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Colombo International Nautical and Engineering College
CINEC CAMPUS
Faculty of Marine Engineering
Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 46)

2ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

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

|		
Date: 2024 .01.10	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 (4 marks)
   ii. Define the terms current and voltage. (4 marks)
   b) The circuit consists of a 100V battery with an insignificant internal resistance connected to five resistors which are 30 Ω, 15 Ω, 20 Ω, 20 Ω and R. If the battery supplies 4 A, (6 marks)
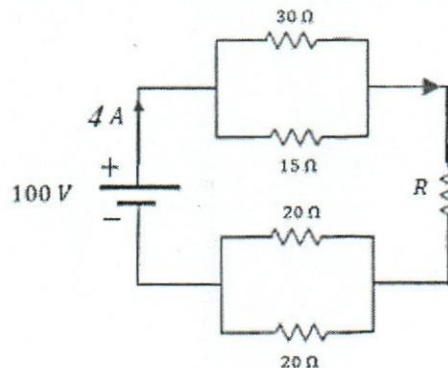

   i. What is the voltage drop across 30 Ω resistor?
   ii. Calculate value of R.
   iii. What is the power consumption of R resistor?

   c) Calculate the generated power of above 100 V battery, if 15 Ω resistor is disconnected.
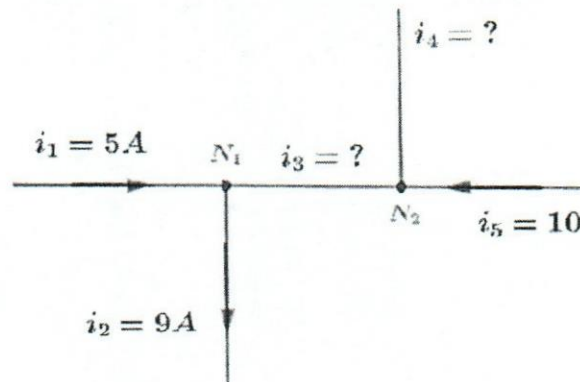
   (6 marks)

2. a) Define resistance and describe the key reasons it changes in a conducting material. (6 marks)

b) What is the resistance of a copper wire with resistivity of 1.78×10^{-8} Ωm, diameter of 10mm, and length of 1000m? (4 marks)

c) i. Find the equivalent resistance (R_{ad}) of following resistor network. (4 marks)
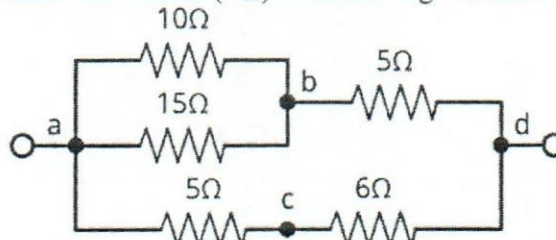
ii. Evaluate the equivalent resistance (R_{af}) of the following network using star delta transformation. (6 marks)
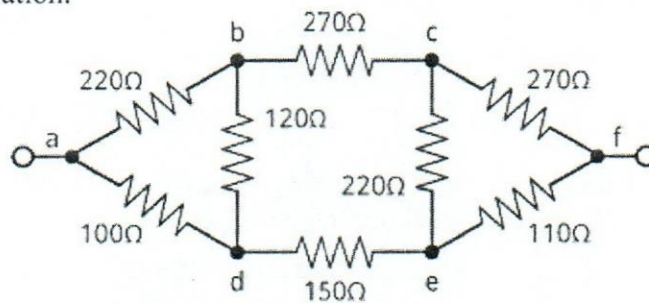
3. a) State Kirchhoff current law and Kirchhoff voltage law. (06 marks)

b) The figure below shows currents in a part of electric circuit.
Find the values of current 'i_3 and i_4'. (04 marks)

