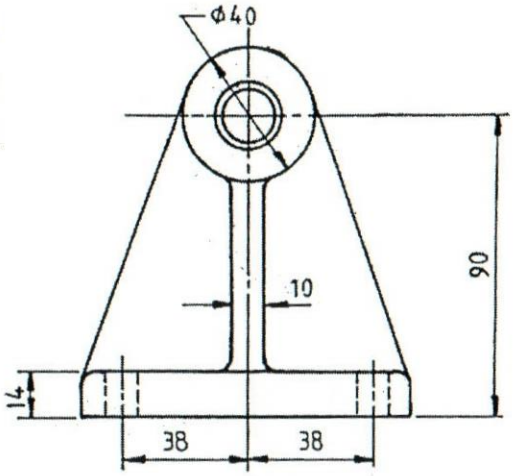
The figure shows the components of a "Pulley bracket". Assemble the different parts in their correct positions and draw to full size in first angle projection the following views

a. Sectional front elevation corresponding to the given elevation of the bracket
b. End elevation projected in the right of view 'a'
c. Plan projected from 'a'

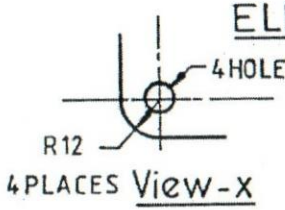
**Print main title "*PULLEY BRACKET*", scale and dimensions on your drawing. Estimate any missing dimensions*



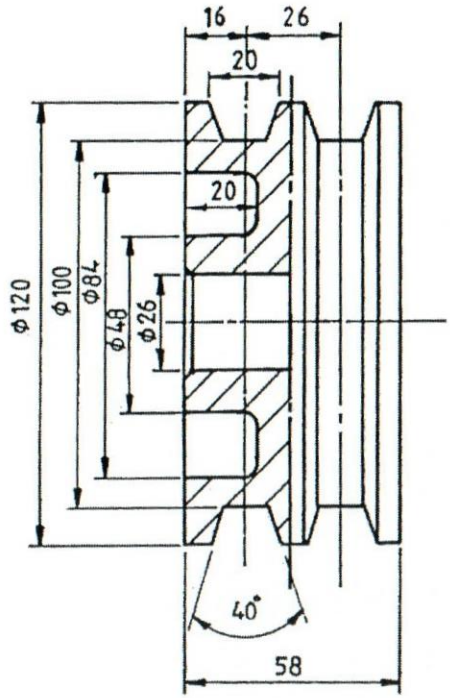
ELEVATION



END ELEVATION

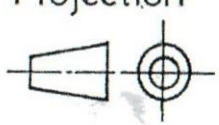


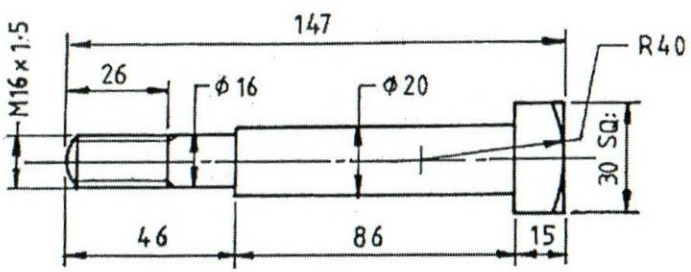
BRACKET ①



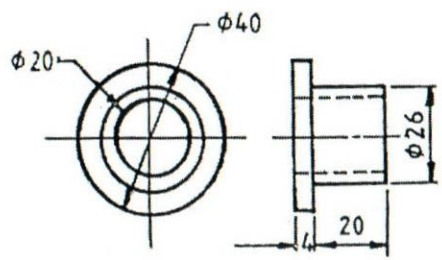
PULLEY ②

Projection

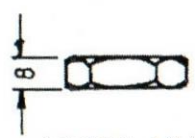




AXLE BOLT ④



BUSH 2Nos ③



LOCK NUT ⑤

PULLEY BRACKET

all dimensions in millimeters

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COURSE CODE: ED 0350 PI (BATCH 41)

2ND SEMESTER EXAMINATION QUESTION PAPER
Mathematics

Answer any SIX Questions

- *Date: 2020.07.12* *Pass mark 50%* *Time allocated: 03 Hrs*

1. a) If $A=\begin{bmatrix}3 & -1 & 2\\ 4 & -2 & 1\end{bmatrix}$ $B=\begin{bmatrix}0 & 5\\ 7 & 1\\ 0 & 3\end{bmatrix}$ and $C=\begin{pmatrix}0 & -3\\ 2 & 4\end{pmatrix}$

Find i. AB (8 marks)

ii. A^T+BC

b) Solve, with the help of matrices, the simultaneous equations. (12 marks)

$x+y+z=3$
$x+2y+3z=4$
$x+4y+9z=6$

2. a) Prove that (6 marks)

$(\sin x-\cos x)^2=1-\sin 2x$

b) Solve the trigonometric equation $16\sin^2\theta+24\sin\theta\cos\theta+9\cos^2\theta-\frac{25}{4}=0$ (4 marks)

c) Express $f(x)=16\sin^2\theta+24\sin\theta\cos\theta+9\cos^2\theta-\frac{25}{4}$ in form of $f(x)=A\sin(2\theta-B)+C$ and Hence sketch the periodic graph $f(x)$. (10 marks)

3. a) Give that $A(3-2i)+B(1+i)-8+7i=0$; find A and B if A, B are both real. (6 marks)

b) Express $\frac{2+3i}{5+i}$ in form of $\mu(\alpha+i\beta)$. (8 marks)

c) Hence, evaluate $\left(\frac{2+3i}{5+i}\right)^{-24}$ (6 marks)

