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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 REPEAT EXAMINATION QUESTION PAPER
Engineering Knowledge General

- *Answer any Six questions.*
  Date: 2023.03.11   Pass mark 70%   Time allocated: 03 Hrs

1 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]

2. 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]

3 a) Sketch a hydraulically controlled 4-ram steering system showing the main parts   [08 marks]

 b) make a sketch and describe the function of the floating lever.   [08 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) 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]

6   a) Sketch and name the low-pressure freshwater generator including all important components.   [10 Marks]

   b) Briefly explain how a reverse osmosis desalinating plant operate   [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. Oily water separator is a very important piece of equipment on board a ship.

   a) For what purpose is it used?   [02 Marks]

   b) Sketch and describe an oily water separator.   [14 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: 2023.03.05*

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 cm². Calculate
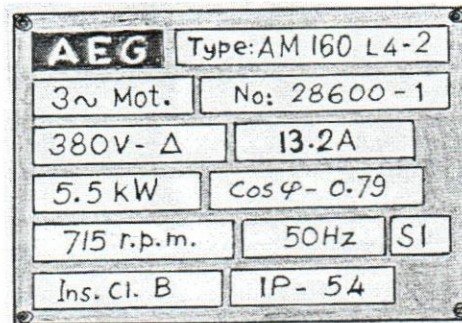
   i.   The frequency

   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.

AEG	Type: AM 160 L4-2
3~ Mot.	No: 28600 - 1
380V- Δ	13.2A
5.5 kW	Cos φ- 0.79
715 r.p.m.	50Hz S1
Ins. Cl. B	IP- 54

    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 NO 45)

1ST SEMESTER REPAT EXAMINATION QUESTION PAPER
Thermodynamics

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

Date: 2023.02.18   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 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 m**l 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)

2.

   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 ^0C** (2 marks)

      ii. The volume of **10 kg** of Oxygen at **10 bar** and **-5 ^0C** (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 m³/kg* of Oxygen gas at *27 ⁰C* is heated at constant volume to a temperature of *200 ⁰C*. calculate the initial pressure, the final pressure, heat transfer and enthalpy change

  (8 marks)

3.

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

  b. *0.5 kg* of air initially at *25 ⁰ C* and *2 bar* is occupied in a volume of *0.02 m³*. The air sample is heated under constant pressure to *100 ⁰C*. Then it is cooled under constant volume until its temperature is back to the initial value. Finally, it compressed isothermally to the initial conditions.

  i. Draw the *PV* diagram   (4 marks)

  Determine the followings

  ii. The final volume and pressure of air   (4 marks)

  iii. Work done during the heating process   (3 marks)

  iv. Heat transfer under constant pressure   (3 marks)

  v. Heat transfer under constant volume   (3 marks)

4.

  e. Describe the specific heat capacity of a gas   (4 marks)

  f. 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)

  g. Taking characteristic gas constant, R and adiabatic index, γ for Oxygen as *0.26 kJ/kg K* and *1.393* respectively, estimate the specific heat capacities c_p and c_v of Oxygen.

  (4 marks)

  h. *0.30 m³/kg* of Oxygen gas at *27 ⁰C* is compressed adiabatically to a temperature of *257 ⁰C*. Estimate the initial pressure, the final pressure, internal energy and enthalpy change

  (8 marks)

5.

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 **2.0 cm** thick has formed on its surface. The air above the ice is **-20 °C**. Take the thermal conductivity of ice to be **0.5023 W/m K** and its density to be **0.92 g/cm³**.

    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)

6.

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*

7.

a. Describe Dolton's partial pressure law (3 marks)

b. A tank of volume **5 m³** contains air and wet steam having **0.92** dryness fraction at a total pressure of **1.013 bar** and temperature **27 °C**. 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)

8. A low grade fuel with **64 %** of **Carbon (12)**, **8 %** of **Hydrogen (H₂)**, **3 %** of **Sulphur**, **2 %** of **Oxygen** and the remaining incombustible material. Determine

    a.   The calorific value of the fuel   (4 marks)

    b.   The minimum air required for the complete combustion of 1 kg fuel   (4 marks)

    c.   The actual mass of air if the excess air supply is **40 %**   (4 marks)

    d.   The composition of the exhaust gas on percentage mass basis.   (8 marks)

Take the calorific values of **C, H** and **S 33.7, 144** and **8.3 MJ/kg** respectively.

9.

    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 **2.5 kg/s**. The gas enters the turbine with a velocity of **200 m/s** and specific volume of **0.82 m³/kg**. The gas leaves the turbine with a specific volume of **1.95 m³/kg**. The exit area of the turbine is **0.03 m²**. In its passage through the turbine system, the specific enthalpy of air is reduced by **350 kJ/kg** and there is a heat transfer loss of **35 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)

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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

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

| Date: 2023.03.04 | 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.
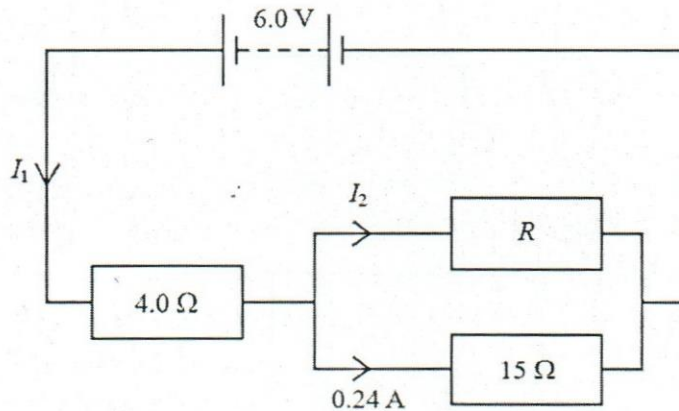

   i. Calculate the potential difference across the 15 Ω resistor.
   ii. Calculate the current I_1 in the 4.0 Ω resistor.
   iii. Calculate the current I_2 and the resistance R. (9 marks)