c) i. Using Kirchhoff's laws find each branch current. (08 marks)
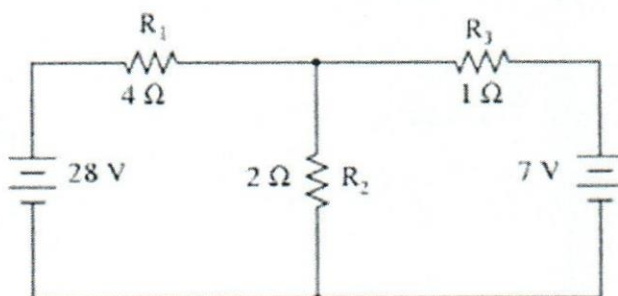
ii. Hence, calculate the voltage across the 2 Ω resistor. (02 marks)

4. a) i. Define the term capacitance. (03 marks)

   ii. Draw the charging and discharging voltage curves of capacitor. (04 marks)

   b) Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2 mm thick and relative permittivity 6. ($\varepsilon_0 = 8.854\times10^{-12}$ F·m^{-1}) (04 marks)

   c) i. Determine the equivalent capacitance between A and B for the group of capacitors shown in below. (06 marks)
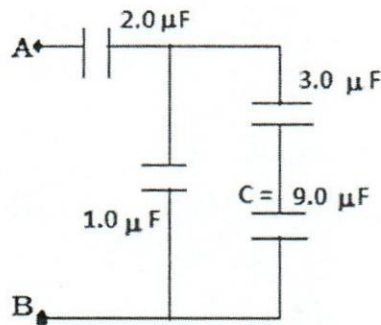
   ii. Find charge on 3.0µF capacitor. (03 marks)

5. a) Describe formation of diode from pure silicon crystal to P-N junction diode. (6 marks)

   b) Draw circuit diagram of the full wave rectifier with waveform. (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)
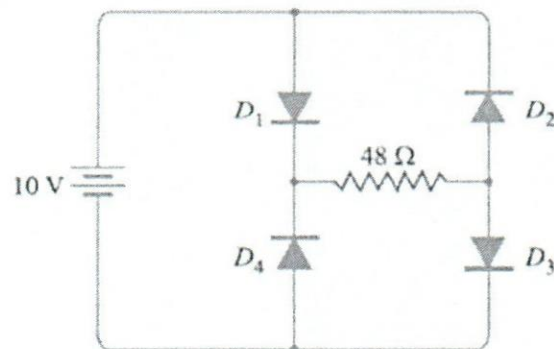
8. a) Express Thevenin's theorem (04 marks)

 b) Using Thevenin's theorem, Find the current in 8 Ω load resistor. Given that the battery has internal resistance of zero. (12 marks)
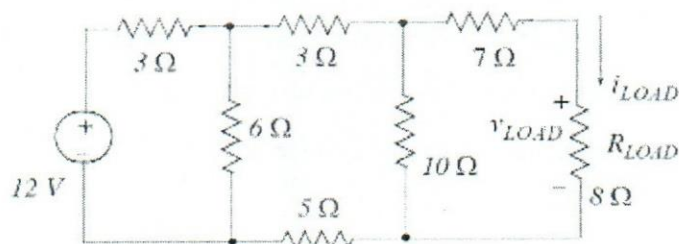
 c) Hence, find power consumption of load resistance. (04 marks)

9. a) Define reactance and impedance in A.C circuits. (04 marks)

 b) A series RLC circuit with $L = 100 \ mH$, $C = 50 \ \mu F$ and $R = 40.0 \ \Omega$ is connected to the power supply with 240V and 50Hz.
 Find
 i. the impedance of the circuit? (04 marks)
 ii. the current (04 marks)
 iii. the power factor (04 marks)

 d) If inductance and capacitance of above circuit are variables, what is the minimum impedance

 and maximum current of the circuit. (04 marks)

6. a) i.   What are the differences between intrinsic semiconductor and extrinsic semiconductor?

                                                                    (02 marks)

     ii.   What are the majority carriers and minority carriers of P-type semiconductor?