4. a) Find the sum of roots and product of roots of equation of $x^2+x-3=0$. (7 marks)

   b) Prove that $kx^2+2x-(k-2)=0$ has real roots for any value of k. (7 marks)

   c) If α and β are roots of quadratic the equation $ax^2+2bx+c=0$, prove that the quadratic equation whose roots are $\alpha+\frac{1}{\beta}$ and $\beta+\frac{1}{\alpha}$ is $acx^2+2b(a+c)x+(a+c)^2=0$ (6 marks)

5. a) Differentiate following expressions with respect to x. (6 marks)

   i. $\frac{x^3}{1-x}$ *ii.* $(1+x^2)\sin x^2$ *iii.* $\sin(e^x \tan x)$

   b) Differentiate the expression $x^2 \ln(\cos x)$ with respect to $\cos x$. (6 marks)

   c) If $y=\frac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2)\frac{d^2y}{dx^2}+3x\frac{dy}{dx}=0$. (8 marks)

6. a) Prove that $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$ where n is a positive integer. (6 marks)

   b) Find the following limits (6 marks)

   i. $\lim_{x\to 3}(x^2-2x+3)$ *ii.* $\lim_{x\to 2}\frac{x^5-32}{x-2}$ *iii.* $\lim_{x\to 3}\frac{x^3-27}{x-9}$

   c) Evaluate

   i. $\lim_{x\to 0}\frac{x\tan x}{1-\cos x}$ ii. $\lim_{x\to 0}\frac{\sin(\sin^2 x)}{x^2}$ (8 marks)

7. a) If $z=x^y+y^x$, Find $\frac{\partial^2 z}{\partial x \partial y}$ (6 marks)

   b) If $z=e^{ax+by}.f(ax-by)$, prove that $b\frac{\partial z}{\partial x}+a\frac{\partial z}{\partial y}=2abz$ (8 marks)

   c) A balloon is in the form of right circular cylinder of radius 1.5 m and length 4 m and is surmounted by hemispherical ends. If the radius is increased by 0.01 m and the length by 0.05 m, find the percentage change in the volume of the balloon. (6 marks)
   (Hint:
   volume of sphere $V=\frac{4}{3}\pi r^3$ and total derivative of $z=f(x,y)$ is $dz=\frac{\partial z}{\partial x}dx+\frac{\partial z}{\partial y}dy$)

8. a) Evaluate $(-128)^{\frac{3}{7}}$ (6 marks)

   b) Simplify $\frac{1}{1+x^{b-a}+x^{c-a}}+\frac{1}{1+x^{a-b}+x^{c-b}}+\frac{1}{1+x^{a-c}+x^{b-c}}$ (7 marks)

   c) Solve for x, $5(2^x)-4^x-4=0$ (7 marks)

9. a) Evaluate $\log_2 16$ (4 marks)

b) If $\log_{10} 2 = x$, express $\log_{512} 5$ in terms of x. (6 marks)

c) The equation has $x^{\left[(\log_5 x)^2 - \frac{9}{2}(\log_5 x)+5\right]} = 5\sqrt{5}$ exactly three real roots. (10 marks)

i. Substituting $\log_5 x = q$, express above equation in term of q

ii. Hence, Determine the value of x.

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COURSE CODE: ED 0350 PI

02ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRO-TECH

- Answer Any Six Questions

Date: 2020.07.11 | Pass mark 50% | Time allocated: 03 Hrs

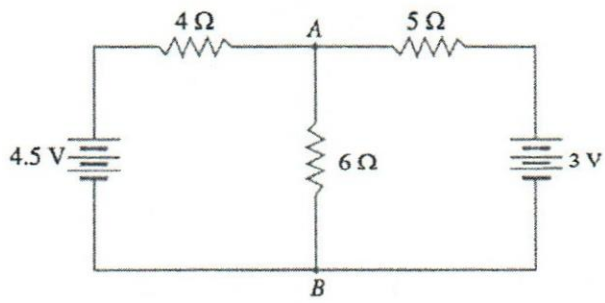
1. A 230 V, 50 Hz ac supply is applied to a coil of 1.33 H inductance and 200 Ω resistance connected in series with a 10 μF capacitor. Calculate

   a) Impedance (06 marks)
   b) Current (04 marks)
   c) Phase angle between current and voltage (06 marks)
   d) Power factor. (04 marks)

2. a) A rectangular copper strip is 20 cm long, 0.1 cm wide and 0.4 cm thick. Determine the resistance between each opposite end. The resistivity of copper is $1.7 \times 10^{-6} \Omega$. (06 marks)

   b) State Kirchhoff's laws for an electrical circuit. (06 marks)

   c) Find the current in each branch. (08 marks)

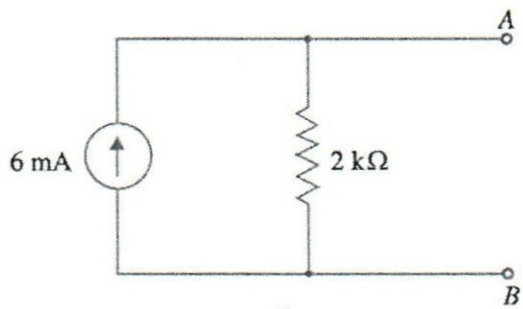


3. a) Draw the diagrams to show star and delta connected systems. (04 marks)
   b) Compare and list the voltage, current and power of star and delta systems. (04 marks)
   c) Three coils, each having a resistance of 20 Ω and inductive reactance of 15 Ω, are connected in star across 400V, 3-phase,50 Hz supply. Calculate line current, power factor and power taken from the mains. (12 marks)