   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)
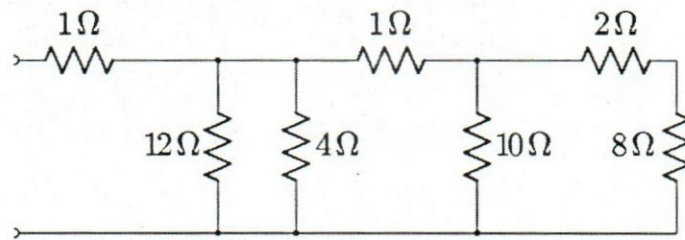
3. a) State Kirchhoff current law and Kirchhoff voltage law.   (06 marks)

    b) The figure below shows currents in a part of electric circuit.
        Find value of current 'i'.   (04 marks)
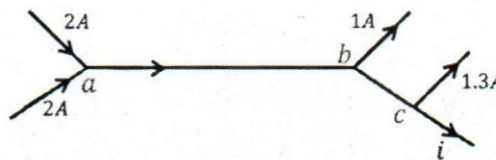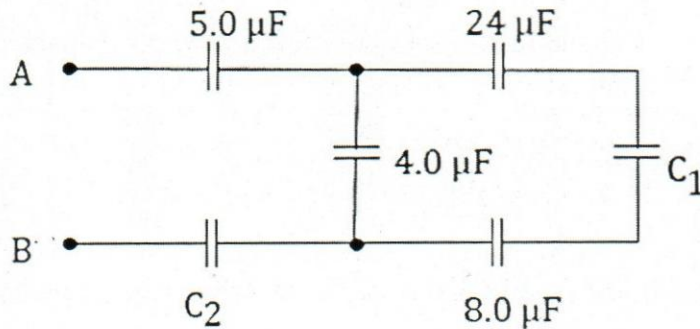

    c) i.   Using Kirchhoff's laws find each branch current.   (08 marks)
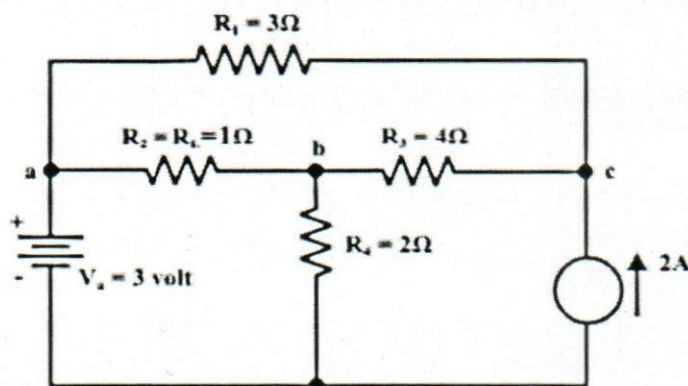

    ii.   Hence, calculate the voltage across the current source.   (02 marks)

4. 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)
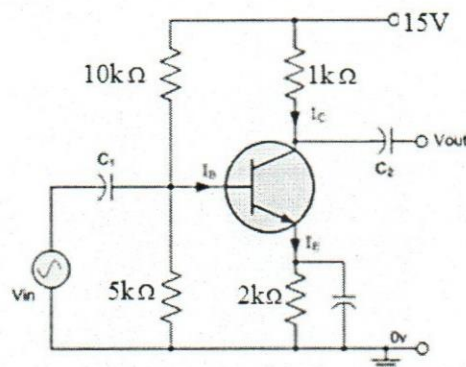

  c)   Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2mm thick and relative permittivity 6. ($\varepsilon_0 = 8.854\times10^{-12}$ F·m^{-1})   (6 marks)
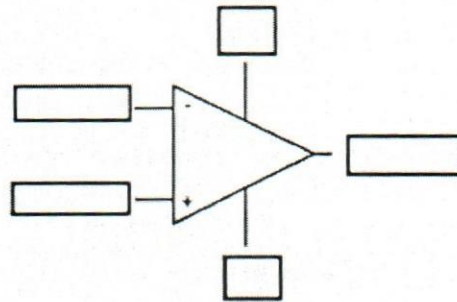
5. a) Describe formation of diode from pure silicon crystal to P-N junction diode.   (6 marks)
  b) Draw schematic diagrams of the full wave and half wave rectifier circuits.   (6 marks)
  c) Determine the current I in the circuit shown in below. Assume the diodes to be of silicon and forward resistance of diodes to be zero.   (8 marks)
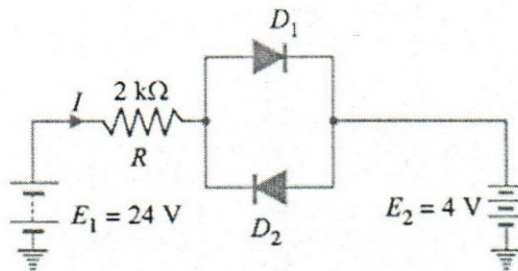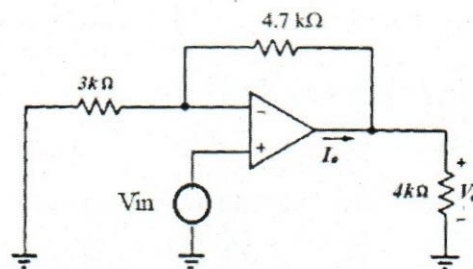