                                                                    (02 marks)

    b) i.   Draw Schematic diagrams of pnp and npn transistors and name each terminal.

                                                                    (04 marks)

     ii.   What are the three methods of transistor biasing?   (04 marks)

    c) Following is a "Si" transistor biased in commom emitter configuration, having $V_{BE} = 0.7V$.
       Determine the operating point.   (08 marks)
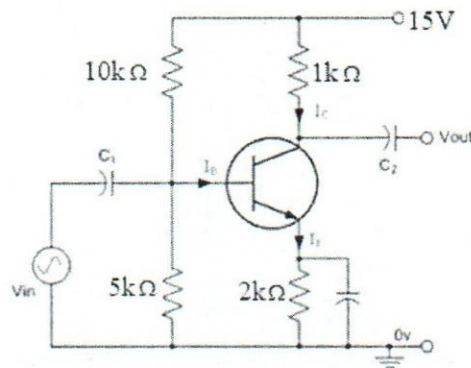
7. a) Identify the terminals in the following op – amp.   (06 marks)
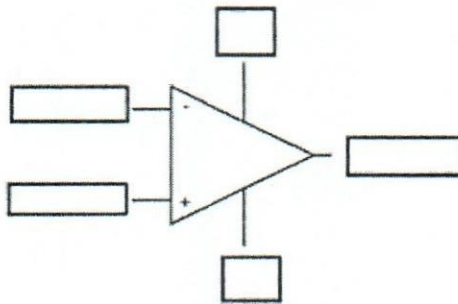
    b) A non-inverting amplifier feedback resistance and input resistance are $4.7 \ k\Omega$ and $3 \ k\Omega$
       respectively. Determine the gain of following circuit   (08 marks)
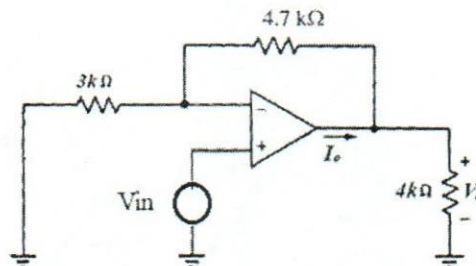
    c) Draw the circuit diagram of summing amplifier.   (06 marks)

02ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

Date: 2024.01.09 Pass mark 70% *Time allocated: 03Hrs*
- Answer any *Six* questions

Question 01

a) Sketch a turbocharger suitable for a large bore 2 stroke engine and name all parts. (10 Marks)

b) Define the word " Turbocharger Surging" . (2 Marks)

c) What are the causes of turbocharger surging ? (4 Marks)

Question 02

a) With the aid of sketches mention the difference between purifier and clarifier. (10 Marks)

b) Mention the correct procedure of disposal of sludge on board ships. (3 Marks)

c) What are the fuel oil treatment methods employed on board ships ? (3 Marks)

Question 03

a) Sketch and describe the operation of a 2-stage air compressor. (10 Marks)

b) What are the safety devices fitted to such air compressors ? (3 Marks)

c) What are the advantages of using intercoolers ? (3 Marks)

Question 04

a) Sketch a starting air system suitable for a large bore 2-Stroke engine and mark all the items.

(8 Marks)

b) What is the purpose of turning gear inter-lock ? (2 Marks)

c) What are the safety devices fitted to this system ? (3 Marks)

d) Briefly explain what is meant by starting air line explosion? (3 Marks)

Question 05

a) Sketch an auxiliary boiler fitted to a motor vessel and mark all the mountings. (10 Marks)

b) What is meant by "blow-back" of a boiler? (2 Marks)

c) What is "steam hammering" in steam system? (2 Marks)

d) What are the dangers involved with high water level in a boiler? (2 Marks)

Question 06

a) Sketch and describe an oil cooled piston suitable for a large bore 2-stroke engine. (12 Marks)

b) What is the function of piston rings? (4 Marks)

Question 07

Briefly explain the working principle and the uses of

    a) Steam turbine (8 Marks)

    b) Gas turbine (8 Marks)

Question 08

a) Sketch and explain the working principal of a fuel injector of a large bore slow speed diesel engine.