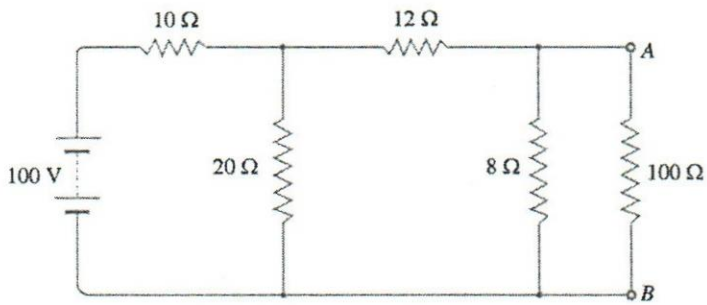
4. a) Define magnetic flux density and magnetic intensity. (08 marks)

   b) An iron ring has a cross-sectional area of 400 mm^2 and mean diameter of 14 cm. It is wound with 500 turns. If the value of relative permeability is 250, find the total magnetic flux set up in the ring. The coil resistance is 400 Ω and the supply voltage is 100 V. (12 marks)

5. a) Convert the following constant current source into equivalent voltage source. Hence, find current from A to B, if 1 kΩ resistance is connected in A and B. (08 marks)



   b) Using Thevenin's theorem, find the current through 100 Ω resistance connected across terminals A and B in the following circuit. (12 marks)



6.

   a) Why testing of insulation resistance of electrical motors is important? (4 Marks)

   b) How insulation resistance of a three phase motor is tested? (8 Marks)

   c) State five factors cause deterioration of insulation resistance. (4 Marks)

7.

a) What are the two basic types of batteries (cells)? (2 Marks)

b) How the state of charge of lead acid batteries are determined? (6 Marks)

c) What are the routine and emergency serviced supplied by batteries? (4 Marks)

d) How the Ah capacity and the voltage are calculated, when the batteries are connected parallel and series? (4 Marks)

8. a) What is the working principal of a D.C. motor? (6 Marks)

b) What are basic three types of D.C. motors? (3 Marks)

c) State the properties of above motors? (3 Marks)

d) How current is supplied to a rotor of a D.C. motor? (4 Marks)

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COURSE CODE: ED 0350 PI

2ND SEMESTER EXAMINATION QUESTION PAPER
Naval Architecture

- *Answer any SIX questions*
- *Date: 2020.07.10* *Pass mark 50%* *Time allocated: 03 Hrs*

1. Describe following terminology.

1. Moulded baseline.	9. Draught moulded.
2. Lightship displacement.	10. Dead weight
3. What is $Aw/100$ = ?	11. For what the Simpsons first rule is used?
4. Volume of displacement	12. MCT1cm
5. L_{PP}	13. Initially unstable ship.
6. Displacement as a volume	14. Use of Simpson's rule
7. Displacement as a weight	15. Heel
8. Permeability of a compartment	16. List

1.1. Half breadth table of a water plane is given below. Compare full area by Simpsons 1st rule and Simpsons 2nd rule.

Ord	1	2	3	4	5	6	7
HB	0	0.5	0.6	0.8	0.5	0.25	0

(16 Marks)

2.

2.1. Define center of gravity of a ship.

2.2. A ship of 6000 tonne displacement is composed of masses of 300, 1200, and 2000 tonne at a distance of 60, 35, 11 m aft of midship, masses of 1000, 1000, and 500 tonne at distances of 15, 30, 50 m forward of midships. Calculate the distance of the centre of gravity of the ship from midships. (16 Marks)

3.

3.1. Explain the effect of suspended masses and compare it with free surface effect.

3.2 . A ship has a displacement of 10516 tonne, KG 8.2 m and KM 9.0 m. a weight of 86 tonne is in the lower hold, Kg 3.40 m, is lifted by the ships derrick, whose head is 22.00 m above the keel.

a. Calculate the GM when the weight is suspended.

b. Calculate the final GM when the weight is replaced in the tween deck at Kg 8.50 m. (16 Marks)

4.

4.1. Write down formula of BM and the formula for calculation of free surface effect and describe its contents.

4.2. A ship of 5000 tonne displacement has a rectangular tank 6m long and 10 m wide. calculate the virtual reduction of metacentric height if this tank is partially full of oil of relative density 0.8. (16 Marks)

5. A ship of 5000 tonne displacement, 96 m long, floats at draughts of 5.6 m forward and 6.3 m aft. The TPC is 11.5, GM_L 105 and the centre of floatation 2.4 m aft of midships. Calculate (i) the MCT1cm and (ii) the new end draughts when 88 tonne are added 31 m forward of midships. (16 Marks)

6. With the help of a diagram show the relationship of various terms of 'speeds'. (16 Marks)

7. A box shaped vessel has length 100m and breadth 20m, has KG at 9.0 m. draw metacentric diagram from 1m to 15m draughts. Determine the draughts at which the vessel will be unstable. (16 Marks)

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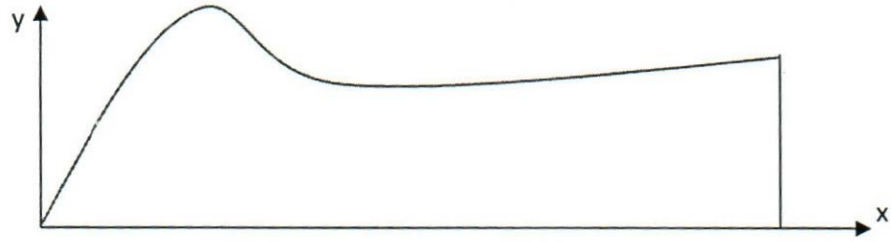
2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Mathematics

Answer any SIX Questions

- *Date: 2020.03.15* *Pass mark 50%* *Time allocated: 03 Hrs*

1. Figure represents a lamina made by coordinates given in the table below. Use the table and figure for the followings.



x(m)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
y(m)	0	0.25	0.75	0.85	0.75	0.65	0.6	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67