6. a) Draw Schematic diagrams of pnp and npn transistors.   (04 marks)
  b) Draw the circuit diagrams for the various methods of transistor biasing.   (06 marks)
  c) Following is a "Si" transistor biased in commom emitter configuration, having $V_{BE} = 0.7V$. Determine the operating point.   (10 marks)
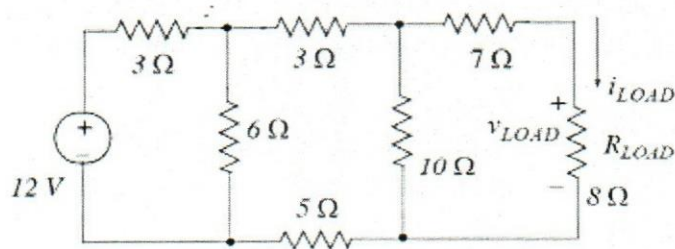
7. a) Identify the terminals in the following op – amp. (06 marks)

b) A non-inverting amplifier feedback resistance and input resistance are 4.7 kΩ and 3 kΩ respectively. Determine V_o and I_o, if $v_{in} = 0.1 \sin \omega t$ (10 marks)

c) Draw the circuit diagram of integrator circuit. (04 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) Explain behavior of semiconductor material with temperature. (04 marks)

b) i. What are the differences between intrinsic semiconductor and extrinsic semiconductor? (06 marks)

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

(04 marks)

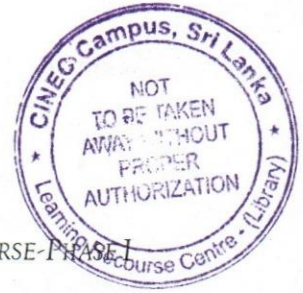c) Explain forward biasing and reverse biasing of diodes. (06 marks)

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COURSE CODE: ED 0350 PI (BATCH 43)

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Mathematics

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

Date: 2023.03.04   Pass mark 50%   Time allocated: 03 Hrs

1.

   a)   Evaluate $(243)^{\frac{3}{5}}$ (6 marks)

   b)   Simplify $\dfrac{1}{1+a^{x-y}}+\dfrac{1}{1+a^{y-x}}$ (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.

2. a)   Prove that $4^{n+1} + 4^n - 3\left(4^{n-1}\right)$ is divisible by 17 for all positive integers of n.

                          (06 marks)

   b)   Simplify $\dfrac{1}{1+a^{y-x}+a^{z-x}}+\dfrac{1}{1+a^{x-y}+a^{z-y}}+\dfrac{1}{1+a^{x-z}+a^{y-z}}$ (07 marks)

   c)   Solve for x, $8^{2x-3} = \dfrac{1}{\sqrt{4^{x+2}}}$ (07 marks)

3. 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)

4.

a) Express following complex number in form of $a+ib$ (06 marks)

$$\frac{(1+i)(1+2i)}{(1+3i)}$$

b) Express as complex numbers in the form $r\angle\theta$ (09 marks)

  i. $\sqrt{3}-i$ ii. i^{2023} iii. $3-3i$

c) Find the square root of $1-i$ (05 marks)

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

5.

a) Prove that   (06 marks)

  i. $\tan^2 x - \sin^2 x = \tan^2 x . \sin^2 x$

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

b) Solve the trigonometric equation $\sin x + \sqrt{3}\cos x = 1$.   (06 marks)

c) Hence, Sketch the graph of $f(x) = 2\sin\left(x + \dfrac{\pi}{3}\right) - 1$.   (08 marks)

6.

a) Evaluate   (6 marks)

  i.   i. $\displaystyle\lim_{x\to 2}\frac{x^5 - 32}{x-2}$ ii. $\displaystyle\lim_{x\to 0}\frac{x\tan x}{1-\cos x}$

b) Differentiate following expressions with respect to x.   (6 marks)

  i. $\dfrac{x^3}{1-x}$ ii. $(1+x^2)\sin x^2$ iii. $\sin(e^x \tan x)$

c) If $y = \dfrac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2)\dfrac{d^2 y}{dx^2} + 3x\dfrac{dy}{dx} = 0$.   (8 marks)

7.

a) Find the partial fractions of $\dfrac{x^3 + x^2 + 2x + 1}{x(x+1)}$ (06 marks)

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

$$\int \frac{x^3 + x^2 + 2x + 1}{x(x+1)}dx$$

c) Evaluate the integral $\displaystyle\int_0^{\pi/4} \frac{1}{1+\sin x}dx$.   (08 marks)

8. a) Evaluate (06 marks)

$$\underset{x\to 0}{Lim}\ \frac{1-\cos^3 x}{x\sin x\cos x}$$

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. (04 marks)

9.

a) If $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, find value of α and β such that

$$A^{-1} = \frac{1}{6}(A^2 + \alpha A + \beta I)$$ (06 marks)

b) Show that $\begin{vmatrix} 0 & b & c \\ b & 0 & a \\ c & a & 0 \end{vmatrix} = 2abc$ (06 marks)

c) Find the inverse of $A = \begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$ (08 marks)

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COURSE CODE: ED 0350 PI (BATCH 44)

02ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge Motor

Date: 2023.01.15   *Pass mark 70%*   *Time allocated: 03Hrs*
• *Answer any **Six** questions*

1. a) Make a detailed sketch of a fuel oil flow diagram starting from DB tank to Main Engine showing all the essential components.   (12 Marks)

    b) What is the purpose of using following component

       i. Viscotherm   (02 Marks)

       ii. Mixing tank   (02 Marks)

2. a) Sketch and describe the operation of a 2-stage air compressor.   (10Marks)
    b) What are the safety devices fitted to an air compressor?   (03 Marks)

    c) Explain why intercoolers and aftercoolers are fitted.   (03 Marks)

3. a) Sketch a smoke tube boiler widely use in marine practice, labelling all the mountings and state the purpose of each of them.   (12 marks)

    b) Explain the procedure for gauge glass blowdown with a suitable sketch.   (04 Marks)

4. With the aid of a sketch explain the working principle of a fuel oil injector of a large bore slow speed diesel engine   (16 marks)

5. a) Briefly describe the conditions which creates a dangerous oil mists in engine crank case.

