CINEC CAMPUS
Beyond A Graduate

<u>PAST PAPERS</u>

Faculty	Department / Section/Division
Not Applicable	Learning Resource Centre

Past Papers

Faculty of Marine Engineering
Department of Marine Electrical

Electrical Phase I
(ETO)
2014-2022

Faculty of Marine Engineering
Department of Marine Electrical Engineering
ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE.
COURSE CODE : EED -0475P1/ B010/M1

EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

- This question paper consist of 05 questions.
- Answer all the questions.

DATE: 2022.08.23.   Pass Mark: 50%   Time Allocated: 03 Hrs

01 (i) Select the statement that defines the mass number of an element.
        (a) The number of protons in the nucleus of an atom
        (b) The sum of the number of protons and electrons in an atom
        (c) The sum of the number of protons and neutrons in the nucleus of an atom
        (d) The number of neutrons in the nucleus of an atom   (02 Marks)

    (ii) Select the equation that defines the anode reaction of an electrochemical cell
        (a) $M \rightarrow M^{n+} + ne$
        (b) $2H^+ + O_2 + 4e \rightarrow 2OH^-$
        (c) $M^{2+} + 2e \rightarrow M$
        (d) $X^{2-} + e \rightarrow X^{3-}$ (02 Marks)

    (iii) Water acts as an acid in the ionization of a base, where as it acts as a base in the
           ionization of an acid. Thus, water is said to be
        (a) Polyprotic
        (b) Amphiprotic
        (c) Diprotic
        (d) Monoprotic   (02 Marks)

    (iv) Trisodium phosphate is added to boiler water to
        (a) Remove bacteria
        (b) Remove dissolved carbon dioxide
        (c) Convert dissolved salts into a sludge
        (d) Improve scale formation   (02 Marks)

    (v) Select the statement which defines the Bronsted −Lowry acid
        (a) A proton donor
        (b) A species that acts as an electron−pair acceptor
        (c) A species that acts as an electron−pair donor
        (d) A substance which dissolves in water to give H^+ ions   (02 Marks)

    (vi) Distillation is the process of production of pure water from sea water by
          evaporation and re−condensing. Evaporation is generally carried out at a
          pressure
        (a) Equal to atmospheric pressure
        (b) Higher than atmospheric pressure
        (c) Twice the atmospheric pressure
        (d) Less than atmospheric pressure   (02 Marks)

(vii) The standard volume of oil used for a test in Saybolt viscometer is
    (a)   25 ml
    (b)   60 ml
    (c)   20 ml
    (d)   50 ml
                    (02 Marks)

(viii) When a grey cast iron water pipe gets graphitized
    (a)   Iron is left on the surface as a porous sponge
    (b)   Silicon is left on the surface
    (c)   Graphite is left on the surface
    (d)   Iron carbide is left on the surface
                    (02 Marks)

(ix) Weight of $NaHCO_3$ needed to prepare 150 ml of a 0.350 M solution is (atomic weights: Na=23, H=1, C=12, O=16)
    (a)   4.41 g
    (b)   0.5 g
    (c)   2.2 g
    (d)   3.51 g
                    (02 Marks)

(x) Water and sediment in marine fuel oils are removed by centrifugal type separators. The important parameter in this separation is
    (a)   The viscosity of the fuel oil
    (b)   The alkalinity of the fuel oil
    (c)   The pour point of the fuel oil
    (d)   The density of the fuel oil
                    (02 Marks)

02 a. i.   Calculate the mole fractions of ethyl alcohol (C_2H_5OH) and water (H_2O) in a solution made by dissolving 13.8 g of ethyl alcohol in 27.0 g of water. Atomic weights: H=1, C=12, O=16
                    (02 Marks)

      ii.   A reagent bottle contains 5.00 g of sodium hydroxide (NaOH). How many milliliters of a 2.00 M solution can be prepared from this weight of sodium hydroxide?
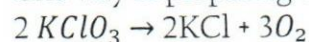Atomic weights: H=1, O=16, Na=23
                    (02 Marks)

      iii. Calculate the pH of the following solutions.
0.0050 M HNO_3
0.0050 M $Ba(OH)_2$
                    (04 Marks)

      iv. One way of preparing oxygen in the laboratory is by the reaction
$2\,KClO_3 \rightarrow 2KCl + 3O_2$
How many grams of $KClO_3$ must be decomposed to produce 48.0 g of oxygen?
Atomic weights: O=16, Cl=35.5, K=39
                    (02 Marks)

      v.   Aluminium (Al), reacts with oxygen (O_2) to form aluminium oxide (Al_2O_3). If oxygen is present in excess and 5.4 g of aluminium reacts, what is the weight of aluminium oxide produced?
Atomic weights: Al=27, O=16
                    (02 Marks)

  b. State whether the following sets of quantum numbers are permissible for an electron in an atom. If not permitted explain why.

i.	n =2	l =1	m = −1	s =+ ½
ii.	n =0	l =1	m =0	s = − ½
iii.	n =3	l =2	m = −2	s = + ½
iv.	n =2	l =0	m =1	s = − ½

                    (08 Marks)

03   a.   Explain how the following types of corrosion occur in metals and alloys.
          i.   Galvanic corrosion   (03 Marks)
          ii.   Dealloying   (03 Marks)

     b.   Explain what you understand by 'cathodic protection'. With the aid of a
          diagram explain the impressed current method used to protect a buried pipeline.   (05 Marks)

     c.   Explain the following
          i.   Why aluminium (Al) is well protected by a thin film of Al_2O_3, but
                magnesium (Mg) is poorly protected by MgO?   (03 Marks)
          ii.   Why activated alumina and silica gel are used to protect metal parts from
                corrosion during shipping and storage?   (03 Marks)
          iii. How hull of a ship could be protected from corrosion?   (03 Marks)

04   a.   i.   Explain how boiler scale is formed.   (03 Marks)
          ii.   Indicate two problems caused by boiler scale   (02 Marks)
          iii. Name two methods you would propose to prevent scale formation on the
                water side of the boiler tubes.   (02 Marks)
          iv.   Explain why it is necessary to remove dissolved gases from boiler feed   (02 Marks)
                water.
          v   Indicate how dissolved oxygen could be removed from boiler feed water.   (03 Marks)

     b.   The analysis of a sample of water from a water supply gave the following results. in ppm

Free CO_2	30
Ca^{++}	70
Mg^{++}	6
HCO_3^-	100
SO_4^{2-}	48
NO_3^-	93
Cl^-	17

          Calculate,
          i.   The ppm of Na^+ ions needed to bring an ionic balance in water.   (03 Marks)
          ii.   The total hardness, temporary hardness and permanent hardness of the
                sample of water in ppm of $CaCO_3$.   (05 Marks)
                Atomic weights: Ca =40, Mg =24, Na =23, C =12, H =1, O =16, S =32, N =14,
                Cl=35.5

05   a.   Explain what is meant by the following terms and indicate why it is necessary to know them
          in handling fuels and lubricants.
          i.   Flash point   (03 Marks)
          ii.   Pour point   (03 Marks)
          iii. Viscosity Index   (03 Marks)

     b.   Explain how fuel oil can be stored in ships and how it can be treated before use.   (03 Marks)

     c.   A mixture of three gas oils A, B and C is obtained by mixing 20000, 30000 and 50000 kg of
          each oil. The specific gravities of the oils (ρ_4^{20}) are 0.860, 0.870 and 0.880 respectively.
          Calculate,
          i.   The mean specific gravity of the mixture (ρ_4^{20}).   (06 Marks)
          ii.   In the above mixture which gas oil is richer in aromatic compounds and
                which oil is richer in paraffin compounds (all three oils have the same   (02 Marks)
                boiling point range).
                Density of water at 4^oC = 1000 kg/m^3

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Faculty of Marine Engineering
Department of Marine Electrical Engineering
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COURSE CODE : EED -0475P1/ B010/M1

EXAMINATION QUESTION PAPER
MATHEMATICS

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

DATE: 2022.08.22.   Pass Mark : 50%   Time Allocated: 03 Hrs

01

   a. Simplify below expressions:

      i. $2x + 4y - 5z - 5x - 9y + 2z + 4x - 7y + 8z$

      ii. $\frac{x}{2} - \frac{2y}{10} + \frac{z}{4}$

      iii. $\frac{24x+6}{3(4x+1)}$ (02X3 Mark)

   b. Solve below equations:

      i. $5(x - 3) = 2(x + 6)$

      ii. $\frac{1}{2}(x + 6) = x + \frac{1}{3}(2x - 5)$ (02X2 Mark)

   c. In a multiple choice examination of 25 questions, four marks are given for each correct answer and two marks are deducted for each wrong answer. One mark is deducted for any question which is no attempted. A candidate attempts q questions and gets c correct.

      i. Write down an expression for the candidate's total mark in terms of q and c

      ii. One student attempts 22 questions and scores 55 marks. Write down and solve an equation for the number of questions which he gets right.

                                                            (05X1 Mark)

02.

   a. Factories the following equations

      i. $x^2 - 2x - 15 = 0$
      ii. $6x^2 + 13x - 5 = 0$
      iii. $x^2 - 5x + 18 = 2 + 3x$ (02X3 Mark)

   b. Solve the following equations:

      i. $3x^2 - 7x - 1 = 0$ using the formula
      ii. $x^2 + 8x + 10 = 0$ using the completing the square method   (02X2 Mark)

   c. Without using differentiation, sketch the graph of $y = x^2 - 5x + 4$ and find all the critical points. (Clearly show all calculations)

                                                            (05X1 Mark)

03.

a. Prove below identities

   i. $(2sinA - cosA)^2 + (sinA + 2cosA)^2 = 5$

   ii. $tanx + \dfrac{1}{tanx} = \dfrac{1}{sinx.cosx}$

   iii. $\dfrac{sin\theta}{1-cos\theta} = \dfrac{1+cos\theta}{sin\theta}$

   iv. $\dfrac{sin\theta}{1-cos\theta} + \dfrac{tan\theta}{1+cos\theta} = sec\theta.cosec\theta + cot\theta$ (03X4 Marks)

b. The diagram below shows the locations of four mobile phone masts (towers) in a field. BC = 75 m, CD = 80 m, angle $B\hat{C}D = 55°$ and angle $A\hat{D}C = 140°$. In order that the masts do not interfere with each other, they must be at least 70 m apart. Given that A is 70m distance from D, find:

   i.   The distance AB

   ii.   The angle $B\hat{A}D$

   iii.   The area enclosed by the four masts (area ABCD)   (02X3 Marks)
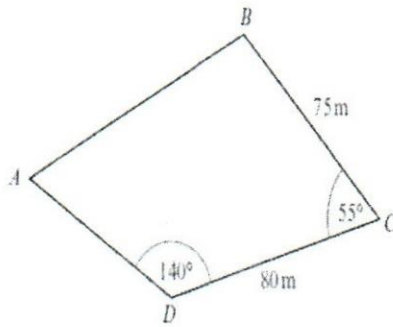
c. Given that $cos\theta = -\dfrac{3}{5}$ and that θ is reflex angle (an angle more than 180⁰), using the help of trigonometric identities, find the value of $sin\theta$ (02X1 Mark)

04.

a. Differentiate with respect to x:

   i. $y = \dfrac{1}{4\sqrt{x}}$

   ii. $y = x^3(3x + 1)$

   iii. $y = \dfrac{x-2}{x^2}$ (02X3 Marks)

b. Find the equation of the tangent to the curve $y = x^3 - 6x^2 + 3x - 2$ at the point where $x = 3$.

        (04X1 Mark)

c. Find the equation of the normal to the curve with equation $y = 8 - 3\sqrt{x}$ at the point (4, 2)

        (05X1 Mark)

05.

a. Find the following integrals;

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

    ii. $\int (4t^2 + 6)\, dt$

    iii. $\int (\frac{2}{x^3} - 3\sqrt{x})\, dx$

    iv. $\int x(x^2 + \frac{2}{x})\, dx$ (03X4 Marks)

b. Given that $\frac{dy}{dx} = \frac{x^2 - 2}{\sqrt{x}}$, find the equation of the function, if it passes through the point (4, 5).

(04X1 Marks)

c. Sketch the curve $y = x(x - 3)$ and indicate all important values of the curve and find the area of the finite region bounded by the curve and x axis.

(04X1 Marks)

06.

a. Solve the equation $z^2 + 6z + 25 = 0$ (z is a complex number)   (02X1 Marks)

b. Express $(7 - 4i)^2$ in the form $a + ib$, where a and b are real numbers.   (02X1 Marks)

c. Given that; $A = \begin{bmatrix} -1 & 0 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 1 \\ 0 & -2 \end{bmatrix}$ find;

    i. AB

    ii. BA (03X2 Marks)

d. Given that the matrix A is singular, find the value of x

$$A = \begin{bmatrix} 3 - 2x & x + 1 \\ 2 & 4 \end{bmatrix}$$

(05X1 Marks)

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EXAMINATION QUESTION PAPER
ENGINEERING SCIENCE

- This question paper consist of 05 questions.
- Answer all the questions.