Calculate the area of the figure using Simpson's 1/3 rd rule (20 marks)

2. a) If $A=\begin{bmatrix}3 & -1 & 2\\ 4 & -2 & 1\end{bmatrix}$ $B=\begin{bmatrix}0 & 5\\ 7 & 1\\ 0 & 3\end{bmatrix}$ and $C=\begin{pmatrix}0 & -3\\ 2 & 4\end{pmatrix}$

Find i. AB (8 marks)

ii. $A^T + BC$

b) Solve, with the help of matrices, the simultaneous equations. (12 marks)

$x+y+z=3$
$x+2y+3z=4$
$x+4y+9z=6$

3. a) Prove that (6 marks)

$$(\sin x - \cos x)^2 = 1 - \sin 2x$$

b) Solve the trigonometric equation $16\sin^2\theta + 24\sin\theta\cos\theta + 9\cos^2\theta - \frac{25}{4} = 0$ (4 marks)

c) Express $f(x) = 16\sin^2\theta + 24\sin\theta\cos\theta + 9\cos^2\theta - \frac{25}{4}$ in form of $f(x) = A\sin(2\theta - B) + C$ and Hence sketch the periodic graph $f(x)$. (10 marks)

4. a) Differentiate $ln|f(x)|$ with respect to x. (6 marks)

Hence, Integrate $\int \frac{f'(x)}{f(x)}dx$

b) Integrate following expression with respect to x. (6 marks)

i. $\int \frac{e^x}{1+e^x}dx$ *ii.* $\int \frac{4x-3}{(x+2)(2x-1)}dx$

c) Let $I_1 = \int e^x \cos x dx$ and $I_2 = \int e^x \sin x dx$, Using integrate by parts obtain two equations connecting I_1 and I_2. Hence find I_1 and I_2. (8 marks)

5. Rational function is given by $f(x) = \frac{1}{(x+1)(x-3)}$ for $x \neq -1, 3$.

a) Show that $f'(x) = \frac{2(1-x)}{(x+1)^2(x-3)^2}$ (6 marks)

b) Determine the coordinates of stationary, intercepts and asymptote points. (8 marks)

c) Hence, sketch the rational graph of $f(x)$. (6 marks)

6. a) Give that $A(3-2i) + B(1+i) - 8 + 7i = 0$; find A and B if A, B are both real. (6 marks)

b) Express the following expressions in the form of $a + ib$ (6 marks)

i. $(2+3i)+(6+12i)$ *ii.* $\frac{4+3i}{4-3i}$ *iii.* $(2+5i)^2$

c) Express $\frac{2+3i}{5+i}$ in form of $\mu(\alpha + i\beta)$. (8 marks)

Hence, evaluate $\left(\frac{2+3i}{5+i}\right)^{-24}$

7. a) Find the sum of roots and product of roots of equation of $x^2 + x - 3 = 0$. (7 marks)

b) Prove that $kx^2+2x-(k-2)=0$ has real roots for any value of k. (7 marks)

c) If α and β are roots of quadratic the equation $ax^2+2bx+c=0$, prove that the quadratic equation whose roots are $\alpha+\frac{1}{\beta}$ and $\beta+\frac{1}{\alpha}$ is $acx^2+2b(a+c)x+(a+c)^2=0$ (6 marks)

8. a) Differentiate following expressions with respect to x. (6 marks)

i. *i.* $(x-1)\sec^2 x$ *ii.* $\dfrac{\sin x-\cos x}{1+\cos x}$

b) Differentiate the expression $x^2\ln(\cos x)$ with respect to $\cos x$. (6 marks)

c) If $y=\dfrac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2)\dfrac{d^2y}{dx^2}+3x\dfrac{dy}{dx}=0.$ (8 marks)

9. a) Prove that $\lim\limits_{x\to a}\dfrac{x^n-a^n}{x-a}=na^{n-1}$ where n is a positive integer. (6 marks)

b) Find the following limits (6 marks)

i. $\lim\limits_{x\to 3}(x^2-2x+3)$ *ii.* $\lim\limits_{x\to 2}\dfrac{x^5-32}{x-2}$ *iii.* $\lim\limits_{x\to 3}\dfrac{x^3-27}{x-9}$

c) Evaluate

i. $\lim\limits_{x\to 0}\dfrac{x\tan x}{1-\cos x}$ ii. $\lim\limits_{x\to 0}\dfrac{\sin(\sin^2 x)}{x^2}$ (8 marks)

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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2020.03.14 *Pass mark 50%* *Time allocated: 03Hrs*

Marking System

Q: 1

a.	Sectional front elevation	:	30 Marks
b.	End elevation	:	20 Marks
c.	Plan	:	20 Marks
	Dimensioning	:	15 Marks
	Titles and lettering	:	10 Marks
	Boundaries Lines and over all neatness	:	05 Marks

Q: 1

The figure shows Front elevation and End elevation of a HOUSING FIXTURE BRACKET, draw the following vies to scale of full size in first angle projection

a. Given front elevation
b. The sectional end elevation on X-X projected to the right of view "a"
c. The plan projected from view "a"