    (04 Marks)

    b) Sketch and describe the principal operation of oil- mist detector used to monitor crank case conditions. (12 Marks)

6. a) Explain 4-stroke and 2-stroke cycle using timing diagram. (08 Marks)

    b) What is the meaning of valve overlap (02 Marks)

    c) Explain efferent types of scavenging systems with aid of suitable sketches. (06 Marks)

7. a) What is tappet clearance, and why it is required? (06 Marks)
    b) What will happen if tappet clearance is less? (05 Marks)

    c) What will happen if tappet clearance is more? (05 Marks)

8. Sketch and describe the operation of Air start valve fitted on a slow speed marine engine
    (16 Marks)

9. a) What is the function of the engine Governor? (04 Marks)

    b) Sketch and describe a simple Governor suitable for a medium speed engine. (12 Marks)

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2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Knowledge General

- Answer any *Six* questions
  Date: 2023.01.14　　　　　Pass mark 70%　　　　　Time allocated: 03 Hrs

1) a) State the properties of a refrigerant. | (04 marks)

   b) Sketch and describe the function of an expansion valve. | (08 Marks)

   c) List the cut outs and safety devices on a refrigeration system. | (04 marks)

2) a) State 4 types of pumps used on ships. | (04 Marks)

   b) Sketch a double acting reciprocating pump & name it. | (06 Marks)

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

3) 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

4) a) Why is an inert gas system used on a tanker? | (04 Marks)
   b) Sketch and name the parts of an inert gas system of a tanker. | (12 Marks)

5) a) Sketch a hydraulically controlled 4-ram steering system showing the main parts

(08 Marks)

b) make a sketch and describe the function of the floating lever. (08 Marks)

6) a) Sketch and describe a plate type freshwater generator. (10 Marks)

b) How do you make the water suitable for drinking. (06 Marks)

7) Oily water separator is a very important piece of equipment on board a ship.

a) For what purpose is it used? (02 Marks)

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

8) a) Sketch and name an air handling unit used onboard (08 Marks)

b) Explain with psychrometric chart how the temperature and humidity is controlled

(08 Marks)

9) i. State the difference between closed loop and open loop control system?
ii. State 3 factors which time response of a controller depends on?
iii. Explain PID controller with the aid of sketches of block diagrams. Further briefly explain the function of each component.
iv. Mention 2 temperature-controlled applications widely used onboard.
v. Explain the fail-safe function of a system using examples.
vi. Draw a sketch of a diaphragm valve and name components. (16 Marks)

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2ND SEMESTER EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of nine questions.
- Answer Any <u>Six (06)</u> Questions

| Date: 2023.01.13 | Pass mark 50% | Time allocated: 03 Hrs |

1.

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

b) Given that $\log_3 2 = 0.6309$ and $\log_3 5 = 1.4650$. Evaluate $\log_3 45$.   (05 marks)

c) Simplify $\dfrac{\log_5 8 \times \log_3 25}{\log_{\sqrt{3}} 4}$ (05 marks)

d) Solve the logarithmic equation $\log_a(x^2 - 10) - \log_a x = 2\log_a 3$.   (05 marks)

2. a) Prove that $4^{n+1} + 4^n - 3(4^{n-1})$ is divisible by 17 for all positive integers of n.

(06 marks)

b) Simplify $\dfrac{1}{1 + a^{y-x} + a^{z-x}} + \dfrac{1}{1 + a^{x-y} + a^{z-y}} + \dfrac{1}{1 + a^{x-z} + a^{y-z}}$ (07 marks)

c) Solve for x, $8^{2x-3} = \dfrac{1}{\sqrt{4^{x+2}}}$ (07 marks)

3. a) Find the sum of roots and product of roots of equation of $\dfrac{2}{x} + 1 = 7x$.   (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 $\alpha + \dfrac{1}{\beta}$ and $\beta + \dfrac{1}{\alpha}$ is

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

4.

a) Express following complex number in form of $a+ib$ (06 marks)

$$\frac{(1+i)(1+2i)}{(1+3i)}$$

b) Express as complex numbers in the form $r\angle\theta$ (09 marks)

    i. $\sqrt{3}-i$ ii. i^{2023} iii. $3-3i$

c) Find the square root of $1-i$ (05 marks)

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

5.

a) Prove that   (06 marks)

    i. $\tan^2 x - \sin^2 x = \tan^2 x . \sin^2 x$

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

b) Solve the trigonometric equation $\sin x + \sqrt{3}\cos x = 1$.   (06 marks)

c) Hence, Sketch the graph of $f(x) = 2\sin\left(x+\dfrac{\pi}{3}\right)-1$.   (08 marks)

6.

a) Differentiate the following function with respect to x
    i. $y = \tan^2 x\left(1+e^x\right)$ (04 marks)

    ii. $y = \dfrac{\ln x}{x+1}$ (04 marks)

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

c) Find $\dfrac{\partial^3 u}{\partial x \partial y \partial z}$, if $u = e^{xyz}$ (06 marks)

7.

a) Find the partial fractions of $\dfrac{x^3 + x^2 + 2x + 1}{x(x+1)}$ (06 marks)

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

$$\int \frac{x^3 + x^2 + 2x + 1}{x(x+1)}dx$$

c) Evaluate the integral $\displaystyle\int_0^{\pi/4} \frac{1}{1+\sin x}dx$.   (08 marks)

8. a) Evaluate (06 marks)

$$\underset{x\to 0}{Lim}\ \frac{1-\cos^3 x}{x\sin x\cos x}$$

   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. (04 marks)

9.

   a) If $A=\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{pmatrix}$ and $I=\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$, find value of α and β such that

   $A^{-1}=\frac{1}{6}(A^2+\alpha A+\beta I)$ (06 marks)

   b) Show that $\begin{vmatrix} 0 & b & c \\ b & 0 & a \\ c & a & 0 \end{vmatrix}=2abc$ (06 marks)

   c) Find the inverse of $A=\begin{pmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{pmatrix}$ (08 marks)