Date: 2022.08.19   Pass Mark : 50%   Time Allocated: 03 Hrs

01. With regards to the linear motion,
    a. Define following terms   (08 Marks)
        i. Displacement
        ii. Velocity
        iii. Acceleration
        iv. Deceleration

    b. A particle moves along a straight line. The particle accelerates uniformly from rest to a
       velocity of 8 m/s in T seconds. The particle then travels at a constant velocity of 8 m/s for
       5T seconds. The particle then decelerates uniformly to rest in a further 40 seconds.
        i   Sketch a speed-time graph to illustrate the motion of the particle.
        ii   Given that the total displacement of the particle is 600m.Find the value of T
                                                                             (12 Marks)

02. With regards to the angular dynamics,
    a. Define following terms.   (08 Marks)
        i. Angular displacement
        ii. Angular velocity
        iii. Angular acceleration

    b. Two different pullies are attached through a belt as follows. The pully A is having a radius
       of 800mm and B is having 200mm and the pully A is rotating at 30 rad/s.

        i. Find the angular velocity of the pully B.   (06 Marks)
        ii. Find the speed of the belt.   (06 Marks)
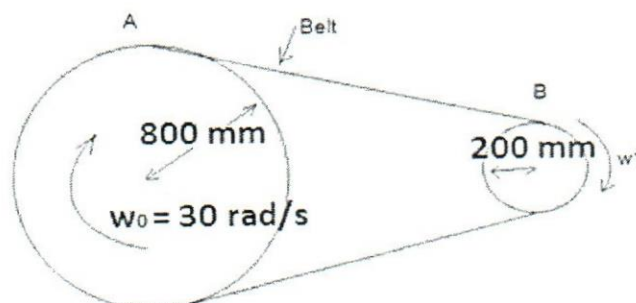
03. With regards to the friction,
  a. State the laws of friction (06 Marks)
  b. A block of mass 5kg lies on rough horizontal ground. The coefficient of friction between the block and the ground is 0.4.A horizontal force P is applied to the block.
  Find the magnitude of the frictional force acting on the block and the acceleration of the block when the magnitude of p is:
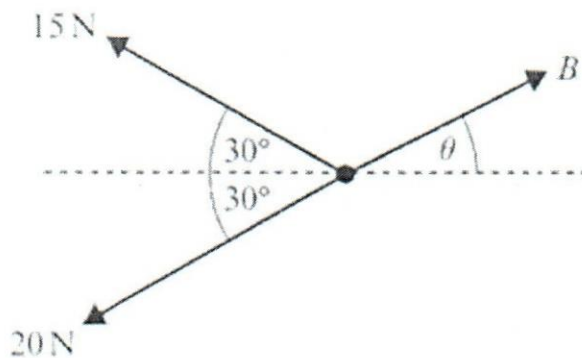   i   10N
    ii   19.6N
    iii 30N (06Marks)

  c. Three forces act upon a particle as shown in the diagram below. Given that the particle is in equilibrium. Calculate the magnitude of B and the angle

(08 Marks)

04. With regards to the heat transfer,
  a. Define the term "Specific heat capacity" (02 Marks)
  b. Define the term "Latent heat" (02 Marks)
  c. Define "Boyles", "Charles" and "Combined gas" laws (06 Marks)
  d. A mercury-in-glass thermometer has a distance of 300 mm between the 0°C and the 100°C marks. If the cross-sectional area of the tube is 0.15 mm2, what will be the total volume of mercury in the thermometer at O°C? The real volume coefficient of expansion of mercury is 0.000 18 /K and the coefficient of linear expansion of the glass is 0.000009 /K.

(05 Marks)

  e. A helium-filled balloon is released at ground level, where the temperature is 17 °C and the pressure is 1.0 atmosphere. The balloon rises to a height of 2.5 km, where the pressure is O. 75 atmospheres and the temperature is 5 °C. Calculate the ratio of the volume of the balloon at 2.5km to that at ground level. (05 Marks)
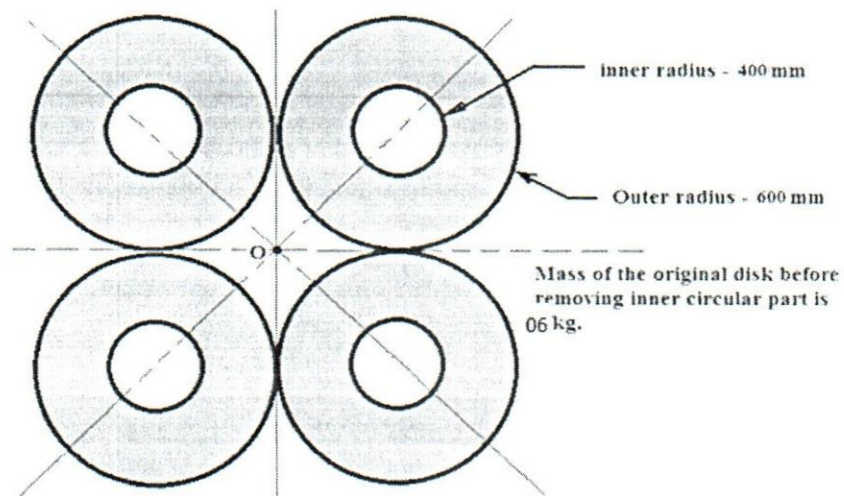
05. With regards to the angular dynamics,

    a.   Define the term "Moment of inertia"   (02 Marks)

    b.   State the theorem of parallel axis   (04 Marks)

    c.   What is radius of gyration?   (02 Marks)

    d.   4 No.of 06 kg circular disks are connected as per the following figure. Thereafter small circular parts of each and every disk have been removed. Find the moment of inertia along axis "O" of the final object.   (12 Marks)

inner radius - 400 mm

Outer radius - 600 mm

Mass of the original disk before removing inner circular part is 06 kg.

EXAMINATION QUESTION PAPER
THERMODYNAMICS

- This question paper consists of 09 questions.
- Answer *any 06* questions.

Date: 2020.08.18   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*

01

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

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

   c. In an experiment to find the coefficient of linear expansion of copper, a rod of copper at *0 ^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. (02 Marks)

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

               (06 Marks)

02

   a. Describe the followings

      i. Specific heat capacity of a substance

      ii. Latent heat of fusion

      iii. Latent heat of evaporation (06 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 ^0C*. Neglecting hat losses,

      i. How long will it take to heat the water to its boiling point, *100 ^0C* ? (06 Marks)

      ii. Starting from *20 ^0C*, what mass of water is boiled away in *5 min* ? (08 Marks)

03

a. State the **Boyle's law** and **Charles' law** for perfect gases (04 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 m³** of Oxygen at **5.5 bar** and **30 °C** (02 Marks)

    ii.   The volume of **10 kg** of Oxygen at **10 bar** and **-5 °C** (02 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** (04 Marks)

d. **0.30 m³/kg** of Oxygen gas at **27 °C** is heated at constant volume to a temperature of **200 °C**. calculate the initial pressure, the final pressure, heat transfer and enthalpy change (08 Marks)

04 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 **⬤ kg** of cooling water was found to rise through **10 °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 °C**. Calculate

a. Thermal power generated by burning of fuel (05 Marks)

b. Power lost to the cooling water (05 Marks)

c. Power lost to the Exhaust gases (05 Marks)

d. Unaccounted power lost if The **Brake power** (useful power) developed is **22 kW** (05 Marks)

05

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

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

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

    Process 2 – 3 : constant 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 (05 Marks)

    ii.   Calculate the **rejection of heat (Q_{41})** and net heat transfer (05 Marks)

    iii. Draw the TS diagram for the cycle (05 Marks

06

a. Describe the **First law** in thermodynamics. (03 Marks)

b. Derive an expression for the **specific heat capacity** of a gas under constant pressure and constant volume. (04 Marks)

c. A **2 kg** of gas sample is heating under **5 bar** of constant pressure from **25 °C** to **100 °C**. The volume of the gas is changed by **0.15 m³** and internal energy has increased by **130 kJ**. Determine

    i.   The *specific heat capacity* of the gas under *constant volume.*   (03 Marks)

    ii.   *Work transfer* during the expansion   (03 Marks)

    iii.   *Heat transfer*   (03 Marks)

    iv.   The *specific heat capacity* of the gas under *constant pressure.*   (04 Marks)

07

a. Describe the none flow energy equation (**NFEE**)   (03 Marks)

b. A gas expands in a closed system doing, **500 kJ** of work on the surroundings while **800 kJ** of heat are transferred to the system. Find the change in internal energy   (03 Marks)

c. A quantity of gas with a molecular mass of **20** occupies a volume of **0.04 m^3** at a pressure of **40 bar** and **1247 ^0C**. It is isentropically expanded from these conditions to a volume of **0.36 m^3** and pressure of **2.5 bar**. Determine

    i.   The index of expansion   (04 Marks)

    ii.   The work transfer during the process   (04 Marks)

    iii.   The value of C_p and C_v for the gas   (06 Marks)

08

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   (03 Marks)

    ii.   Find the enthalpy after the expansion   (02 Marks)

    iii.   Estimate the dryness fraction after the expansion   (03 Marks)

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

09 The pressure and temperature at the beginning of the compression of *Otto cycle* (constant volume cycle) are **1.03 bar** and **25 ^0C** respectively. The maximum pressure of the cycle is **23 bar**. The volume ratio of the cycle is **7:1**.

    i.   *Pressure* and *temperature* of each cardinal point of the cycle   (12 Marks)

    ii.   The *thermal efficiency*   (06 Marks)

    iii.   The *Carnot efficiency* within the same temperature limits   (02 Marks)

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EXAMINATION QUESTION PAPER
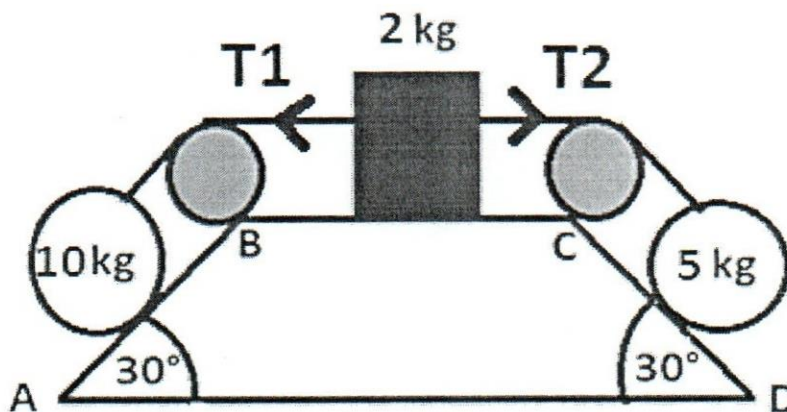MECHANICAL SCIENCE

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

DATE: 2022.08.17   Pass Mark : 50%   Time Allocated: 03 Hrs.

01. Regarding Friction and linear motion

a. If we release the system from rest (Take AB, BC and CD planes are smooth)
   i.   What is the acceleration of the system?
   ii. Find the tension T1 and T2   (08 Marks)

b. The graph shows the velocity of an object travelling in a straight line during a 10 s
   time interval.
   i.   After how long did the object change direction?   (02 Marks)
   ii. Work out the total distance travelled by he object?   (04 Marks)
   iii. Work out the displacement from the strating point of the object after 6
        seconds & 10 seonds   (06 Marks)
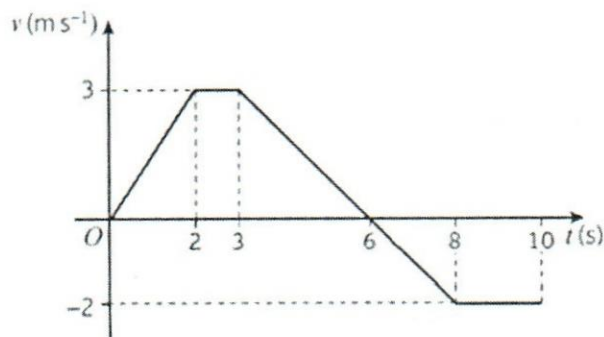
02. Regarding the stability of a ship and center of gravity

    a. A uniform solid composite body consists of a right circular cone of base radius **4r** and height **5r** and a rigid circular cylinder of radius **2r** and height **5r** fixed together as shown in the figure. Find the Centre of mass of the composite body from the vertex of the cone.   (10 Marks)
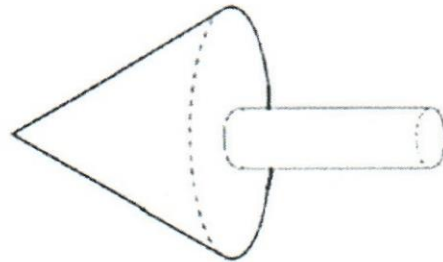
    b. Consider the following cross section of a hull
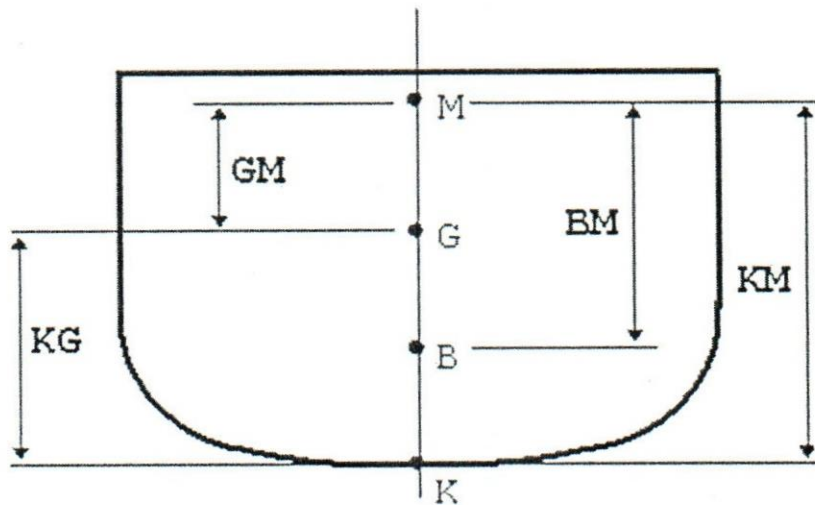
    i   Name the points M, G, B and K   (03 Marks)

    ii Briefly describe the following linear measurements in stability of a ship

       GM, BM, KG and KM   (03 Marks)

    iii Define the following types of stabilities by using diagrams (04 Marks)

- Positive stability
- Negative stability
- Neutral stability

03. Regarding Hydraulics

    a. Define following terms   (06 Marks)
       i   Turbulent flow

      ii Laminar flow

     iii Uniform flow

     iv Steady flow

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

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

                 (02 Marks)

    d. Consider the following water pipe.
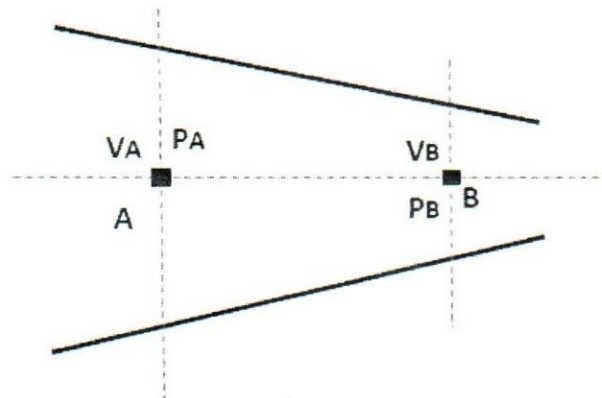
Find:

     i.   Velocity at point A   (04 Marks)
     ii.   Velocity at point B   (04 Marks)
     iii. Mass flow rate   (02 Marks)

Details:

    Diameter at point A = 750 mm

    Diameter at point B = 500 mm

    Pressure difference of point A and B = 3 kPa

04. Regarding Hydrostatics.

    a. State two applications of pascal's law and describe one of them using diagrams.