(10 Marks)

b) What is "Penetration", "Turbulence" and "Atomization ? (3 Marks)

c) Explain how injection pressure is adjusted. (3 Marks)

Question 09

Define the following words.

a) Indicated Power (2 Marks)

b) Brake Power (2 Marks)

c) Mechanical Efficiency (2 Marks)

d) Using following data calculate the Indicated Power of a 2-stroke 6-cylinder engine. (10 Marks)

Area of PV diagram	= 840 mm^2		
Length of Diagram	= 105 mm		
Spring constant	= 200 KN/ M^2 per mm		
Diameter of cylinder	= 960 mm		
Stroke of piston	= 2.5 M	Engine RPM	= 90

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2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge General

- *Answer any Six questions*
  Date: 2024.01.08   Pass mark 70%   *Time allocated: 03 Hrs*

1.) a) Write down 05 mechanical properties of materials & briefly explain.   (10 Marks)
    b) Write down 03 heat treatment processes & briefly explain.   (06 Marks)

2.) a) Sketch a fuel oil system used on ship.   (10 Marks)
    b) What is the purpose of mixing column?   (02 Marks)
    c) What is the difference between Clarifier & Separator?   (04 Marks)

3.) a) Explain with aid of sketches, the hunting gear operations.   (08 Marks)
    b) What are the two type of steering gear actuator?   (02 Marks)
    c) What are the steering gear requirement & safety protections? Briefly explain.   (04 Marks)
    d) What are the two parts of tele motor?   (02 Marks)

4.) a) Draw the line diagram of the refrigerator circuit & name its components.   (06 Marks)
    b) Write down the purpose of each component.   (04 Marks)
    c) Briefly explain the pumping down procedure.   (04 Marks)
    d) List the safety devices of the refrigeration system.   (02 Marks)

5.) With reference to the plate type freshwater generator,
    a) Draw & explain the functions.   (10 Marks)
    b) Briefly explain faults in the freshwater generator.   (06 Marks)

6.) Draw and explain the operation of oily water separator.   (16 Marks)

7.) a) Name two types of heat exchanges found in ship & list their advantages & disadvantages.

          (06 Marks)
    b) State 04 types of heat exchanges used on ship.   (04 Marks)
    c) What are the flaw patterns in heat exchangers. Briefly explain.   (06 Marks)

8.) a) Draw Reciprocating Displacement pump. (06 Marks)

b) What are the advantages & disadvantages of Reciprocating Displacement pump.

(06 Marks)

c) State 04 types of pumps used on ships. (04 Marks)

9.) a. Using a suitable diagram explain the relationship between Detecting element, measuring unit and measuring element. (08 Marks)

b. Using a suitable diagram explain how open loop gain is higher than closed loop gain.

(08 Marks)

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 46)

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

Date: 2023.12.03   Pass mark 50%   Time allocated: 03 Hrs

Q 1.   Briefly explain the 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 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) 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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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

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

| Date: 2023.09.23	Pass mark 50%	Time allocated: 03 Hrs

1.

1.1 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. (5 marks)
    b. Find the time it will take box **A** to hit the ground. (5 marks)
    c. Calculate the velocity of boxes when box **A** hit the ground (4 marks)

1.2 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. (3 marks)
    e. Find the maximum height Box **B** will reach measured from floor (3 marks)
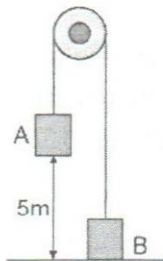
2.

2.1 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)

3.

3.1 What is center of pressure? (4 marks)

3.2 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 $\frac{\pi d^4}{64}$)

4.

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

4.2 '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)

5.

5.1 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)

5.2 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)

6.