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COURSE CODE: ED 0350 PI (BATCH NO 45)

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER

MARITIME LAW

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

  Date: 19.02.2023   Pass mark 50%   Time allocated: 03 Hrs

---

1) According to IMO

   a. What is the IMO briefly Explain   (6 marks)

   b. Explain the Procedure Of making law   (6 marks)

   c. What is the tacit Acceptance?   (4 marks)

2) Under UNCLOS describe following:

   a. Inland waters   (4 marks)

   b. Territorial waters   (4 marks)

   c. High seas   (4 marks)

   d. Archipelagic waters   (4 marks)

3) As per the SOLAS chapter 2 Part 1 & 2

   a. State the regulations pertaining to the ships' emergency generators

                                                               (6 marks)

   b. Define a noncombustible material?   (4 marks)

   c. What are "A" class divisions.   (6 marks)

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

5) Write full terms of the following abbreviations **(16 marks)**

    a. IMO   i. VOC

    b. ILO   j. SSO

    c. CMI   k. CSO

    d. ISPS Code   l. GMDSS

    e. MLC   m. DP (According to ISM)

    f. SOLAS   n. PPM

    g. ORB   o. ECA

    h. EEBD   p. ISPP

6) With related to MARPOL,

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

    b. According to annex IV, state the requirements/ conditions to discharge sewage into the sea **(06 marks)**

    c. State 2 certificates/documents required to carry onboard according to Annex IV

        (04 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 'Company 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. How does the ballast water which is carried by ships can affect the marine pollution? **(06 marks)**

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

9) With regards to MLC 2006,

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

    b. Identify 5 areas that are covered in MLC 2006 **(5 Marks)**

    c. Briefly explain the conditions for the minimum working and rest hours on board **(6 Marks)**

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2ND EXAMINATION QUESTION PAPER
Engineering Drawing

Date: 2022.01.12   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
	Dimensioning (Mark minimum 9 dimensions)	:	10 Marks
	Titles and lettering	:	05 Marks
	Optimization of space	:	05 Marks
	Boundaries Lines and over all neatness	:	05 Marks

Q: 1

The figure shows the components of a "Non-return valve". Assemble the different parts in their correct positions and draw to full size in *first angle projection* the following views;
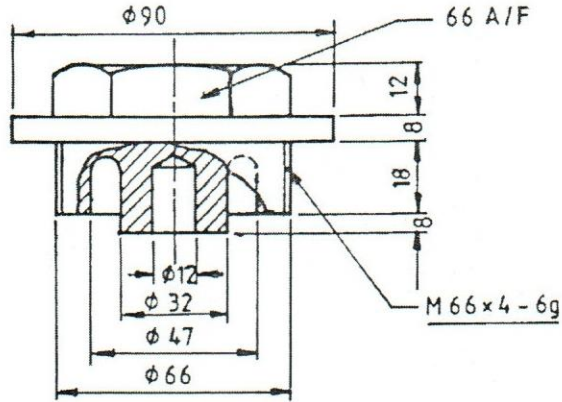
a. Sectional front elevation of the assembled valve corresponding to the given view of the valve body
b. End elevation projected in the right of view $'a'$
c. Plan projected from $'a'$

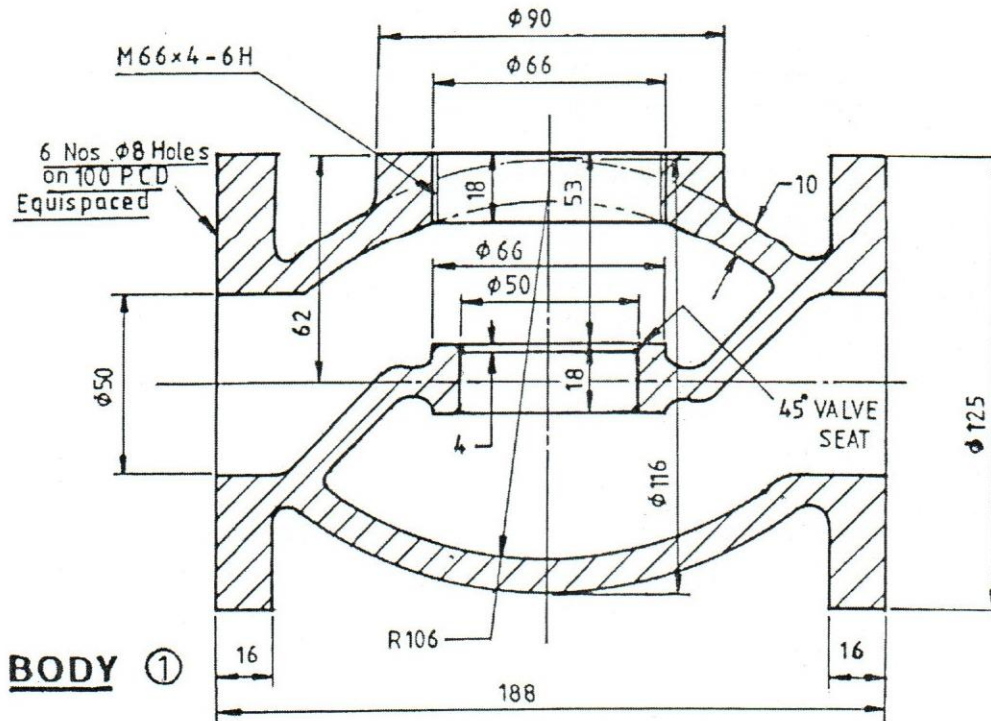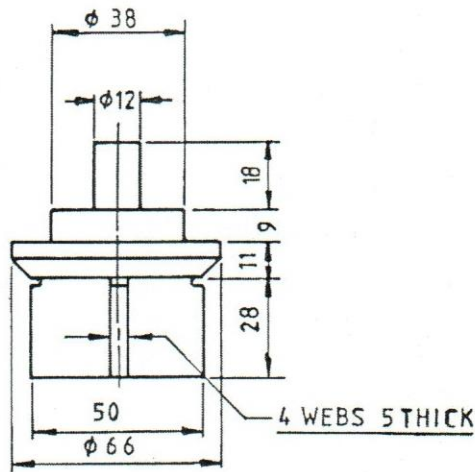*Print main title "NON RETUEN VALVE", scale and provide projection symbol and dimension your drawing.*