                 (04 Marks)

    b. What is the difference between gauge pressure and absolute pressure?

                 (04 Marks)

c. A compressor has a piston of 60 mm diameter and it acts against a gas with a pressure of 8 bars. Calculate the force on the piston.

(04 Marks)

d. Calculate the pressure and force on a horizontal submarine hatch 2.5 m in diameter when it is at a depth of 600 m in sea water of density 990 kg/m3.

(04 Marks)

e. Simple lifting jack has a pump piston 10 mm in diameter and a load piston 50 mm in diameter. Calculate the force needed on the pumping piston to raise a load of 12 kN. Calculate the pressure in the oil.

(04 Marks)

05. Regarding System of Forces
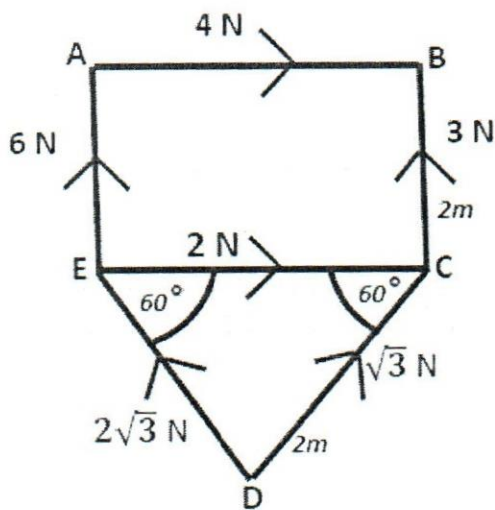
a. Find the resultant force of the system (05 Marks)

b. Find the angle of the resultant force (05 Marks)

c. What is the point (X value) where resultant force meets CE produced (Take E as the origin (0,0)) (05 Marks)

d. Get an equation for the line of action (05 Marks)

EXAMINATION QUESTION PAPER
HYDRAULIC SYSTEMS

- This question paper consists of *Six (06)* questions.
- *Answer any 05 questions.*

Date: 2022.06.30   Pass mark 50%   Time allocated: 03Hrs

01. a. Write down the four properties of a hydraulic oil   (10 Marks)

　　b. What are the additional functions provided by hydraulic oil tank?   (05 Marks)

　　c. What are the additional functions provided by hydraulic oil?   (05 Marks)

02. a. Draw schematic diagram of a Hydraulic power pack & name all the components.   (12 Marks)

　　b. What are the things you check & observe daily as a routing on board a ship steering gear
　　　 hydraulic system.   (08 Marks).

03. a. Explain briefly
　　　　i.　check valve   (04 Marks)

　　　　ii.　adjustable flow control valve   (04 Marks)

　　　　iii.　Shuttle valve   (04 Marks)

　　b. Name the different methods of activating directional control valves.   (08 Marks)

04. a. With the aid of a schematic diagram briefly explain how do you set the direct acting pressure
　　　 relief valve to 35 Bar.   (08 Marks)

　　b. What is the overpressure margin of a direct acting pressure limiting valve?   (06 Marks)

　　c. Overpressure margin depend due to what property?   (06 Marks)

05. a. What are the components associated to ships hydraulic hatch cover opening system ?
　　　(08 Marks)
　　b. What are the checks to be curry out before operating the ships hatch cover system at port?
　　　(12 Marks)

06. Sketch the following component standard symbols.

　　a. Lever operated spring neutral 4 port 3 position directional control valve with tandem canter.
　　　(05 Marks)

　　b. Double solenoid with push button activated 4 port 3 position directional control valve with
　　　 closed centre.   (05 Marks)

　　c. Draw a basic counter balance valve associated to ships deck crane jib hydraulic cylinder & name all the
　　　 components   (10 Marks)

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EXAMINATION QUESTION PAPER
AUTOMATION, CONTROL & INSTRUMENTATION 1

- This question paper consists of **05 (five)** questions.
- Answer **all** questions.

Date: 2022.06.29	Pass mark 50%	Time allocated: 03Hrs

1. With regards to the control systems,

   a. State the essential components used in a control system. (04 Marks)

   b. Describe the mathematical representation of a typical control system with the aid of a sketch. (06 Marks)

   c. Briefly describe about the **Negative feedback** and the **Positive feedback** used in control systems. (04 Marks)

   d. Compare the characteristics of **Analog** and the **Digital** controllers. (06 Marks)

2. With regards to the sensors and transducers,

   a. State the definition of a "**Transducer**" (02 Marks)

   b. Explain the principle of **liquid level measurement** using **capacitive liquid level Probe**. (06 Marks)

   c. Explain **Purge system (Bubbler system)** of liquid level measuring in ships. (06 Marks)

   d. Explain the operation of **bourdon type pressure gauge** using sketches. (06 Marks)

3. With regards to the digital technology,

   a. Find the **binary** value of 9A56BE $_{Hex}$ (02 Marks)

   b. Explain the **operation** of 8:1 MUX with the aid of a sketch. (06 Marks)

   c. Explain the **operation** of 3:8 Decoder with the aid of a sketch. (06 Marks)

   d. Find the **Boolean expression** of following logic circuit. (06 Marks)
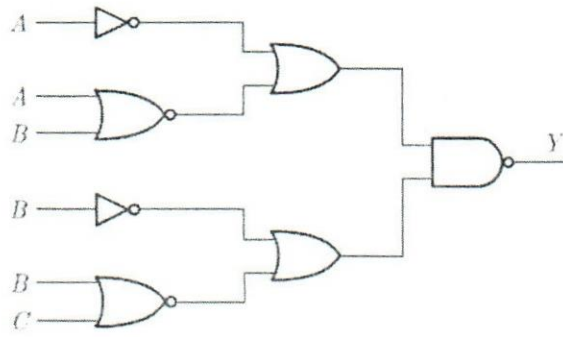
4. With regards to the temperature sensors,

  a. Describe the **construction** of a typical **thermocouple probe** with the aid of sketches.

  (05 marks)

  b. What are the **possible measurement errors** that can be occurred when using thermocouples?

  (05 Marks)

  c. Describe the **construction** of a typical 3-wire PT-100 probe with the aid of a sketch.

  (05 Marks)

  d. Describe the **behavior** of an **NTC type thermistor** by using its characteristic curve.

  (05 Marks)

5. With regards to the PLCs,

  a. Sketch and explain the **internal structure of PLC** and describe the **types of the PLCs** based on the structure. (05 Marks)

  b. Compare the **differences** between modular and compact PLC devices. (05 Marks)

  c. What are the **advantages** of using PLCs than hard wired control panels? (04 Marks)

  d. With regard to the function as per the given conditions in the table, write a **Boolean expression** for the output Q.1 in terms of inputs A, B and C and draw a **ladder diagram** for the same. (06 Marks)
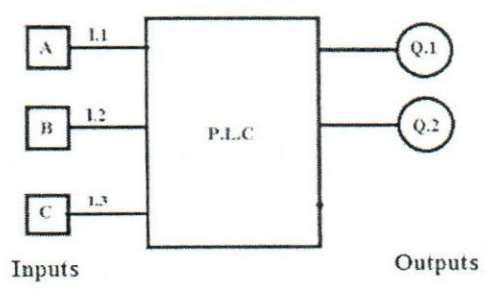
Inputs   Outputs

Conditions	Inputs			Output
	A	B	C	Q.1
1	0	0	0	1
2	0	0	1	0
3	0	1	0	1
4	0	1	1	0
5	1	0	0	1
6	1	0	1	1
7	1	1	0	0
8	1	1	1	0

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EXAMINATION QUESTION PAPER
BRIDGE & NAVIGATIONAL EQUIPMENT

- *This question paper consists of 06 questions.*
- *Answer Any 05 questions.*

Date: 2022.06.30   Pass mark 50%   Time allocated: 03Hrs

01. Describe the working of the following
    a. Emergency Position Indicating Radio Beacon (EPIRB)   (10 Marks)
    b. Search and Rescue Radar Transponder(SART)   (10 Marks)

02. a. Explain the basic propagation methods of following frequencies.
    i. MF   (04 Marks)
    ii. HF   (04 Marks)
    iii. VHF   (04 Marks)

   b. What are primary factors effecting propagation of High Frequencies (HF).   (08 Marks)

03. Draw a block diagram showing the internal sections and instruments connected to an Automatic Identification System. (AIS)   (20 Marks)

04. Describe the process followed by a GPS receiver to display ship position   (20 Marks)

05. a. With aid of a block diagram of a Basic Marine Radar System, briefly explain the function of each section of a Marine Radar equipment.   (16 Marks)

   b. What is the purpose of "TR Switch" in a Marine Radar.   (04 Marks)

06. With clearly marked blocks, briefly describe the Long Range and Identification System

                                                                                (20 Marks)

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EXAMINATION QUESTION PAPER
WORKSHOP THEORY

- *This question paper consists 06 questions.*
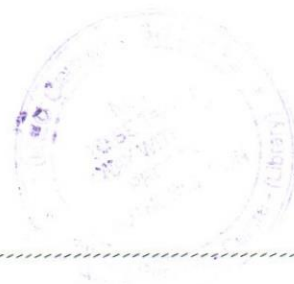- *Answer any 05 Questions.*

Date: 2022.07.05   Pass marks 50%   Time allocated: 03Hrs

01. a.   What are the safety equipment used for protecting the following parts of human body?

   i.   Head protection

   ii.   Hearing protection

   iii.   Face & eye Protection

   iv.   Respiratory protection

   v.   Hand & Foot Protection   (03 Marks x 5)

   b.   Sketch & describe 5 hand tools which are used widely?   (05 Marks)

02. a.   What do you understand by the term "fitting"?   (08 Marks)

   b.   What are the usage of bench wise? Explain with a sketch.   (12 Marks)

03. a.   Name the classification of fitting tools.   (08 Marks)

   b.   Name 03 nos of measuring tools.   (06 Marks)

   c.   Name 02 nos cutting tools.   (06 Marks)

04. a.   What are the tools used for repair, maintenance & service?   (06 Marks)

   b.   Name the 5 types of chisels.   (10 Marks)

   c.   Name the 3 common types of hammers.   (04 marks)

05. a.   What is a Lathe machine?   (06 Marks)

   b.   Name the points that determines the size of a lathe?   (04 Marks)

   c.   With a sketch briefly explain turning operation by lathe.   (10 Marks)

06. a.   What is the definition of a thread?   (04 Marks)

   b.   Name the types of threads.   (06 Marks)

   c.   With a sketch explain the elements of screw thread.   (04 Marks)

   d.   What are the steps to follow thread cutting on a lathe?   (06 Marks)

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EXAMINATION QUESTION PAPER
MARINE ELECTRICAL SYSTEM
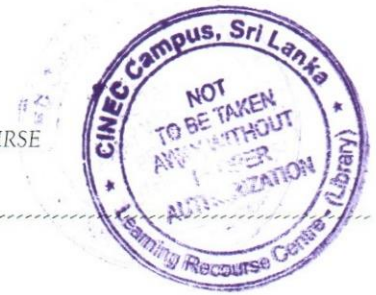
- *This question paper consist of 06 questions..*   Date   : 2022.07.05
- *Answer any 05 Questions.*   **Pass mark 50%**   Time allocated :   03 Hrs

01. With reference to deck cargo cranes,
   a. What are the safety devices incorporated in all Electric cargo cranes on Deck?   (04 Marks)
   b. Which component of the electric crane hoist motor holds the hoist cable drum and
       how it prevent lowering cargo load during power failure   (04 Marks)
   c. Write down of critical parts of deck cranes which requires continuous monitoring, Routine
       maintenance
                                                                              (04 Marks)
   d. Write most important safeties, Limit switches, sensors, protections required for following
       sections of All Electric Cargo cranes   (08 Marks)
       i.   Cargo cable and Cargo Hook
       ii.   Crane boom
       iii. Slewing
       iv.   Main power system