6.1 Write four equations that could describe the motion of an object in a straight line experiencing uniform acceleration. (4 marks)

6.2. 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)

6.3 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)

7.

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

7.2 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)

8.

8.1 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)

8.2 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)

8.3 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)

8.4 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)

9.

9.1 Define "radian" and derive equations for angular displacement, angular velocity, and angular acceleration. (6 Marks)

9.2 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)

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

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

Date: 2023.12.02   Pass mark 50%   *Time allocated: 03 Hrs*

Answer 6 questions only

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 6×10^2 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)
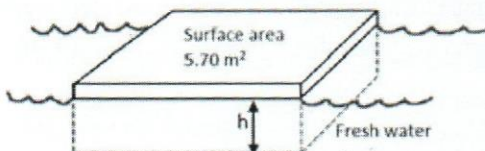
2.

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 <u>upward</u> 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**.
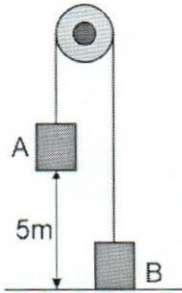
(8 marks)

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)
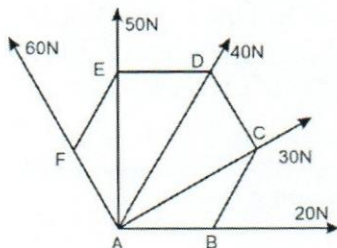
6.

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)

40mm

R30mm
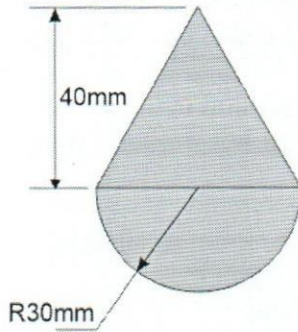
7.

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 $\frac{\pi D^4}{64}$)

R100mm

Free surface

Fresh water
Density
1000 kgm^3
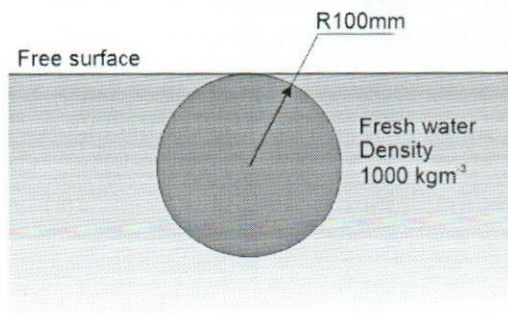
8.

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)
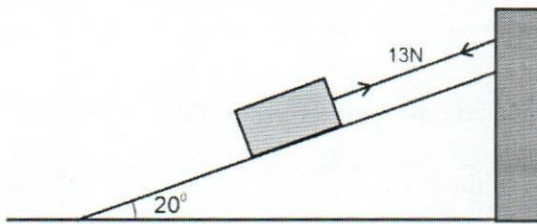
9.

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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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH NO 46)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Thermodynamics

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

Date: 2023.09.24   Pass mark 50%   Time allocated: 03 Hrs

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

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

Specific heat capacity of water **4.2 kJ/kg K,** 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.   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 °C**. Neglecting hat losses,

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

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

2.

   a. State the First Law in thermodynamics   (3 marks)

   b. Describe the specific heat capacity of a gas   (5 marks)

   c. **0.5 kg** of air initially at **25 °C** and **2 bar** is occupied in a volume of **0.02 m³**. The air sample is heated under constant pressure to **100 °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. 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 $0\ ^0C$ is $0.5\ m$ in length. Raising the temperature of the rod from $25\ ^0C$ to $45\ ^0C$ produces an extension of $0.17\ mm$. Find

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

        ii. The length of the rod at $25\ ^0C$ and $45\ ^0C$ (4 marks)

    d. A sample of oil is filled in a copper can of $100\ ml$ at $25\ ^0C$ and it is heated to $50\ ^0C$ 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)

4.

    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 $32\ ^0C$ and the inside temperature is $4\ ^0C$. 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.