Estimate any missing dimensions

NON RETURN VALVE

GLAND COVER NUT ③

66 A/F
12
8
18
8
M 66×4 – 6g
Ø12
Ø 32
Ø 47
Ø 66
Ø90

VALVE ②

Ø 38
Ø12
18
9
11
28
50
Ø 66
4 WEBS 5 THICK

BODY ①

M66×4-6H
6 Nos. Ø8 Holes on 100 PCD Equispaced
Ø90
Ø66
18
53
10
Ø 66
Ø 50
62
Ø50
18
45° VALVE SEAT
Ø 116
Ø 125
4
R 106
16
16
188

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2ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of nine questions.
- Answer Any <u>Six (06)</u> Questions

Date: 2023.01.11   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%

1. a) i.   State Ohm's law   (4 marks)
        ii.   Define the term voltage.   (2 marks)
    b) The circuit consists of a battery with an insignificant internal resistance connected to three
   resistors, ideal ammeter and ideal voltmeter.   (9 marks)
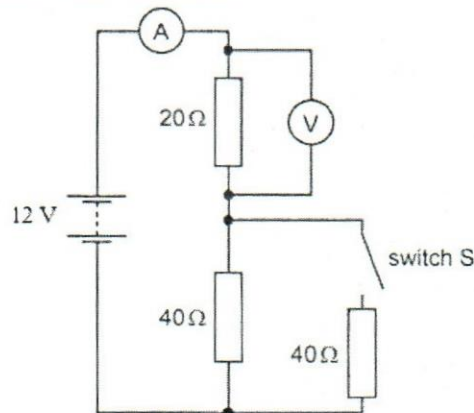
    i.   What are the readings of ammeter and voltmeter when switch S is open?
    ii.   Calculate power consumption of 20 Ω resistor.
    iii. What will happen to the readings on the voltmeter and ammeter when switch S is
          closed?

    c) Calculate the generated power of above 12 V battery.   (5 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 m² and separated by a dielectric 2mm thick and relative permittivity 6. ($\varepsilon_0 = 8.854 \times 10^{-12}$ 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)
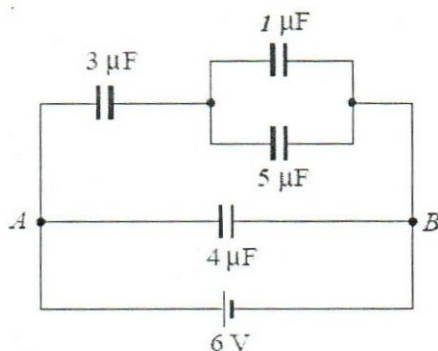

    ii.   Find charge on 3.0µF capacitor.   (03 marks)

5. a) Describe formation of diode from pure silicon crystal to P-N junction diode.   (6 marks)
    b) Draw schematic diagrams of the full wave and half wave rectifier circuits.   (6 marks)
    c) Determine the current I in the circuit shown in below. Assume the diodes to be of silicon and forward resistance of diodes to be zero.   (8 marks)
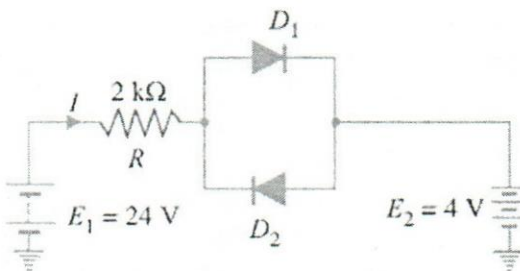

6. a) Draw Schematic diagrams of pnp and npn transistors.   (04 marks)
    b) Draw the circuit diagrams for the various methods of transistor biasing.   (06 marks)
    c) Following is a "Si" transistor biased in commom emitter configuration, having $V_{BE} = 0.7V$. Determine the operating point.   (10 marks)
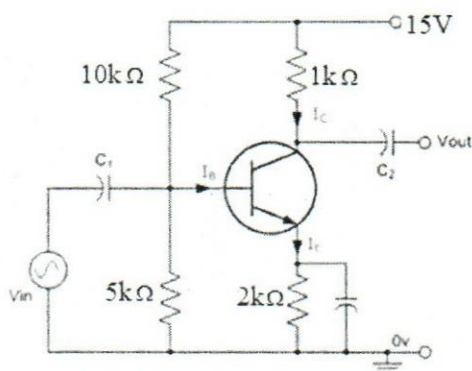
2. a) i.   Define resistance and resistivity.   (4 marks)

    ii.   Explain the behavior of resistance with temperature.   (2 marks)

    b) A copper wire of diameter 1 cm had a resistance of 0.15 Ω. It was drawn under pressure so that
        its diameter was reduced to 50 %. What is the new resistance of the wire?   (4 marks)