**Print main title "*HOUSING FIXTURE BRACKET*", scale and dimensions on your drawing. Estimate any missing dimensions*

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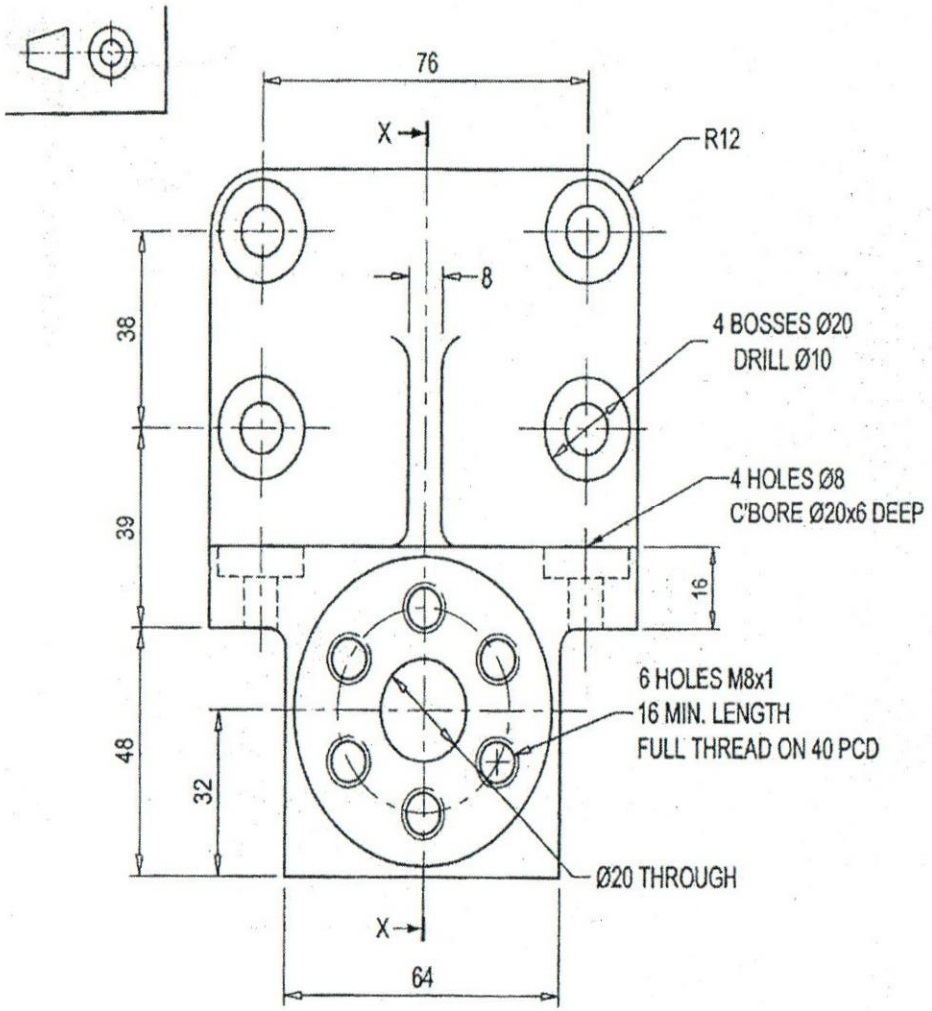
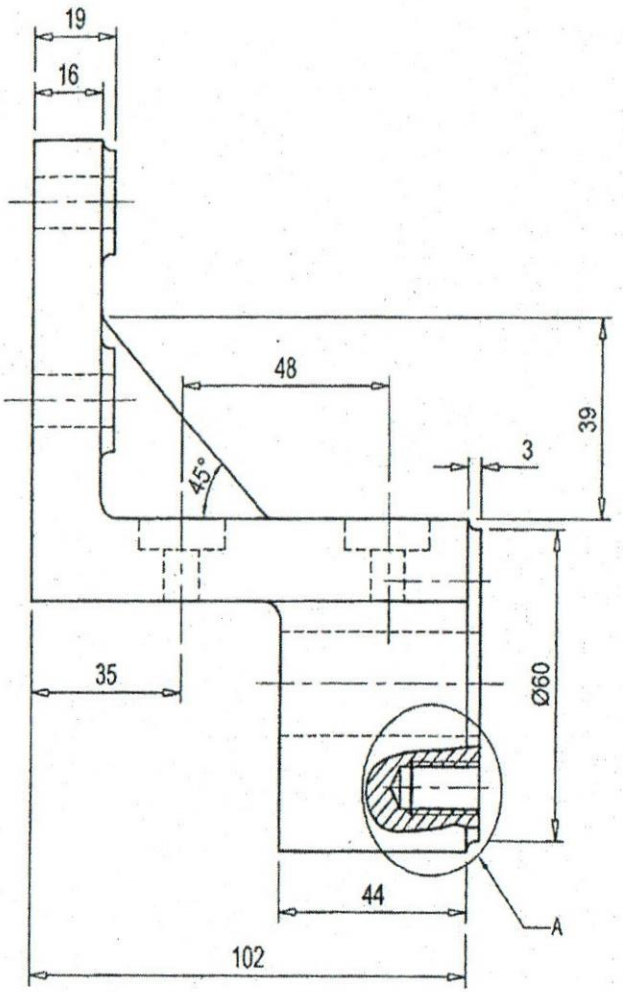
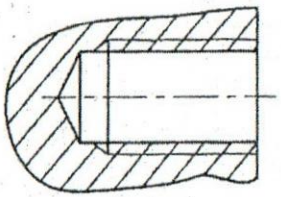


FRONT ELEVATION



END ELEVATION



DETAIL AT "A"

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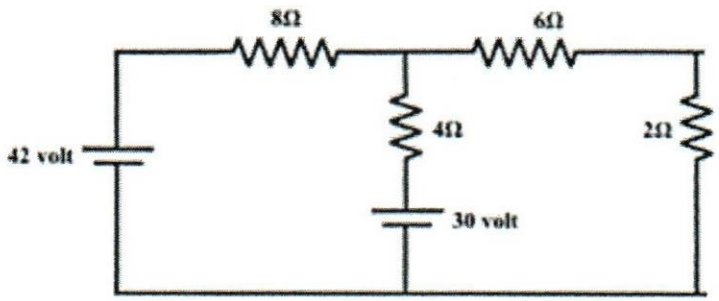
02ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRO-TECH