02. Reference to electrical circuits in tankers & flammable Areas
   a. Tabulate name of six type of Ex protection with its abbreviation   (05 Marks)
   b. Sketch and explain an intrinsically safe circuit protected by Zener barrier.   (05 Marks)
   c. Explain two Zones Where Zener barriers are installed and the sensors are installed   (05 Marks)
   d. Write down names of locations requires of Explosion proof Enclosures installed   (05 Marks)

03. With reference to Main switch board
   a. Write down Protections required for Electrical systems at the Main panel   (05 Marks)
   b. Sketch a DC Injection earth fault monitoring system used onboard 440 V Main bus .
       and list advantages and disadvantages of DC Injection earth fault monitoring system ?
                                                                              (05 Marks)
   c. List criteria to be matched to synchronize an incoming generator to the live bus bar.   (05 Marks)
   d. Sketch explain requirement of instruments at shore power supply panel arrangement on board.
                                                                              (05 Marks)

04. With reference to Galley, Refrigeration room & Hospital
   a. Sketch and describe hot plate Element connection of Galley with three level heating.   (05 Marks)
   b. Where alarm buzzer is installed to warn if any one trapped in the Refrigeration room.
                                                                              (05 Marks)
   c. Explain how temperature of multiple Ref rooms (Meat & Veg Rooms) are controlled/maintained
                                                                              (05 Marks)
   d. Where emergency calling bell of hospital to be connected to warning Duty Officers
                                                                              (05 Marks)

05. With reference to Fire alarm and smoke detection system
    a. List Four Components /devices which might get deactivated by activation of CO_2 Alarm.
        (05 Marks)
    b. Where the cargo hold smoke detection system is installed and how it senses any smoke in hold
        (05 Marks)
    c. Write four different type of fire detectors installed and connected Ships fire alarms   (05 Marks)
    d. What is the purpose of end resistors installed at the beach fire detection zones?   (05 Marks)

06. With reference to safety & Emergency Procedure
    a. List down most important Electrical Permits, Safety forms and other check lists required before carrying out Low Voltage Electrical Maintenance on board ships   (05 Marks)
    b. Write down safety procedures to do arc welding by welder fitter on a Electrical Enclosure
        (05 Marks)
    c. Write down any assessment to be carried before applying for a permit to work on Electrical system   (05 Marks)
    d. Write down Tests/checks Which may be carried out by Surveyors on annual basis and related reports to be maintained by Electro Technical Officers.   (05 Marks)

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EXAMINATION QUESTION PAPER
MARINE ELECTRICAL PRACTICE

- This question paper consist of 06 questions..
- Answer all the Questions.   **Pass mark 50%**

Date   : 2022.07.04
Time allocated :   03 Hrs

---

01. a. Give the eight (08) safety precautions would you observe to avoid electrical accidents.

(08 Marks)

b. Write short notes on

    i.   Power factor   ii. Single phasing

    iii. Eddy current   iv. Conductivity   (08 Marks)

02. a. Describe the working of a fluorescent lamp with help of a next sketch explaining the function of each part.

(05 Marks)

b. Write short note
        i.   "Stroboscopic effect"   ii. "Light efficiency of a incandescent lamp"
        iii. " Fussing factor of a fuse"   iv. "Slip of a induction motor

(08 Marks)

03. a. Figure shows a rating plate of an induction machine. Explain the terms in each case (1 to 11)

(11 Marks)

SIEMENS		
[1] → 3- Mot	IEC 872 - 1	← [2]
[3] → 400V Δ / YY	2.4 / 2.8 Δ / YY	← [4]
[5] → 0.9 / 1.1 kW	Cos φ - 0.9 / 0.85	← [6]
[7] → 1440/ 288 r.p.m	50Hz	← [8]
[9] → IP- 54	S1 ↑ [10]	Insul. Cl. F ← [11]

b.   Calculate.
        i.   Synchronous speed in high speed
        ii.   Slip speed in low speed.
        iii.   Numbers of poles in high speed
        iv.   Apparent power in low speed
        v.   Total power losses in high speed

(05 Marks)

04. a. Explain with neat sketch the following transformers
    i. Identify difference between two windings of single-phase (Isolation) transformer and Three-phase autotransformer
    ii. Applications of above-mentioned transformers in Ships.

(06 Marks)

b. A 440/110V single phase transformer supplies a load of 10 kW at 0.85 power factor load. Calculate currents in secondary and primary. (Ignoring transformer losses)

(06 Marks)

05. a. A three phase six (06) terminal connection induction motor has been flooded with sea water and its insulation resistance is down to zero MΩ. Write down the procedure in steps to be taken for putting the motor back in to service.

(06 Marks)

b. When an electrical cable in expressed as
    Cu/XLPE/SWA/PVC-35mm^2 – 19/1.53mm – 600/1000V. What does it mean.

(08 Marks)

06. Draw "Power " and "Control" circuit for the Star-Delta automatic starter which uses Magnetic contactors . (Mark the all terminal numbers and equipment identification letters numbers.)

Specification
Power circuit supply	- 3 - 400/60Hz with E (Insulated neutral system)
Motor	- 3 - 440V/60Hz – 7.5kW (3520 r.p.m)
Control circuit supply	- 24V/60Hz
LED Indicator lamp:	- For Y running (Green)
	- For Δ (Yellow)
	- For O/L (Red)

(14 Marks)

07. a. Explain meaning of each of three digits used in Ingress Protection code. 3 digits of IP code is applicable to Electrical motors installed at open deck such as mooring winch

(03 Marks)

b. Write down few applications of EXd type Electrical Enclosures used in Cargo Ships

(02 Marks)

c. Write down three (3) of most important Work permits used by ETO for
    i. to repair NUC lamps at the signal mast and
    ii. level sensor in a fuel oil service tank

(04 Marks)

d. Sketch and Mark the following in a Lay out of Drawing of Navigation lights with specifications / Technical information of each lamps. Mark the following on the lay out drawing
    i. Locations of Each Navigation lamp
    ii. Vision angle of each lamps
    iii. Power of each Navigation lamp
    iv. Voltages of lamps generally used for Navigation lights
    v. Colour of each Navigation Lamps
    vi. Distance of visibility of each lamps during clear weather

(06 Marks)

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EXAMINATION QUESTION PAPER
COMPUTER & NETWORKING


- *This question paper consists of 05 Questions*
- *Answer all the questions.*

Date: 2022.07.04   Pass mark 50%   Time allocated: 03Hrs


Question 01

You are working as an ETO of ABC shipping. You are been instructed to carry on a network infrastructure based on the information provided below:

a. Ship communicates with the motherland via satellite communication;
b. A small satellite dish is mounted in the ship;
c. There are 10 users in the engine room and the computer are measuring the sensors of the engine room;
d. The captain has a separate computer communication to the ships LAN;
e. All the servers are connected and work as the centralized point in the deck;
f. The servers are application; proxy, and a DNS server.

The captain has asked to draw a network diagram without redundancy. Firewall is the only security device and no IPS used. There is an internet connection and also a separate dish for internet and another separate dish to communicate with the motherland.

(20 Marks)

Question 02

Explain in detail through diagrams, examples, and justification.

a. How is RAM **different** from a ROM?   (05 Marks)

b. Explain **OSI Layers**?   (05 Marks)

c. Explain **tagging and untagging** of the OSI layers?   (10 Marks)

Question 03

Explain in detail through diagrams, examples, and justification.

a. How is a personal computer **different** from a laptop?   (05 Marks)

b. What is **GUI** standing for? How **useful** is it for day-to-day work?   (05 Marks)

c. Indicate the **colour codes** of a **cross-over cable**?   (10 Marks)

Question 04

Explain in detail through diagrams, examples, and justification.

a. What is a **Computer Network**?   (05 Marks)

b. Discuss **different places** that Computer Networks can be seen.   (05 Marks)

c. Explain with a diagram what **virtualization** is?   (10 Marks)

Question 05

Explain in detail through diagrams, examples, and justification.

a. Explain the definition of a **LAN**?   (05 Marks)

b. Can a **LAN** be seen in a **WAN**? Explain with diagrams?   (05 Marks)

c. How does **Single Mode Fibre Optic cables** differ from **Multimode Fibre Optic cables**?
                                                                                                (10 Marks)

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EXAMINATION QUESTION PAPER
ELECTRO TECHNOLOGY

- This question paper consist 06 questions.
- Answer all the Questions.

Date: 2022.07.06   Pass mark 50%   Time allocated: 03Hrs

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01. State Kirchhoff's Current Law and Voltage Law.   (04 Marks)
    01. Find the magnitude of currents in each branch of the following circuit.   (09 Marks)
    02. State which batteries are charging and which batteries are discharging?   (03 Marks)
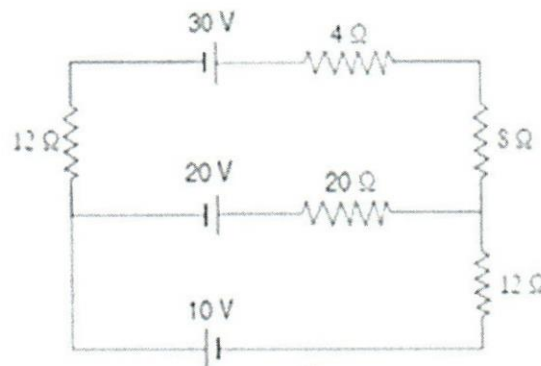
02. Four emfs are given by following equations.
    V1 = 12 sin 314t
    V2 = 8 sin(314t+60),
    V3 = 5 sin(314t-60) and
    V4 = 4 sin(314t+45)   (Angles given in degrees)
    a. Find
        i. The period and the frequency of V1   (02 Marks)
        ii. The peak value and peak-to-peak value of V2   (02 Marks)
        iii. The rms and average value (over half cycle) of V4   (02 Marks)

    b. Find
        i. The resultant voltage equation of the above voltages when they are added together.
           (10 Marks)
        ii. The power dissipated when the resultant voltage is connected to a 120 Ohm resistor and the amount of energy used if this connection is maintained for 30 minutes.   (02 Marks)

03. A coil of resistance 50 Ohm and inductance 0.318H is connected in parallel with a circuit comprising a 75 Ohm resistor in series with a 159 uF capacitor. The resulting circuit is connected to a 230V, 50Hz supply. Calculate
    a. Branch currents, Circuit impedance and Circuit impedance broken down to resistance and reactance
       (10 Marks)
    b. The supply current   (03 Marks)
    c. Power dissipated   (03 Marks)

04.

00022

a. Draw power triangle with associated measuring units and symbols (04 Marks)
b. Using power triangle explain the disadvantages of low power factor. (03 Marks)
c. What happens to the reactive power component in an electric circuit? (02 Marks)
d. What are the causes of poor power factor? (02 Marks)
e. State two methods that can be used to improve power factor in an industrial environment.
(02 Marks)
f. A single-phase motor takes 8.5A at a power factor of 0.85 lagging when connected to a 230V, 60Hz supply. Find the capacitance required to bring the power factor to 0.95. (05 Marks)

05.

a. Use star delta transformation and find the resistance between terminals A and B. (Resistance values given in ohms)
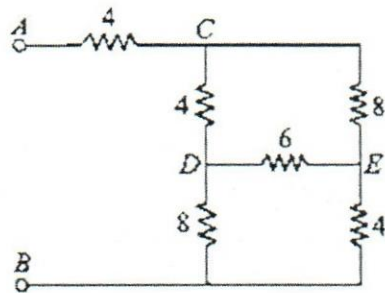
(08 Marks)

b. Using Thevenin's theorem find current through the 10 Ohm resistance. (Resistance values given in ohms)

(08 Marks)

06.
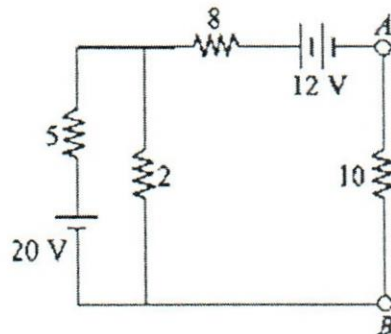
a. State the relationships (using sketches) of Line currents/voltages and Phase currents/voltages in balanced 3 phase star connection and in delta connection. What is the active power dissipated in both arrangements? (05 Marks)
b. A star connected load having resistance 42.6 ohms per phase and inductive reactance 32 ohms per phase (series connected) connected across 400V, 3 phase supply.
Calculate
i. Line current, Reactive power and power dissipated. (08 Marks)
ii. Line current when one of the loads (One leg) becomes open circuited. (03 Marks)

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EXAMINATION QUESTION PAPER
ELECTRICAL POWER AND MACHINES

- *This question paper consist of 06 questions..*
- *Answer all the Questions.* **Pass mark 50%**

Date : 2022.07.05
Time allocated : 03 Hrs

01. a. Sketch and name each components of Static Excitation System (05 Marks)
     b. Compare advantages & disadvantages of Error operated AVR and Functional AVR (04 Marks)
     c. Sketch and Name each component of Brush less Generator (05 Marks)
     d. List all protections required for marine Alternator (05 Marks)

02. a. List Protections required at the Main and distribution switch board (05 Marks)
     b. Sketch and explain earth fault lamp sets and list advantages and disadvantages of it (04 Marks)
     c. Write down advantages of DC injection Earth fault alarm comparing Earth fault lamp (04 Marks)
     d. Sketch and explain the purpose of Preferential tripping (04 Marks)

03. a. Explain the working principle of the AC three phase Induction motor (04 Marks)
     b. Why squirrel cage Induction Rotor can't run at the synchronous speed or rotating magnetic field (04 Marks)
     c. Explains why slip is essential in an induction motor. (03 Marks)
     d. List the specification of a three phase motor. (05 Marks)