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. 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

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*

8.

a. State the steady flow energy equation in full, defining the symbols and unit used

        (5 marks)

b. Air passes through a gas turbine at the rate of *10 kg/s*. The gas enters the turbine with a velocity of *100 m/s* and specific volume of *0.68 m^3/kg*. The gas leaves the turbine with a specific volume of *1.85 m^3/kg*. The exit area of the turbine is *0.045 m^2*. In its passage through the turbine system, the specific enthalpy of air is reduced by *300 kJ/kg* and there is a heat transfer loss of *48 kJ/kg*. Determine

    i. The inlet area of the turbine in m^2 (5 marks)
    ii. The exit velocity of the air *m/s*   (5 marks)
    iii. The power developed by the turbine system in *kW*   (5 marks)

9. 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)

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
MARITIME LAW

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

Date: 23.09.2023   *Pass mark 50%*   *Time allocated: 03 Hrs*

(01.)   With reference to UNCLOS, explain what is,
    a) An innocent passage?   (04 Marks)
    b) Territorial sea?   (04 Marks)
    c) Baseline?   (04 Marks)
    d) Continental shelf?   (04 Marks)

(02.)   With reference to MARPOL ANNEX I,
    a) What are the regulations when pumping out machinery spaces bilges outside special areas for ships more than 10,000 GT?   (04 Marks)
    b) What certificate/ documents should be carried on board to comply with this annex? (08 Marks)
    c) Name the special areas which comes under MARPOL ANNEX I?   (04 Marks)

(03.)   a) What is the IMO? Briefly explain.   (04 Marks)
    b) Name the 04 committees of IMO.   (04 Marks)
    c) What is TACIT approval and list the advantages of it.   (08 Marks)

(04.)   a) What are the 14 chapters contain in SOLAS?   (08 Marks)
    b) What is non-combustible material?   (04 Marks)
    c) What is the standard fire test?   (04 Marks)

(05.)   With reference to ISM code,
   a) Explain why ISM is necessary?   (04 Marks)
   b) Who is the designated person?   (04 Marks)
   c) What are the certificates to be issued under ISM code?   (02 Marks)
   d) What is a critical equipment?   (02 Marks)
   e) What i non-conformity?   (04 Marks)

(06.)   As per ISPS code,
   a) What is a security level? Explain.   (04 Marks)
   b) Explain ship security plan.   (04 Marks)
   c) Explain the role of SSO and CSO.   (04 Marks)
   d) What is a ship security alert system?   (04 Marks)

(07.)   With reference to IMDG code,
   a) What is the objective of the code?   (04 Marks)
   b) What is the reason for the IMDG code to be update every two years? (04 Marks)
   c) What are the 09 classes of dangerous goods?   (08 Marks)

(08.)   With reference to Annex VI,
   a) List the substances prohibited to be burnt in shipboard incinerators. (04 Marks)
   b) State 02 Ozone depleting substances.   (02 Marks)
   c) Explain how ship engines exhaust gases cause air pollution. Also explain what the
      preventive actions are taken to control pollution by exhaust gases. (08 Marks)
   d) Define emission control area.   (02 Marks)

(09.)   With regard to MLC 2006,
   a) Name 05 titles of the MLC 2006.   (05 Marks)
   b) Identify 05 areas that will be attended by the port state inspectors? (05 Marks)
   c) Briefly explain the conditions for the minimum working and rest hours on board.

                                                                   (06 Marks)

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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Workshop Theory (Batch 46)

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

Date: 2024.09.24   Pass mark 50%   Time allocated: 03 Hrs

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

    (i) Dial gauge   (vi) Filler gauge

    (ii) Depth gauge   (vii) Thread gauge

    (iii) V block   (viii) Scriber

    (iv) Face- plate   (ix) Centre punch

    (v) Outside and inside calipers.   (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 examples of engineering component manufactured by cast iron. What are the advantages and disadvantages 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)