- Answer All Six Questions

Date: 2020.03.14 Pass mark 50% Time allocated: 03 Hrs

1. A 230 V, 50 Hz ac supply is applied to a coil of 0.6 H inductance and 350 Ω resistance connected in series with a 6.8 μF capacitor. Calculate
   a) Impedance (06 marks)
   b) Current (04 marks)
   c) Phase angle between current and voltage (06 marks)
   d) power factor. (04 marks)

2. a) A length of wire has a resistance of 4.5 Ω. Find the resistance of another wire of the same material three times as long and twice the cross-sectional area. (06 marks)
   b) State Ohm's law and Kirchhoff's laws for an electrical circuit. (06 marks)
   c) Find the current in each branch. (08 marks)



3. a) Draw the diagrams to show star and delta connected systems. (04 marks)
   b) Compare and list the voltage, current and power of star and delta systems. (04 marks)
   c) Three 50 Ω resisters are connected in star across 400V, 3-phase supply. Find phase current, line current and power taken from the mains. (12 marks)
4. a) Define magnetic flux density and magnetic intensity. (06 marks)
   b) An iron ring has a cross-sectional area of 400 mm^2 and mean diameter of 14 cm. It is wound with 500 turns. If the value of relative permeability is 250, find the total magnetic flux set up in the ring. The coil resistance is 400 Ω and the supply voltage is 200 V. (12 marks)

5. a) Explain how you would measure Insulation resistance of a three-phase induction motor.

(10 marks)

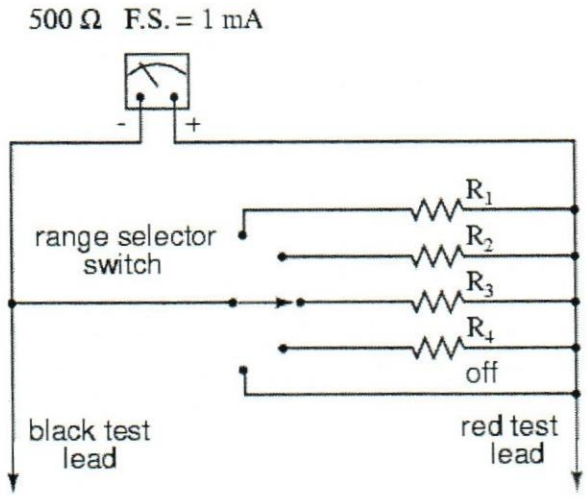
b) Explain what data need to be gathered, and how do you tabulate the readings obtained.

(10 marks)

6. a) Explain with a diagram the function of a Brushless Generator. (14 marks)

b) Why are they more popular than any other kind of generators? (06 marks)

7. a) Explain the function of the circuit diagram shown in following figure. (05 marks)



b) When R4 resistor is selected, current through the test leads is 50mA. Find the value of R4.

(5 marks)

c) If R3 resistor is 5.05 ohm, find the total current through the test leads. (5 marks)

d) How do you use the same meter to measure the voltage of 10V across a load? (5 marks)

8. a) Which motor type is widely used on ships? (4 marks)

b) Explain the meaning of rotating magnetic field. (4 marks)

c) What is the meaning of synchronous speed? (4 marks)

d) A 3- phase, 50 Hz induction motor has 8 poles. If the full load slip is 2.5%

Determine;

i. synchronous speed

ii. rotor speed (4x2 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 41)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

- This question paper consists of Nine questions.
- Answer any SIX questions

Date: 2020.01.18 Pass mark 50% Time allocated: 03 Hrs

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

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

Specific heat capacity of water ***4.2 kJ/kg K***

1.

a. Describe the three types of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of linear expansion and coefficient of superficial expansion using the coefficient of volumetric expansion of solid materials (4 marks)

c. A straight rod made by a certain alloy has a length of ***10.012 cm*** at ***20 ^0C*** and length of ***10.045 cm*** at ***100 ^0C***. Assume that there is no bending or twisting of the rod during the expansion

i. What is the coefficient of linear expansion of the alloy? (4 marks)

ii. What is the length of the rod at the freezing point of water? (4 marks)

iii. What is the temperature if the length of the rod is ***10.025 cm***? (4 marks)

2. A furnace wall is made with a thickness of ***120 mm*** with insulating brick which has a coefficient of thermal conductivity of ***6.8×10^{-2} W/m K*** and a thickness of ***20 mm*** with metal which has a coefficient of thermal conductivity of ***80 W/m K***. The outside and inside face temperatures of the material is ***25 ^0C*** and ***400 ^0C***. Determine

i. The overall heat transfer coefficient (5 marks)

ii. Rate of heat transfer trough the wall (5 marks)

iii. The intermediate temperature (5 marks)

iv. Draw the temperature variation through the wall (5 marks)

3.

a. Describe ***Dolton's partial pressure law*** (5 marks)

b. A vessel of volume ***14 m^3*** contains air and wet steam having ***0.96*** dryness fraction at a total pressure of ***0.16 bar*** and temperature ***42 ^0C***. Taking ***R*** for air = ***0.287 kJ/kg K***. Determine

i. The ***partial pressure of steam*** in the vessel (3 marks)

ii. The ***partial pressure of air*** in the vessel (3 marks)

iii. The ***specific volume of wet steam*** in the vessel (3 marks)

iv. The ***mass of air*** in the vessel (3 marks)

v. The ***mass of steam*** in the vessel (3 marks)

4.

a. Briefly explain the following terms

i. Boyle's law

ii. Charles' law

iii. Avogadro's law (6 marks)

b. Write an expression for the gas constant by using the molecular mass and universal gas constant. (4 marks)

c. The analysis by mass of sample of air is ***23.14 % Oxygen***, ***75.53% Nitrogen***, ***1.28% Argon*** and ***0.05 % carbon dioxide***. Estimate the gas constant for air.