04. a. Draw the diagrams with field windings and armature circuit for all types of DC motors. (05 Marks)
     b. What is armature reaction? Explain with flux distribution diagram in a rotor and stator part (04 Marks)
     c. Explain purpose of the Interpole in a DC Machine (04 Marks)
     d. Explain purpose of Starting resistance at start and reason for removing resistance at run (04 Marks)

05. a. What is the difference between ideal transformer & practical(real) transformer? (04 Marks)
     b. List and describe the type of losses in a transformer. (04 Marks)
     c. Draw an equivalent circuit of a simple single-phase transformer. (04 Marks)
     d. Explain two minimum conditions to operate 3-phase transformers in parallel. (04 Marks)

06. a. Write down Reduced voltage starting methods of large AC squirrel cage Induction motor (04 Marks)
     b What is the best way to protect Three phase motor against Single phasing (03 Marks)
     c. Describe Protection required to protect AC three phase squirrel cage induction Motor. (04 Marks)
     d. Type of Enclosures used for Three phase motors and starters on Open deck and Hazardous area (04 Marks)

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EXAMINATION QUESTION PAPER
ELECTRONICS & ELECTRO TECHNOLOGY

- *This question paper consists 08 questions.*
- *Answer any 06 (Six) Questions.*

Date: 2022.07.07   Pass marks 50%   Time allocated: 03Hrs

01. With regards to the power electronic components an operational amplifiers,
    a. Draw the symbols, mark the terminal names and briefly describe the operation of following semiconductor elements:
       i. Power Diodes,   (02 Marks)
       ii. SCR,   (02 Marks)
       iii. GTO   (02 Marks)
       iv. MOSFET   (02 Marks)
       v. IGBT   (02 Marks)

    b. If the transistor is having β=100 and V_{BE}= 0.7V, Calculate,
       i. Base, Collector and Emitter currents of the transistor   (05 Marks)
       ii. The voltage at the output terminal.   (03 Marks)
       iii. The gain of the total arrangement.   (02 Marks)
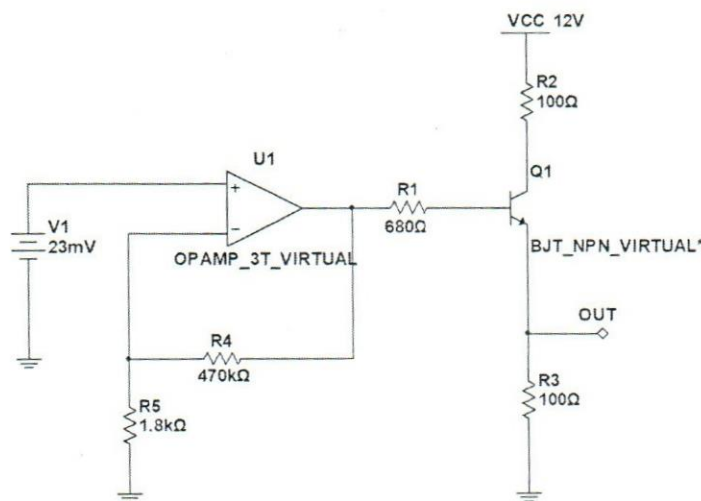
02. With regards to the power electronic converters,
    a. Draw the circuit diagram of single phase ac voltage controller with back to back connected SCR arrangements and briefly describe its operation with output wave shapes.

    (10 Marks)

    b. Explain the operation of a single phase Cycloconverter with the aid of sketches. Also mention about the voltage controlling and frequency controlling concepts.

    (10 Marks)

03. With regards to the control systems,

   a. Define and describe typical elements of following control theoretically,
      i. Proportional – P (02 Marks)
      ii. Integral – I (02 Marks)
      iii. Derivative – D (02 Marks)
      iv. PI (02 Marks)
      v. PD (02 Marks)
      vi. PID (02 Marks)

   b. A Forward-Reverse Induction Motor controller to be implemented by using a PLC with following requirements. (08 Marks)
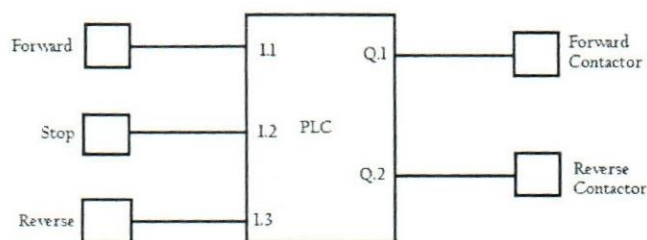
   • When the Motor is running on one mode (either Forward or Reverse), directly change to the other mode is disabled. That means the change of the rotating mode should enable after the Stopping of the Motor.
   • After pressing Stop button after any mode of rotation, the time period of 5 seconds should be given for the de acceleration of the Motor before enabling other rotating modes.
   Considering above mentioned facts draw a ladder diagram for the above function.

04. With regards to the on-board measurement systems,
   a. What is a Protocol? Describe the communication with smart transducers using HART protocol.
   (06 Marks)

   b. Explain following type of sensors used in on board applications.
      temperature with:
      i   3 wire PT-100 sensor (03 Marks)
      ii   Thermocouple (03 Marks)
      iii Oil mist detector (04 Marks)
      iv   capacitive level probe (04 Marks)

05. Following three impedances are connected in series as shown in the figure. Calculate,
   a.
      i. The circuit current (04 Marks)
      ii. The circuit phase angle (04 Marks)
      iii. The voltage drops across each impedance. (04 Marks)
      iv. Total power dissipated (04 Marks)

40 V, 20 kHz
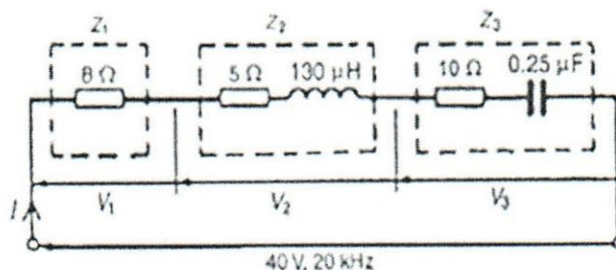
   b. What is the condition to be satisfied for series resonance? What would be the Resonant Frequency of the circuit? (04 Marks)

06. Determine,

   a. The value R in the following circuit for Maximum power transfer using Thevenin's Theorem

                                                                          (08 Marks)

   b. Value of the maximum power transferred
     (The battery in series with R is a 2V battery)

                                                                          (12 Marks)
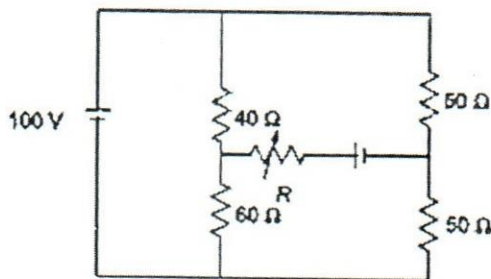
07. The secondary of a 3-phase star connected transformer, which has a phase voltage of 230V feeds a delta connected load each phase of which has a resistance of 30 Ohm and an inductive reactance of 40 Ohm. Calculate the

   a. Voltage across each phase of the load   (04 Marks)
   b. Current in each phase of the load   (04 Marks)
   c. Current in the transformer secondary windings   (04 Marks)
   d. Total power taken from the supply and its power factor   (08 Marks)

08.

   a.

   The Primary and secondary windings of a 500kVA, 6600/400V transformer have resistances of 0.42 Ohm and 0.0011 Ohm respectively and the iron loss is 2.9kW. Calculate the efficiency at full load assuming the power factor to be 0.8 lagging.

                                                                          (10 Marks)

   b.

   Two alternators (No.1 and 2) working in parallel, supply a lighting load of 3000 kW and a motor load aggregating to 5000 kW at a power factor of 0. 71. Alternator 1 is loaded to 5000 kW at power factor 0. 8 lagging. Determine the load and power factor of the Alternator 2.

                                                                          (10 Marks)

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EXAMINATION QUESTION PAPER
ELECTRICAL DRAWING

- *This question paper consist 05 questions.*
- *Answer All the Questions.*

Date: 2022.07.11   Pass mark 50%   Time allocated: 03Hrs

01 Draw general symbols used in electrical circuit for the following devices.

a. Resistor	b. Fuse	c. Triple pole switch
d. M.C.B.	e. Inductor	f. Capacitor
g. Heater	h. Transformer	i. N.P.N.Transistor
j. LED	k. Voltmeter (A.C)	l. Buzzer
m. Δ Connected motor	n. VDR	o. Shunt motor (15 Marks)

02. a. What are the four (04) types of electrical diagrams.   (04 Marks)

b. Draw the wiring diagram of the following single line diagram   (16 Marks)

S1 for E1

S2 and S3 for E2
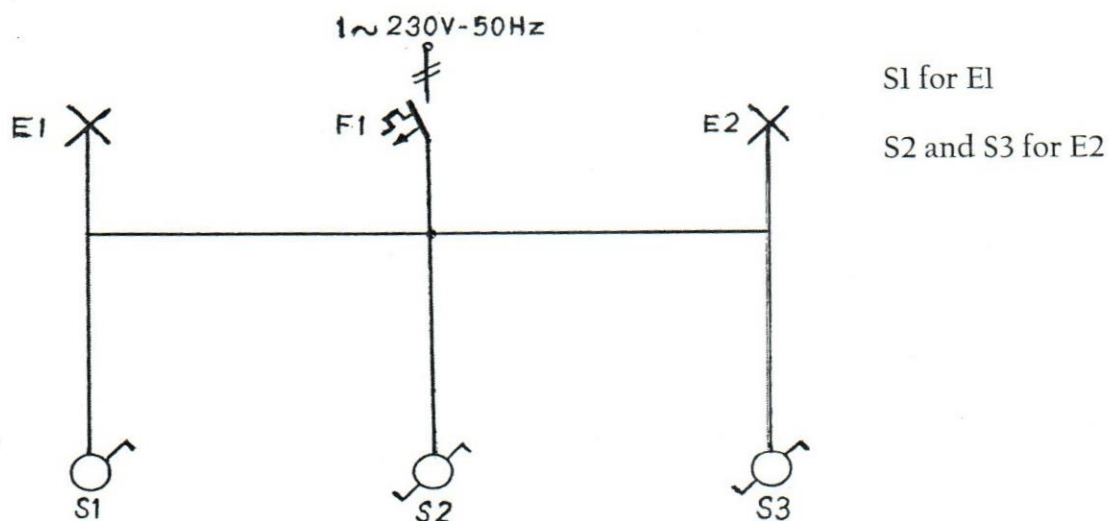
03. Figure shows the block diagram of a single-phase AC to DC conversion system. Draw the circuit diagram by illustrating each block.
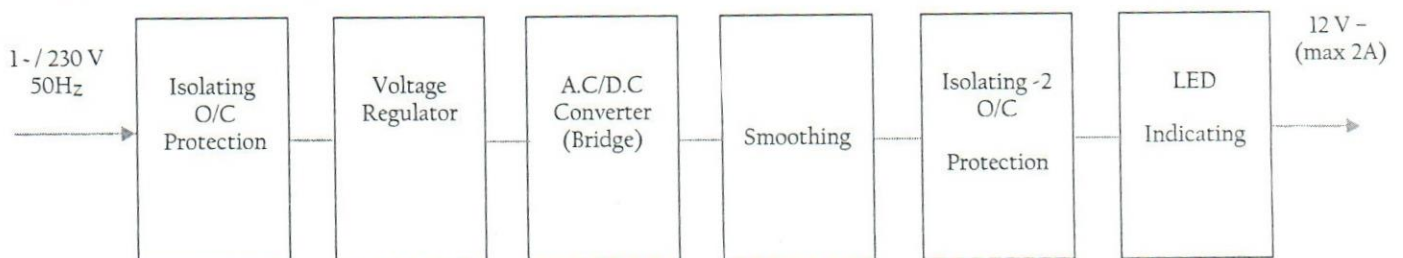
(22 Marks)