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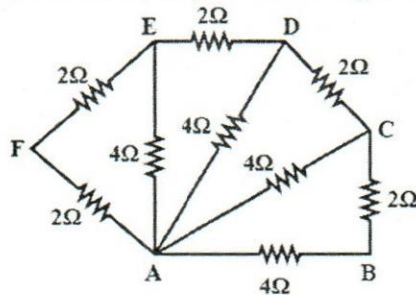
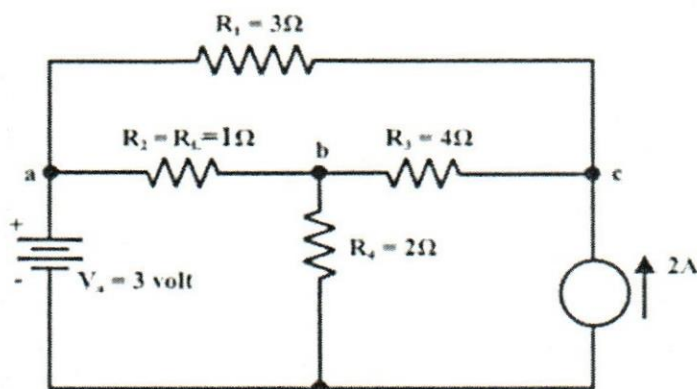   ii.   Evaluate the equivalent resistance (R_{AB}) of the following network using star delta
            transformation.   (6 marks)
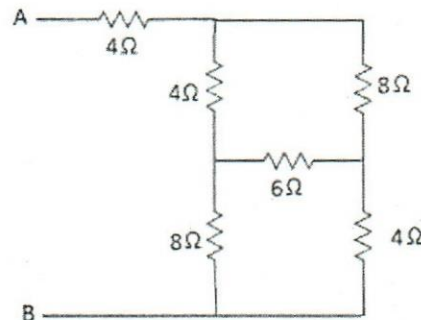
3. a) State Kirchhoff current law and Kirchhoff voltage law.   (06 marks)

    b) The figure below shows currents in a part of electric circuit.
        Find value of current 'i'.   (04 marks)

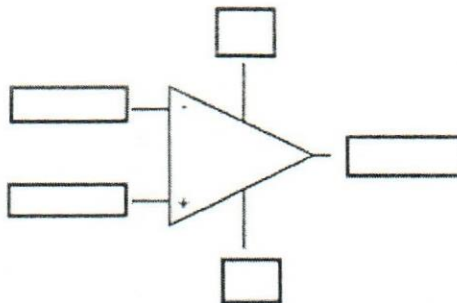
    c) i.   Using Kirchhoff's laws find each branch current.   (08 marks)
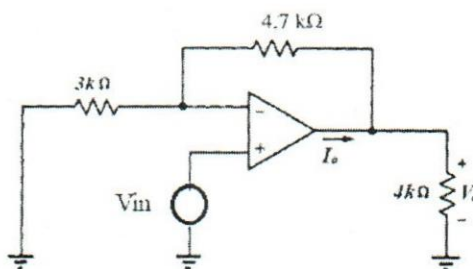

    ii.   Hence, calculate the voltage across the current source.   (02 marks)
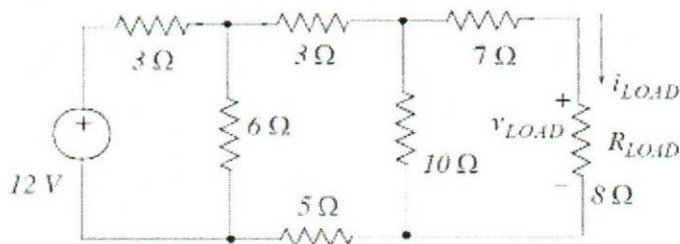
7. a) Identify the terminals in the following op – amp.   (06 marks)

b) A non-inverting amplifier feedback resistance and input resistance are 4.7 kΩ and 3 kΩ respectively. Determine V_o and I_o, if $v_{in} = 0.1\sin \omega t$ (10 marks)

c) Draw the circuit diagram of integrator circuit.   (04 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) Explain behavior of semiconductor material with temperature.   (04 marks)

b) i.   What are the differences between intrinsic semiconductor and extrinsic semiconductor?   (06 marks)

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

(04 marks)

c) Explain forward biasing and reverse biasing of diodes.   (06 marks)

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2ND SEMESTER EXAMINATION QUESTION PAPER
Electrotechnology

- *This question paper consist of 08 questions.*
- *Answer any 06 questions only.*

Date: 2023-01-10   Pass Mars 50%   Time allocated: 03Hrs

01. a.
    i.   Draw the structure of a carbon atom and name all the particals.
    ii.   What are the difference between "element" and "compounds". Give some examples.
    iii. What is "atomie weight" and "atomic number" ?
    iv.   What are called "free electrons"   (02 x 4 = 08 Marks)

    b. What are the different units and symbols for following quantities.

       i. Electric Conductance   ii. Magnetic flux density   iii. Current density

                                                              (02 x 3 = 06 Marks)

    c. The length of an aluminum wire is 1km and the size of conductor is 1/1.38mm. What will
       be the ohmic resistance of the wire. Resistivity of aluminum – 2.8x10^{-8} Ωm

                                                              (02 x 4 = 06 Marks)

02. a. Explain Kirchhoff's current and voltage laws.   (04 x 2 = 08 Marks)

    b. A battery having an e.m.f. of 105V and an internal resistance of 1Ω is connected in parallel
       with a   D.C.Generator of e.m.f. 110V and internal resistance of 0.5Ω to supply a load
       having resistance of 8Ω.calculate

       i.   The currents in the battery, the generator and the load.
       ii.   The potential difference across the load

                                                              (12 Marks)

03. a. How does the resistance of the following vary with temperature.

       i.   Copper wire   iii.   Nichrome wire
       ii.   Carbon filament   iv.   Tungsten filament

                                                              (02 x 4 = 08 Marks)

b. Two resistors of 4Ω and 16Ω are connected in parallel. The group is connected to a 19.8Ω resistor in series. Find

   i.   The total resistance of the circuit.

   ii.   The total current if the applied voltage of the whole circuit is 230V.

   iii.   The currents in the parallel branches.

   iv.   The electric power consumed by 16Ω resistor.

   v.   The voltage across 19.8Ω resistor.

   vi.   The electric energy consumed in 10 hours , by the whole circuit.

(02 x 6 = 12 Marks)

04. a. Draw a pictorial view to show the essential parts of moving -coil multimeter .(label the each parts).Draw four (04) scale symbols used on analogue meter.