Taking the molecular weights of ***O_2, N_2, Ar, CO_2*** as ***32, 28, 40*** and ***44*** respectively, and the universal gas constant ***8.314 kJ/ k-mol K***. (10 marks)

5.

a. Write down the ***characteristic gas equation*** and name each term in its (4 marks)

b. Describe the specific capacity of gas under constant pressure (***Cp***) and constant volume (***Cv***). Hence, write an expression for ***gas constant*** using specific heat capacities (***Cp*** and ***Cv***) (6 marks)

c. An air reservoir contains ***20 kg*** of air at ***3.2 MPa*** and ***16 ^0C***. If the air is heated to ***65 ^0C***, calculate

i. The volume of the air reservoir (3 marks)

ii. The new pressure (3 marks)

iii. The heat energy transfer and internal energy change (4 marks)

Neglect any expansion of the reservoir

6. In an air compressor, air is compressed according to the law $PV^{1.25} = constant$. The initial conditions of the air is ***1.013 bar***, and ***27 ^0C***. The compressor has a bore of ***300 mm*** and the stroke of ***450 mm***. the clearance volume is ***4%*** of the swept volume. If the final pressure is ***12 bar***, calculate

   i. For what length of the stroke air is delivered (5 marks)

   ii. The volume of air delivered per stroke (5 marks)

   iii. The final temperature (5 marks)

   iv. The mass of the air in the cylinder before the compression (5 marks)

7.

   a. A gas follows a ploltropic process according to the law $PV^n = constant$. Where n is the polytropic index. Write down expressions for

      i. The temperature ratio (T_2/ T_1) using volume ratio (v_2/ v_1) and pressure ratio (P_2/ P_1). (2 marks)

      ii. Work done (3 marks)

   b. ***0.20 kg*** of air at a pressure of ***200 kPa*** occupies ***0.14 m^3*** and from this condition it is compressed to ***1.6 MPa*** according to the law $PV^{1.25} = constant$. Determine

      i. The change of internal energy of the air (5 marks)

      ii. The work done on or by the air (5 marks)

      iii. The heat received or rejected by the air (5 marks)

8.

   a. Write expressions for the ***entropy change*** during process at constant volume and constant pressure. (4 marks)

   b. In a reversible process ***0.20 m^3*** of air at a pressure of ***3.15 bar*** and the temperature of ***47 ^0C*** is heated at constant pressure to a volume of ***0.80 m^3***. It is then cooled at constant volume back to the original temperature.

      i. Sketch the process on a ***T-S diagram*** (4 marks)

      Estimate

      ii. The temperature of air after heating (2 marks)

      iii. The ***net flow of heat*** during the process (4 marks)

      iv. The ***net entropy change*** (6 marks)

9.

a. Some thermodynamic and transport properties of ***refrigerant -134a*** contain in the table below. Using the properties of vapour complete the table (6 marks)

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
1.640	*-15*	*31.97*	*209.54*	.....
2.94	0	*51.83*	.....	*250.50*
7.706	*30*	.....	*173.13*	*266.71*

b. Refrigerant ***-134a*** uses to operate refrigerant plant in the temperature range between ***25 ^0C*** and ***-15 ^0C***. Saturated liquid at ***30 ^0C*** expands to a wet vapour at ***1.640 bar*** by the throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (5 marks)

ii. Find the enthalpy after the expansion (3 marks)

iii. Estimate the dryness fraction after the expansion (6 marks)

Hint: Use the properties in the table given in the ***part a***

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

- *This question paper consists of Nine questions.*
- *Answer any SIX questions*

Date: 2020.01.18 *Pass mark 50%* *Time allocated: 03 Hrs*

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

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

Specific heat capacity of water ***4.2 kJ/kg K***

1.

a. Describe the three types of expansion of solid materials. (4 marks)

b. Write expressions for coefficient of linear expansion and coefficient of superficial expansion using the coefficient of volumetric expansion of solid materials (4 marks)

c. A Nickel-alloy rod has a length of ***10.001 cm*** at ***25 ^0C*** and length of ***10.025 cm*** at ***105 ^0C***. Assume that there is no bending or twisting of the rod during the expansion

i. What is the coefficient of linear expansion of the alloy? (4 marks)

ii. What is the length of the rod at the freezing point of water? (4 marks)

iii. What is the temperature if the length of the rod is ***10.015 cm***? (4 marks)

2. A cold storage compartment is covered with a thickness of ***120 mm*** with insulating material which has a coefficient of thermal conductivity of 6.8×10^{-2} ***W/m K*** and a thickness of ***40 mm*** with metal which has a coefficient of thermal conductivity of ***68 W/m K***. The outside and inside face temperatures of the material is ***25 ^0C*** and ***– 4 ^0C***. Determine

i. The overall heat transfer coefficient (5 marks)

ii. Rate of heat transfer trough the wall (5 marks)

iii. The intermediate temperature (5 marks)

iv. Draw the temperature variation through the wall (5 marks)

3.

a. Describe ***Dolton's partial pressure law*** (5 marks)

b. A vessel of volume ***14 m^3*** contains air and wet steam having ***0.96*** dryness fraction at a total pressure of ***0.16 bar*** and temperature ***42 ^0C***. Taking ***R*** for air = ***0.287 kJ/kg K***. Determine

i. The ***partial pressure of steam*** in the vessel (3 marks)

ii. The ***partial pressure of air*** in the vessel (3 marks)

iii. The ***specific volume of wet steam*** in the vessel (3 marks)

iv. The ***mass of air*** in the vessel (3 marks)

v. The ***mass of steam*** in the vessel (3 marks)

4.

a. Briefly explain the following terms

i. Boyle's law

ii. Charles' law

iii. Avogadro's law (6 marks)

b. Write an expression for the gas constant by using the molecular mass and universal gas constant. (4 marks)

c. The analysis by mass of sample of air is ***23.14 % Oxygen***, ***75.53% Nitrogen***, ***1.28% Argon*** and ***0.05 % carbon dioxide***. Estimate the gas constant for air.