04. Draw the isometric view includes essential dimensions. (size of each square is 15mm x 15 mm)

(23 Marks)
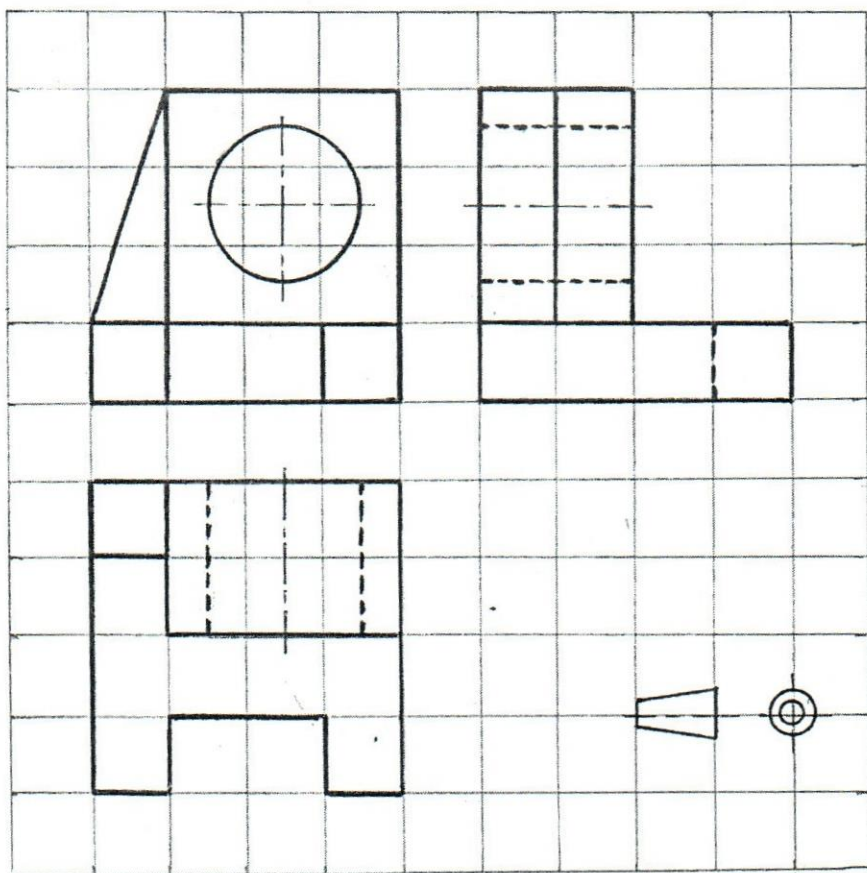
05. Geometrically construct below "C-WRENCH" using full scale.
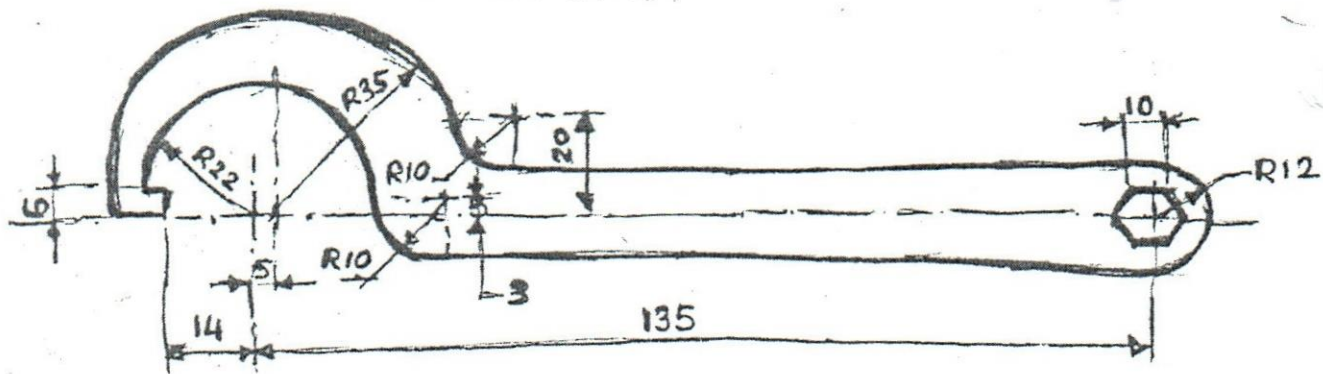
(20 Marks)

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ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE.
COURSE CODE : EED -0475/ B009/P1/M2

EXAMINATION QUESTION PAPER
MEASUREMENTS AND INSTRUMENTATION

- This question paper consist of six questions.
- Answer all the questions.

DATE: 2022.07.11   Pass Mark : 50%   Time Allocated: 03 Hrs

01   a. List types of electrical measuring instruments?   (04 Marks)

b. Briefly explain above instruments with examples.   (06 Marks)

c. Describe the following torques in brief.   (06 Marks)

  i.   Deflecting torque

  ii.   Controlling torque

  iii. Damping torque

02   a. A permanent magnet moving coil instrument gives full-scale deflection with 5mA and has a resistance of 5Ω. Calculate the resistance of the necessary components in order that the instrument may be used as

  i.   a 2A ammeter   (05 Marks)

  ii.   a 100V voltmeter   (05 Marks)

b. List the advantages and disadvantages of moving coil instrument.   (06 Marks)

03   a. A moving iron instrument gives full scale deflection with 200V. It has a coil of 20000 turns and a resistance 2000Ω. If the instrument is used as an ammeter to give full-scale deflection at 10A, calculate the number of turns required.   (04 Marks)

b. How do you extend the range of moving iron AC ammeter & voltmeter?   (05 Marks)

c. A 15V moving iron voltmeter has a resistance of 300Ω and an inductance of 0.12H. Assume that the voltmeter reads correctly on DC , what will be the percentage error when the instrument is placed on 15V AC supply at 100Hz?   (07 Marks)

04   a. Draw the principles parts of a single phase induction wattmeter.   (06 Marks)

b. List the errors of induction wattmeter.   (04 Marks)

c. A dynamometer type wattmeter with its voltage coil connected across the load side reads 192W.The load voltage is 208V and the resistance of the potential coil circuit is 3825Ω. Calculate true load power and percentage error due to wattmeter connection   (06 Marks)

05   a. List the advantages of potentiometer.   (04 Marks)
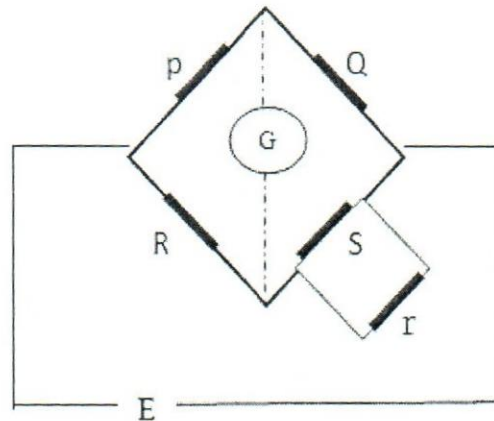
b. Explain the balanced condition of DC whetstone bridge circuit with suitable diagram.

(06 Marks)

c. In wheatstone bridge $P = 8\Omega$, $Q = 11\Omega$, $R = 5\Omega$ and $S = 7\Omega$. How much resistance must be put in parallel to the resistance$(r)S$ to balance the bridge.

(08 Marks)

06   a. List the advantages and disadvantages of induction disc wattmeter.   (06 Marks)

b. Draw the following circuit diagram for the power measurement in star connected load.

   i.   Two wattmeter method.   (03 Marks)

   ii.   Three wattmeter method.   (03 Marks)

c. Draw a connection arrangement of a 3-phase electrical power system to measure   voltage, current, power, frequency & power factor with the protecting devices and earthing. Use correct symbols in your circuit   (06 Marks)

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EXAMINATION QUESTION PAPER
ELECTRONIC & POWER ELECTRONIC - 1

- *This question paper consist **06** questions.*
- *Answer **any 05** Questions.*

Date: 2022.07.07   Pass mark 50%   Time allocated: 03Hrs

01. Regarding semiconductor diodes.

a. What is the difference between intrinsic and extrinsic semiconductors and briefly describe the process of forming extrinsic semiconductors.   (04 Marks)

b. Draw the circuit diagram of a forward biased diode and reverse biased diode. Show the polarity of the voltage source.   (04 Marks)

c. Draw the VI characteristics of a Si diode in common coordinate system (Forward and reversed). Show the turn of knee voltage value.   (04 Marks)

d. Draw the circuit diagram of the three phase full wave rectifier.   (04 Marks)

e. Describe the difference between Active and passive electronic components.   (04 Marks)

02. Regards Bipolar Junction Transistors (BJT)

a. Draw the input characteristics of NPN transistor in common emitter configuration.   (04 Marks)

b. Fill in the blanks.

    i.   The base of a transistor is .... doped.
    ii. The element which has the biggest size in a transistor is..........................
    iii. In a npn transistor, the majority charge carriers are ....
    iv. A transistor is a .... operated device
    v.   The emitter of a transistor is .... doped   (04 Marks)

c. Consider the given voltage-divider biased transistor circuit. (Assume β=100 and VBE=0.7 V)

    i.   Base current (IB)

    ii. Collector current (IC)

    iii. Emitter current (IE)

    iv. Determine VCE

V_{CC}
+10 V

R_1 10 kΩ R_C 1.0 kΩ

R_2 5.6 kΩ R_E 560 Ω
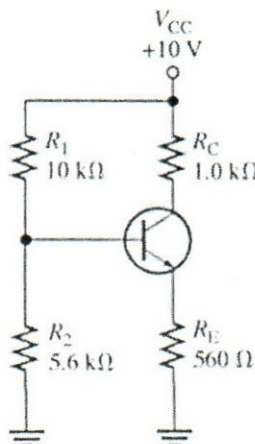
(03 x 04 Marks)

03. Regarding thyristors

a. State different components in the thyristor family. Sketch the symbols and name the terminals of them. (04 Marks)

b. Draw the VI characteristic curve of a TRIAC (04 Marks)

c. Expand the following abbreviations (04 Marks)

   i.   SCR

   ii. DIAC

   iii. TRIAC

   iv. SCS

d. Describe two applications of a SCR (04 Marks)

e. Briefly describe the operation of a DIAC (04 Marks)

04. Regarding Zener diodes

a. Sketch the symbol of a zener diode and name terminals of it. (02 Marks)

b. Draw the VI characteristic curve of a zener diode (02 Marks)

c. Briefly describe the operation of a zener diode and state some applications of zener diodes. (04 Marks)
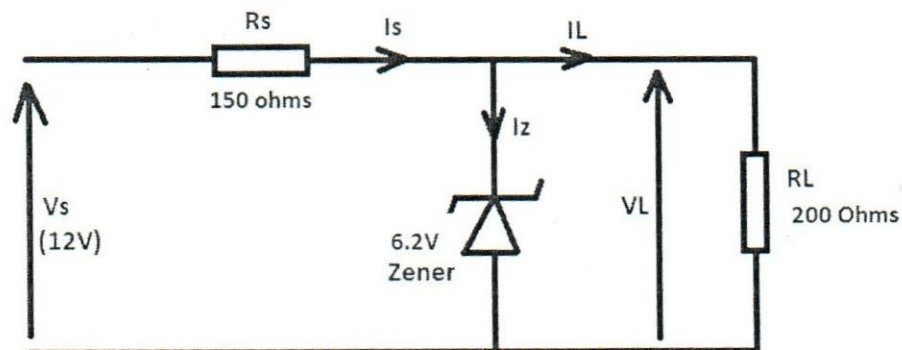
d. Find the values of the following

   i.   Load voltage (VL)
   ii. Load current (IL)
   iii. Supply current (IS)
   iv. Zener current (IZ) (03 x 4 Marks)

05. Regarding power supplies.

a. Draw the block diagram of an unregulated linear power supply. (02 Marks)

b. Draw the circuit diagram of an unregulated linear power supply with the relevant output voltage wave forms and briefly describe the functionalities of each part. (04 Marks)

c. Draw the circuit diagram of a regulated linear power supply with the relevant output voltage wave forms. (04 Marks)

d. What are the main two types of voltage regulators and describe one of them. (04 Marks)

e. What is the main difference between linear power supplies and Switch Mode Power Supplies? (SMPS) (02 Marks)

f. What are the disadvantages of SMPS?

g. What is an uninterruptible power supply? (02 Marks)

h. Draw a circuit diagram of an uninterruptible power supply (02 Marks)

Page 2 of 3

06. Regarding operational amplifiers and LEDs
    a. What are the advantages and disadvantages of using LEDs?   (02 Marks)
    b. How to find the polarity of a LED.   (02 Marks)

V = 12 V   R ?

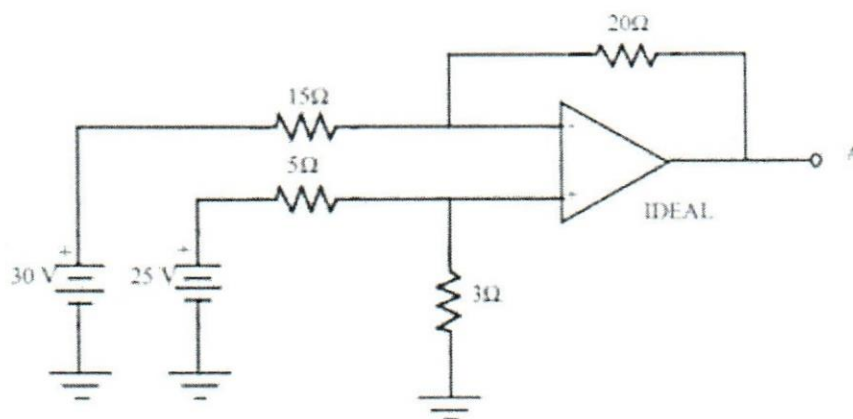V Led = 2 V
I Led = 30 mA
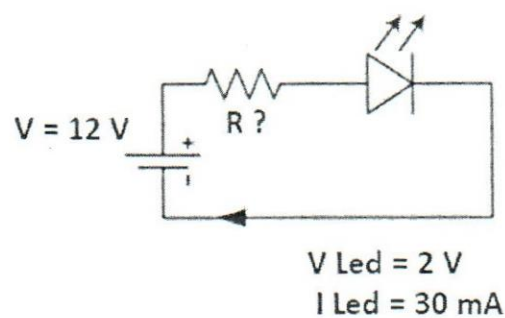
    c. What should be the value of ballast resistor of the above circuit?   (02 Marks)
    d. If the resistance is much lower than above value what can you observe? (02 Marks)
    e. Find VA of the given operational amplifier   (12 Marks))

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COURSE CODE: EED -0475P3/ B004

EXAMINATION QUESTION PAPER
MARINE ELECTRICAL ENGINEERING PRACTICE & BRIDGE AND NAVIGATION

- *This question paper consists 08 questions.*
- *Answer any 06 (Six) Questions.*

Date: 2022.07.07   Pass marks 50%   Time allocated: 03Hrs

01. a. With reference to the use of Electrical equipment in hazardous areas in ships, describe the
following in detail
i. Ex– d   (02 Marks)
ii. Ex– p   (02 Marks)
iii. Ex– I   (02 Marks)
iv. Ex– o   (02 Marks)
v. Ex– q   (02 Marks)
vi. Ex– n   (02 Marks)

b. Discuss the terms " Lower explosive limit (LEL)" and " Upper explosive Limit UEL" (04 Marks)

c. With regards to hazardous zones in Tankers Explain Zone 0, Zone 1 and Zone 2.   (04 Marks)

02. a. Explain the term "Continuous Machinery Survey"   (06 Marks)
b. What is the "Interval of Survey " and its advantage.   (04 Marks)
c. Explain the term " Condition of class" imposed by classification society giving examples.
(06 Marks)
d. What machinery need to be surveyed under safety equipment survey.   (04 Marks)

03. With reference to Oily water separators (OWS)
a. Describe the purpose of Annex I of MARPOL Convention.   (04 Marks)
b. Describe with a aid of sketch, the circuit for interface detection.   (06 Marks)
c. Explain the consequences if the interface position is incorrect.   (06 Marks)
d. What records you maintain in Engine room Oil Record book.   (04 Marks)

04. With reference to voltage variation profiles caused by load changes imposed on alternative current
generators when starting large motors online
a. Sketch the voltage dip, showing acceptable recovery time.   (04 Marks)
b. State FOUR salient factors that cause the variation in part (a)   (04 Marks)
c. Outline FOUR salient factors that assist recovery from the deviation shown in part (a).
(04 Marks)
d. Describe an AVR with the aid of a block diagram   (08 Marks)

05. a. Explain GPS Clock synchronization and measurement of distance to the satellite. 00006

                  (10 Marks)

    b. Describe operation of terrestrial and space based DGPS systems with typical examples.