(08 Marks)

b. The coil of a moving coil meter has a resistance of 10Ω and gives full scale deflection when

a current of 15mA passes through it. What modification must be made to the instrument of converts it into

   i.   An ammeter reading to 30A

   ii.   A voltmeter reading to 60V.   (02 x 6 = 12 Marks)

05. a. Describe the fleming's left hand , Right hand rules and state Lenz's law.

(02 x 4 = 12 Marks)

b. An aeroplane having a wing span of 50m is flying horizontally at a speed of 800km/h. Calculate the e.m.f. generated between the wing tips, assuming the vertical component of the earth's magnetic field to be 40μT. Is it possible to measure this e.m.f ?   (08 Marks)

06. a. Define

   i.   Magnetic intensity   ii.   Absolute Permeability   iii.   Hysteresis loop

(03 x 3 = 09 Marks)

b. An iron ring has cross-section area of 400mm² and a mean diameter of 25cm.It is wound with 500 turns. If the value of relative permeability is 250, find the total magnetic flux set up in the iron. The resistance is 500Ω and the supply voltage is 240V.

(Take μ_0 as $4\pi \times 10^{-7}$ H/m)   (11 Marks)

07. a. Three capacitor of 5 μF, 12μF and 20μF are connected in parallel and series. Calculate the total capacitances.

(03 x 2 = 06 Marks)

b. A coil of resistance 88.32Ω and inductance 0.14H is connected in series with a capacitor of 35μF and across a 500V – 50Hz supply.

   i.   The impedance of the coil

   ii.   The current in the circuit

   iii. The power factor in the circuit

    iv.   The phase angle between the voltage and current
    v.   The potential drop across the capacitor
    vi.   The potential drop across the capacitor
    vii.   The total active power taken from the supply.   (02 x 7 = 14 Marks)

08. a. Determine the following parameters for motor when operating at rating plate.
    i.   The phase current
    ii.   The apparent power
    iii.   The reactive power
    iv.   The number of pole pair
    v.   Synchronous speed
    vi.   Slip

BBC BROWN BOVERI	3~ Mot.
Type: QU 160 M8-BD	S1
380 V △	13.1 A
5.5 kW	COSφ 0.79
715 r.p.m.	50 Hz · IP45
VDE 530/72	MADE IN GERMANY

(02 x 6 = 12 Marks)

b. Sixteen Leclanche cells, each of e.m.f. 1.45V and internal resistance 0.125Ω are connected, four cell in series per row, four rows in parallel. Find the current through the external resistance of 3.5Ω.   (08 Marks)

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Faculty of Marine Engineering
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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET TRAINING COURSE-PHASE I
COURSE CODE: ED 0350 PI (BATCH 44)

2ND SEMESTER EXAMINATION QUESTION PAPER
Naval Architecture

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

Date: 2023.01.09   Pass mark 50%   Time allocated: 03 Hrs

Q1. A ship 135 m long, 18m beam and 7.6 m draught has a displacement of 14000tonne. The area of load water plane is 1925m^2 and the area of the immersed midship section 130m ^{2} Calculate

(a) Waterplane area coefficient C_w (4 marks)

(b) Midship area coefficient C_m (4 marks)

(c) Block coefficient C_b (4 marks)

(d) Prismatic coefficient C_p (4 marks)

Q2. The half breaths of the waterplane load water plane of a ship 150m long, commencing from aft , are 0.3,3.8, 6.0, 7.7, 8.3, 9.0, 8.4, 7.8, 6.9, 4.7,and 0 m respectively.

Calculate   (a) Area of waterplane.   (10 marks)

           (b) Distance of centroid from mid ships   (06 marks)

Q3.

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

(ii) An oil tanker of 17000t 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 tank whose center is 50m forward of mid ships.

200 t of fuel from after bunker tank is now burned. Calculate the new position of

the centre of gravity.

(a) After the oil has been transferred.   (08 marks)

(b) After the oil has been used.   (06 marks)

Q4.

(a) What is meant by freshwater allowance? (02 marks)

(b) When density of sea water is 1.025t/m^3 and density of fresh water is

1.000 t/ m^3 prove that increase in mean draught ship moves from sea water to fresh water is $\triangle$/ 40TPC. (06 marks)

(c) A ship of 10,000 t displacement has a water plane area of 1300 m^2. The ship loads in water of 1.010 t/m^3 and moves into water of 1.026t/m^3

Find the change in mean draught. (08 marks)

Q5

(a) What is the meaning of TPC and explain how it is found? (02 marks)

(b) Explain the meaning of MCT1cm. (02 marks)

(c) What is the meaning of GM$_L$ (02 marks)

(d) A ship of 5000t displacement, 96m long, floats at draught of 5.6m forward and 6.3m aft. The TPC is 11.5, GM$_L$ 105m and centre of flotation 2.4 m aft of midships.

Calculate (i) MCT 1cm (03 marks)

(ii) the new end draughts when 92 tonne are added 30m forward of midships. (07 marks)

Q6.

A vessel of constant rectangular cross-section is 7.2m wide.

(a) Draw the metacentric diagram using .5m intervals of draught up to the 4.0m water line.

(12 marks)

(b) If the centre of gravity is 3.0 m above the keel, determine from the metacentric diagram the limits of draught between which the vessel will be un stable. (04 marks)

Q7.

Write short notes on following parts of the ship.

Your answer should include purpose for having those paris.

(a) Double bottom tanks. (04 marks)

(b) Bulkheads (04 marks)

(c) Duct keel (04 marks)

(d) Panting beams and wash bulkhead. (04 marks)

Q8. Following diagram shows a bottom structure of a ship.

Chose the relevant part name corresponding to each number as per the diagram. Tank top, Margin plate, Solid floor, Continuous Centre girder, Intercostal side girder, lightning hole, Flat plate keel, Bracket floors.

Bottom Structure