Taking the molecular weights of ***O_2, N_2, Ar, CO_2*** as ***32, 28, 40*** and ***44*** respectively, and the universal gas constant ***8.314 kJ/ k-mol K***. (10 marks)

5.

a. Write down the ***characteristic gas equation*** and name each term in its (4 marks)

b. Describe the specific capacity of gas under constant pressure (***Cp***) and constant volume (***Cv***). Hence, write an expression for ***gas constant*** using specific heat capacities (***Cp*** and ***Cv***) (6 marks)

c. An air reservoir contains ***20 kg*** of air at ***3.2 MPa*** and ***16 ^0C***. If the air is heated to ***65 ^0C***, calculate

i. The volume of the air reservoir (3 marks)

ii. The new pressure (3 marks)

iii. The heat energy transfer and internal energy change (4 marks)

Neglect any expansion of the reservoir

6. In an air compressor, air is compressed according to the law $PV^{1.25} = constant$. The initial conditions of the air is ***1.013 bar***, and ***27 ^0C***. The compressor has a bore of ***300 mm*** and the stroke of ***450 mm***. the clearance volume is ***4%*** of the swept volume. If the final pressure is ***12 bar***, calculate

   i. For what length of the stroke air is delivered (5 marks)

   ii. The volume of air delivered per stroke (5 marks)

   iii. The final temperature (5 marks)

   iv. The mass of the air in the cylinder before the compression (5 marks)

7.

   a. A gas follows a ploltropic process according to the law $PV^n = constant$. Where n is the polytropic index. Write down expressions for

      i. The temperature ratio (T_2/ T_1) using volume ratio (v_2/ v_1) and pressure ratio (P_2/ P_1). (2 marks)

      ii. Work done (3 marks)

   b. ***0.20 kg*** of air at a pressure of ***200 kPa*** occupies ***0.14 m^3*** and from this condition it is compressed to ***1.6 MPa*** according to the law $PV^{1.25} = constant$. Determine

      i. The change of internal energy of the air (5 marks)

      ii. The work done on or by the air (5 marks)

      iii. The heat received or rejected by the air (5 marks)

8.

   a. Write expressions for the ***entropy change*** during process at constant volume and constant pressure. (4 marks)

   b. In a reversible process ***0.20 m^3*** of air at a pressure of ***3.15 bar*** and the temperature of ***47 ^0C*** is heated at constant pressure to a volume of ***0.80 m^3***. It is then cooled at constant volume back to the original temperature.

      i. Sketch the process on a ***T-S diagram*** (4 marks)

      Estimate

      ii. The temperature of air after heating (2 marks)

      iii. The ***net flow of heat*** during the process (4 marks)

      iv. The ***net entropy change*** (6 marks)

9.

a. Some thermodynamic and transport properties of ***refrigerant -134a*** contain in the table below. Using the properties of vapour complete the table (6 marks)

Pressure, bar	*Saturation temperature, ^0C*	*Enthalpy, kJ/kg*		
		h_f	h_{fg}	h_g
1.640	*-15*	*31.97*	*209.54*	.....
2.94	0	51.83	.....	250.50
7.706	*30*	.....	*173.13*	*266.71*

b. Refrigerant ***-134a*** uses to operate refrigerant plant in the temperature range between ***25 ^0C*** and ***-15 ^0C***. Saturated liquid at ***30 ^0C*** expands to a wet vapour at ***1.640 bar*** by the throttling valve.

i. Draw the Temperature-Enthalpy diagram for the expansion (5 marks)

ii. Find the enthalpy after the expansion (3 marks)

iii. Estimate the dryness fraction after the expansion (6 marks)

Hint: Use the properties in the table given in the ***part a***

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 41)

- *This question paper consists of six questions.*
- *Answer All SIX questions*

Date: 2020.01.17 *Pass mark 50%* *Time allocated: 03 Hrs*

1). a. Name the 4 purposes of engineering threads.
b. Briefly explain parameters of ISO metric thread with a sketch. (2 x 4 marks)
c. Briefly explain the following thread terms.
i. Major diameter.
ii. Minor diameter.
iii. Pitch diameter.
iv. Lead.
v. Helix angle. (5 x 2 marks)

2)
a. Explain the meaning of workshop practice.
b. What are PPE used in ship board practice? (2 x 5 marks)

3). a. What do you understand by weld metal protection?
b. Which methods used for this?
c. Explain the classification of welding.
d. What are the principals of fusion welding?
e. Briefly explain about weld metal protection. (5 x 4 marks)

4). a. Briefly explain the MIG welding with a sketch?
b. What are the advantages of Inert gas welding?
c. Briefly explain the stick welding with a sketch.
d. Name the defects with respect to weld quality. (4 x 4 marks)

5). a. What do you understand by turning of flat surfaces?
b. Briefly explain with a sketch how do you perform turning of cylindrical surfaces?
c. What is the advantage of Turret lathe machine?
d. Name the types of lathe machines. (4 x 4 marks)

6). a. Define the term "drilling".
b. What are the 3 types of drilling machines?
c. Name 3 functions of cutting fluid.
d. Name the tools need for drilling operation.
e. Name the materials used for drill bits. (5 x 4 marks)