                  (10 Marks)

06. a. What are the main aspects of annual survey of AIS as published by IMO   (10 Marks)

    b. Describe AIS long range principles and applications   (10 Marks)

07. a. What are main components of LRIT system   (10 Marks)

    b. With aid of a sketch describe the operation of Fiber Optic Gyro Compass   (10 Marks)

08. a. Explain the Radar fault identification by use of Power Monitor and Performance Monitor

                  (10 Marks)

    b. With aid of a sketch, describe the main component parts of a Marine Radar transceiver

                  (10 Marks)

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COURSE CODE : EED -0475/ B008/P1/M3

EXAMINATION QUESTION PAPER
MARINE ENGINEERING KNOWLEDGE

- This question paper consists of *06 questions.*
- Answer *any five (05)* questions.

Date: 2022.06.27   Pass mark 50%   Time allocated: 03Hrs

01. a. Briefly explain the fuel oil system of a Main Engine.   (06 Marks)
     b. Name the 4 strokes of an engine.   (04 Marks)
     c. Briefly describe these terms.
         i.   Exhaust gas turbocharger.
         ii. Stuffing box.
         iii. Scavenge fire.   (06 Marks)
     d. Write 04 reasons why 2 stroke engines are more popular than 4 stroke marine engines?
                                                                       (04 Marks)

02. a. What is the meaning of an Engine room bilges?   (04 Marks)
     b. Briefly explain an oily water separator including 15 ppm monitor   (08 Marks)
     c. What are the maintenance work to be carried out for an oily water separator?   (08 marks)

03. a. Explain step by step basic operation of Fresh water generator?   (08 Marks)
     b. What are the two essential requirements to start the freshwater generator?   (06 Marks)
     c. Why is it important to carry out feed water treatment?   (06 Marks)

04. a. What is the purpose of" boiler burner"?   (08 Marks)
     b. Explain the functions of flame eye of oil-fired boiler?   (04 Marks)
     c. What are the boiler safety alarms?   (08 Marks)

05. a. Draw a basic refrigeration system and explain?   (06 Marks)

     b. What is the purpose of each components below in a fridge system.
         i. Back pressure valve
         ii. Filter drier
         iii. Expansion valve   (03 Marks x 3)
     c. In an air condition system what are the comfortable conditions depend on?   (05 Marks)

06. a. Briefly explain the sewage treatment plant with "MARPOL" annex.   (06 Marks)
     b. What are the routine checks to be carry out to ensure sewage treatment plant is functioning
        properly?   (06 Marks)
     c. How does the anaerobic and aerobic decomposition occurs? What are the products of each?
                                                                       (08 marks)

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COURSE CODE : EED -0475/B008/P1/M3

EXAMINATION QUESTION PAPER
MARINE LEGISLATION & SAFETY MANAGEMENT SYSTEMS

- *This question paper consist of 05 questions..*
- *Please note No.1 Question is mandatory. Answer No.1 question and any other 3 questions.*

Date : 2022.06.28   ***Pass mark 50%***   *Time allocated:*   03 Hrs

01. Explain the following terms with regards to shipboard activities.
    a. IMO.

    b. Flag State.

    c. Classification Society.

    d. Subdivision Bulkheads.

    e. Port state control.

    f. ISPS

    g. Condition of Class.

    h. DPA.

    i. MLC 2006.

    j. National Regulations.

    (Above each part carry 4 marks, total marks 40).

02. a. Explain the term " Management " with regards to shipboard management.   (04 Marks).

    b. Describe the following management activities.

    i. Planning.   (04 Marks)

    ii. Objectives and Goals.   (04 Marks)

    iii. Directing.   (04 Marks)

    iv. Controlling   (04 Marks)

03. Explain in detail four pillars of Maritime Law.   (20 Marks)

04. State four mandatory certificates ship should obtain before sailing. Explain in detail what need to be done to obtain the above certificates   (20 Marks)

05. a. Briefly explain the types of Maintenance systems available in shipboard practice.   (10 Marks)

    b. State what is meant by "5S" system explaining each "S" in detail.   (10 Marks)

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EXAMINATION QUESTION PAPER
PNEUMATIC SYSTEM

- This question paper consists of 06 questions.
- Answer all the Six (06) Questions.

Date: 2022.06.27   Pass mark 50%   Time allocated: 03Hrs

01. Explain the following in detail with a aid of a diagram

   a. Close loop pneumatic Control system.   (08 Marks)

   b. Pneumatic final control element.   (08 Marks)

02.
   a. Explain in detail a Proportional Control system, giving an example of a shipboard control system   (12 Marks)

   b. What is meant by hunting of control media.   (04 Marks)

03.
   a. Why it is necessary to maintain purity of air in a control system. How it is done.
                                                                   (08 Marks)
   b. What maintenance are required to be done in a ship board control system.
                                                                   (08 Marks).

04.
   a. Write 04 advantages of Pneumatically controlled systems over Electrically controlled systems.   (08 Marks)

   b. In a pneumatic circuit, how do you designate each element with respect to their functions. Explain with the aid of a sketch.   (08 Marks)

05. Explain the following electro-pneumatic control elements with symbols.

   a. Inductive proximity sensor.   (05 Marks)
   b. Capacitive proximity sensor.   (05 Marks)
   c. Photo electric proximity sensor.   (06 Marks)

06. Draw a diagram of a pneumatically operated Main Engine cylinder hard air starting valve and explain its function.   (16 Marks)

REPEAT EXAMINATION QUESTION PAPER
MEASUREMENTS & INSTRUMENTATION.

- *This question paper consist 05 questions.*
- *Answer All the Questions.*

Date: 2022.05.04   *Pass mark 50%*   *Time allocated: 03Hrs*
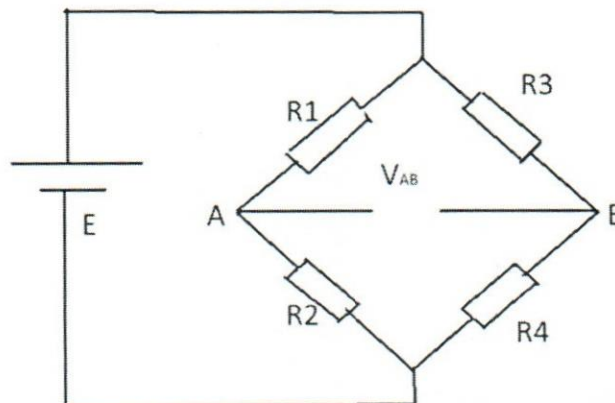
1. With regards to **Moving Coil Meters**,

   a. Sketch the typical construction details of a Permanent Magnet Moving Coil Meter (PMMCM) and name its components.   (06 Marks)

   b. Describe **Full Scale Deflection Current (I_{fsd})** and Sensitivity of PMMCMs   (04 Marks)

   c. A PMMCM which is having I_{fsd} of **100 mA** and internal resistance of **5Ω**, has to be used as,
      i. A Voltmeter that can measure up to 100 VDC   (05 Marks)
      ii. An Ammeter that can measure up to 20 ADC   (05 Marks)
   Find the values of required components for both above requirements.

2. With regards to **Moving Iron Meters**,

   a. What are the two type of moving iron measuring instruments.   (06 Marks)

   b. Sketch and explain the principle of operation of ONE type of moving iron instrument.

                                                                                (10 Marks)

   c. What are the applications of Moving Iron instruments in the industry?   (04 Marks)

3. With regards to the **Whetstone and AC bridges**,

a. Find the **potential difference across points A and B (VAB)** in following bridge circuit.

(05 Marks)

b. Obtain the **condition for balance** (03 Marks)

c. Find the **unknown impedance** of following AC bridge at the balanced condition.

(12 Marks)

4. With regards to **instrument transformers,**
   a. Briefly describe the **operating principle** of
      i.   Potential Transformers (03 Marks)
      ii. Current Transformers (03 Marks)
   b. Describe the **connections and specifications** of current transformers with the aid of sketches,

(06 Marks)

   c. A three-phase power meter has to be used to measure the power consumption of a shipboard power distribution panel with potential and current transformers. Sketch a **typical wiring diagram** for this requirement. (08 Marks)

5. With regards to other **industrial measuring instruments,**

   a. Sketch and explain the **operation of Vibrating Reed Frequency Meter.**

(07 Marks)

   b. Describe the purpose and the **operating principle of the Synchroscope.**

(07 Marks)

   c. Write a short note about **AC clip on current meters** and their applications.

(06 Marks)

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REPEAT EXAMINATION QUESTION PAPER
ELECTRO TECHNOLOGY

- This question paper consist 06 questions.
- Answer any 05 Questions.

Date: 2022.05.04   Pass mark 50%   Time allocated: 03Hrs

Q01.
a.   A 100 Ω resistor,200uH capacitor and 100mH inductor are connected in series with an AC source of 230V, 50Hz. Find;

i.	Impedance	(02 Marks)
ii.	Current through the circuit	(03 Marks)
iii.	Draw the phasor diagram	(03 Marks)
iv.	Phase angle between voltage and current	(03 Marks)
v.	Power factor	(03 Marks)
vi.	Find the potential difference through the inductor	(03 Marks)
vii.	Find the potential difference through the capacitor	(03 Marks)

Q02.
a.   State what is meant by the terms 'Impedance' and 'Reactance'.   (04 Marks)
b.   The frequency of the a.c. supply is increased. Sketch a graph to show how the reactance of the inductor varies with the frequency of the output from the supply.   (04 Marks)
c.   Draw the variation of capacitive reactance with frequency on the same graph.   (04 Marks)
d.   State what is meant by series resonance of a series RLC circuit.   (04 Marks)
e.   Get an expression for series resonance frequency of a RLC Circuit.   (04 Marks)

Q03
a.   Instantaneous voltage waveform equations are given as:

$v1 (t) = 2 \sin (120\pi t +30°)$

$v2 (t) = 6 \sin (120\pi t),$

$v3 (t) = 3 \sin (120\pi t - 60°)$

$v4 (t) = 4 \cos (120\pi t)$

$v5 (t) = 10 \sin (120\pi t+ 90°)$

i.	Calculate the period and the frequency of each.	(03 Marks)
ii.	Calculate the peak and the peak-to-peak amplitude of v1 (t).	(03 Marks)
iii.	Calculate the r.m.s. amplitude of v2 (t).	(03 Marks)
iv.	Find the instantaneous voltage value after 0.004seconds of v3 (t).	(03 Marks)

b.   Find the resultant voltage waveform equation of the above voltage waveforms in part (a). Equation should be written in the same format of the given voltages.   (08 Marks)
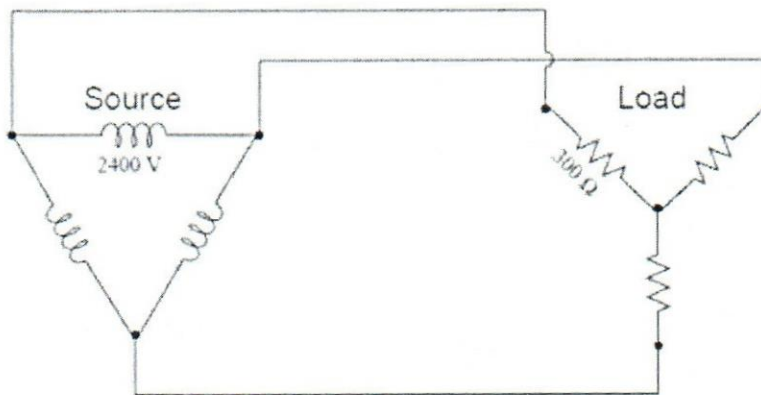
Q04.

a. For a three phase AC supply system
    i.   Draw the star connected and Delta connected arrangements.   (02Marks)
    ii.   For the above arrangements in part (i), give the relationship between
        • phase voltage and line voltage
        • Phase current and line current   (02Marks)
    iii.   Total power equation with phase quantities (Vph and Iph) and line quantities (VL and IL)
        (02Marks)

b. Calculate all voltages, currents and total power in this balanced delta-Y system

    i.   E line
    ii.   I line
    iii.   E phase (source)
    iv.   I phase (source)
    v.   E phase (load)
    vi.   I phase (load)
    vii. P total   (02 x 7 Marks)

Q5.
    a. State the Lenz's law in relation with Electromagnetic Induction?   (05 Marks)
    b. State the Faraday's Law in relation with electromagnetic Induction?   (05 Marks)
    c. Figure 4a and Figure 4b shows a solenoid coil is wound on a paper cylinder. The ends of the coil are connected to a zero galvanometer. A magnet moves towards the coil at the velocity of V m/s as shown in figure. Using Faraday's Laws and Lenz's Law explain the direction of current through the galvanometer.   (05 Marks)

Figure 4a   Figure 4b

d. Write down the equations of instantaneous voltages for the waveforms shown below. (05 Marks)

Q06.

a. Define power factor of a system.   (03 Marks)
b. What causes low power factor?   (03 Marks)
c. State four disadvantages of low power factor.   (03 Marks)
d. What are the methods of improving power factor?   (03 Marks)
e. A single phase motor connected to 400 V, 50 Hz supply takes 31·7A at a power factor of 0·7 lagging.
    Calculate the capacitance required in parallel with the motor to raise the power factor to 0·9
    lagging.   (08 Marks)

CINEC Campus (Pvt) Ltd
Department of Marine Electrical Engineering
ELECTRO TECHNICAL OFFICER CADET TRAINING COURSE -P3
COURSE CODE : EED -0475P3/B003

EXAMINATION QUESTION PAPER
MARINE LEGISLATION & NAVIGATIONAL EQUIPMENT

- This question paper consist 07 questions.
- Answer any 06 questions only.

Date: 2020.11.24   Pass mark 50%   Time allocated: 03Hrs

01. With reference to the Sewage Treatment plants
    a.   Describe the purpose of Annex IV of MARPOL convention.   (04 Marks)
    b.   Describe the provisions regarding the discharge of sewage into the sea.   (06 Marks)
    c.   Describe with a diagram the operation of a Sewage treatment plant.   (06 Marks)

02. With reference to Air Pollution from ships
    a.   Describe main areas in shipboard practice which concern with Air Pollution.   (08 Marks)
    b.   Explain what role Sulphur in fuel oil play in Air Pollution, what regulations are there to mitigate the effect   (08 Marks)

03. Explain the following management tools with reference to MARPOL convention.
    a.   Shipboard Oil Pollution Emergency Plan.   (04 Marks)
    b.   Oil Regard Book.   (04 Marks)
    c.   Shipboard Energy Efficiency Management Plan.   (04 Marks)
    d.   Garbage Record Book   (04 Marks)

04. Describe the Public-Address system including the PABX as used in ships   (16 Marks)

05. Present a diagram of the International LRIT Network   (16 Marks)

06. a. Draw a block diagram of a Marine Radar equipment and explain the section   (08 Marks)

    b. Explain the use of Performance Monitor and Power Monitor to identify Radar faults.   (08 Marks)

07. Show the components of GMDSS system and clearly describe the Terrestrial and Satellite sub system for main communication networks

    (16 Marks)

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COURSE CODE : EED -0475P3/ B003

EXAMINATION QUESTION PAPER
MARINE ELECTRICAL PRACTICE – HIGH VOLTAGE

- *This question paper consist of 06 questions.*   Date: 2020.11.26
- *Answer any 05 questions.*   *Pass mark 50%*   Time allocated: 03Hrs

01. With reference to High voltage switch boards

   a. What are the Physical construction or structural differences between LV panel and HV Panel
     [06]
   b. List additional Electrical features available in the HV panels compared to LV panels [04]
   c. List additional safety features available in the HV panels compared to LV panels [06]
   d. List two Interlocks used with HV to block access of HV Switch Board compartments [04]

02. With reference to High Voltage Tests
   a. List Proper procedures to carry out IR test in HV Equipment [06]
   b. What are the documents required to carry out IR test on HV equipment [05]
   c. What are the values of this PI test decides the insulation status of motor winding [04]
     i. Bad condition
     ii. Doubt full Condition
     iii. Good Condition.
     iv. Excellent condition
   d. List five possible reasons for the low value of IR test or PI test [05]

03. With reference to Advantages and Disadvantages of High Voltage systems on board ships
   a. List Advantages of high voltage systems onboard ships [06]
   b. What are the disadvantages of high voltage systems onboard [06]
   c. Why modern ships are designed with HV systems [04]
   d. List and explain four types of earthing used in HV systems [04]

04. With reference to Inter lock safety of High Voltage systems on board ships
   a. What are the main condition to be met before Engaging Circuit main Earth [08]
   b. Explain purpose for meeting the following conditions (at-lease one reason for each condition)
     i. State of Vacuum Circuit breaker [03]
     ii. Position of Vacuum Circuit breaker [03]
     iii. State of Excitation Switch [03]
     iv. State of Cable Compartment Door [03]

05. With reference to harmonics in High Voltage ships

00010

    a.   What are the reasons for harmonic generation   [05]

    b.   Ways to reduce harmonic distortion   [05]

    c.   List two methods of Harmonic monitoring   [05]

    d.   What are the disadvantages of Harmonics in Electrical power systems   [05]

06. With reference to Protection relays in High Voltage Switch boards

    a.   List features of Digital protection relay used in High voltage Main Switch boards   [05]

    b.   What are the advantages of Digital protection relays   [05]

    c.   List of minimum protections provided by Digital protection relays   [05]

    d.   List of External components connected to Digital protection relays of a Generator Panel   [05]

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ELECTRO TECHNICAL OFFICER TRAINING PROGRAM
COURSE CODE: EED475/B008
ELECTRICAL POWER AND MACHINES

FINAL EXAMINATION

- This question paper consists 06 questions.
- Answer all questions.

Date : 2021.10.11

Time allocated: 3 Hours

---

01) a) Sketch and name each part of Four different type of DC motors [04]
   b) Explain reason of taking higher current during startup of DC shunt Motor and give a solution [04]
   c) Draw a DC shunt motor with Inter-pole (use correct symbol) Explain purpose of the Inter-pole [04]
   d) Use equation and to explain back emf in DC motors [03]

02) a) Prepare a table and compare parts of the 3 phase squirrel cage rotor and Wound rotor Ind motor [05]
   b) Why squirrel cage Induction Rotor can't run at the synchronous speed or rotating magnetic field [03]
   c) Type of Enclosures used for Three phase motors and starters on Open deck and Hazardous area [03]
   d) List Reduced voltage starting methods of large AC squirrel cage Induction motor [03]

03) a) Sketch Construction of Transformer, name & Explain working principle of Power transformer [04]
   b) Draw Equivalent circuit of Power Transformer and mark all sections clearly [04]
   c) Draw symbol of single phase and three phase power transformer [03]
   d) List three applications of Power transformer and three applications of Instrument transformer [04]

04) a) Make a table to compare components /parts of Brush type Alternator and Brushless Alternator. [05]
   b) Draw a brushless generator and name all Electrical parts / components (use full page to draw) [07]
   c) With a help of Sketch, List Important conditions to synchronize & run Two Alternators in parallel [04]
   d) With Example, Explain Why Some generators are allowed only for Brief paralleling [02]

05) a) Sketch and explain Error operated Auto Voltage Regulator [05]
   b) Draw (use full page) a static Exciter with compound type transformer and name each part of it [08]
   c) Explain how the Static Exciter Works to maintain Constant terminal Voltage of generator [04]
   d) Explain How Active and Reactive power shared between two generators Which are runs in parallel [04]

06) a) List Protections required in a Generator Panel to protect AC Generator [05]
   b) List Protections required in a Motor starter panel to protect Three phase Induction motor [04]
   c) List Protection required in a Three phase Main Switch board [05]
   d) Explain purpose of Preferential tripping and List of Electrical loads which cutoff by preferential trip [03]

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COURSE CODE : EED -0475P1/ B008/M2

EXAMINATION QUESTION PAPER
ELECTRONIC & POWER ELECTRONIC - 1

- *This question paper consist 05 questions.*
- *Answer All the Questions.*

Date: 2021.10.08   Pass mark 50%   *Time allocated: 03Hrs*

1. With regards to the Thyristors

   a. Sketch the symbols and mark all terminals of following components in the thyristor family.
      (06 Marks)

      i. SCR
      ii. GTO
      iii. IGCT

   b. Describe the firing and firing angle of thyristors with the aid of sketches. (04 Marks)

   c. Sketch the circuit diagram and output waveforms of a single-phase controlled rectifier using thyristors. (04 Marks)

   d. Draw circuit diagrams for 3 phase AC power control for (06 Marks)
      i. Star connected loads
      ii. Delta connected loads, using thyristors

   With regards to the DC power supplies,

   a. Explain the purpose of using regulator circuits in DC power supplies.
      (04 Marks)

   b. What are the type of regulators used in DC power supplies. (04 Marks)

   c. Draw a complete circuit diagram for a single phase conventional DC power supply and describe the function of each and every component.
      (12 Marks)

3. With regards to the amplifiers,

   a. Describe the purpose of using an amplifier with indicating the examples. (04 Marks)

   b. Describe the difference between Small signal common emitter amplifier and a power amplifier. (06 Marks)

   c. Sketch the circuit diagram of Class-AB push-pull power amplifier and briefly describe its operation. (10 Marks)

4. With regards to the Transistors,

a. Briefly describe the operating modes of the transistor with indicating examples for each and every mode of operation. (04 Marks)

b. In following BJT arrangement, find (Consider the V_{BE} of transistor as 0.6 V)
   i. The base current (06 Marks)
   ii. The collector current (02 Marks)
   iii. The emitter current (02 Marks)
   iv. The load line (06 Marks)

R2 100kΩ
R1 150 Ω
Q2
V1 20 V
BJT_NPN_RATED
Beta = 100, VBE= 0.6V
R3 100 Ω
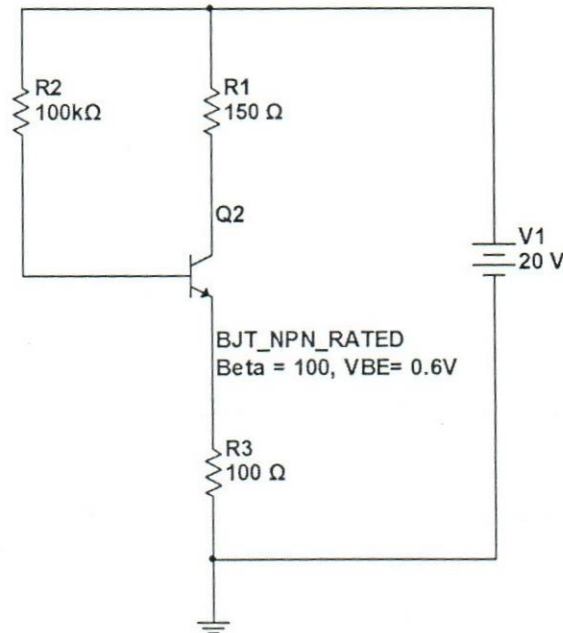
5. With regard to the Zener diodes,

a. With indicating the symbol and terminals of a Zener diode, explain the importance of using them in electronic applications. (04 Marks)

b. In below Zener circuit, find

R3 1kΩ
V2 18 V
D1 5 V
R4 2.2kΩ
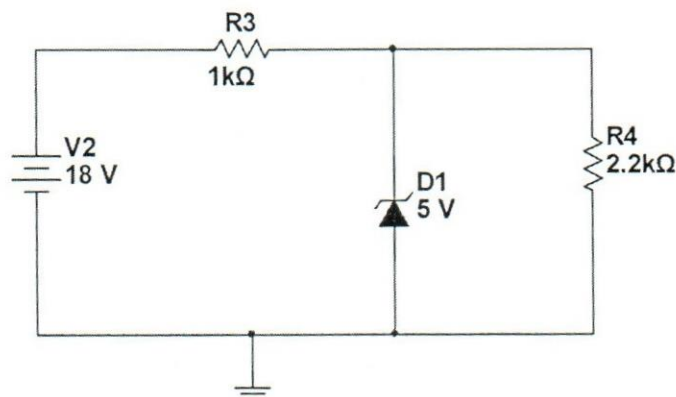
   i. Load voltage – VL (02 Marks)
   ii. Load current – IL (02 Marks)
   iii. Supply current – Is (06 Marks)
   iv. Zener current – Iz (02 Marks)
   v. Power dissipation in the Zener Diode (04 Marks)

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COURSE CODE : EED -0475P1/ B008/M2

EXAMINATION QUESTION PAPER
MEASUREMENTS & INSTRUMENTATION.

- *This question paper consist 05 questions.*
- *Answer All the Questions.*

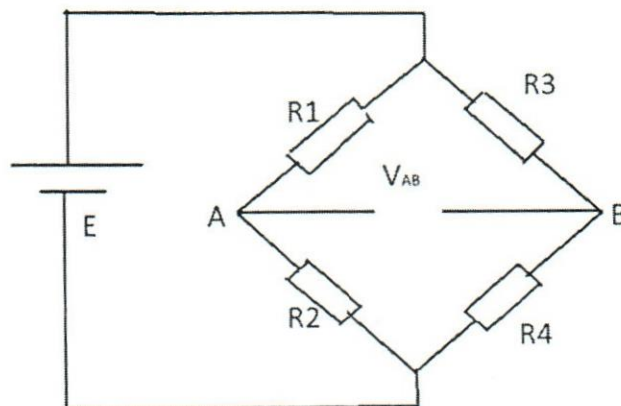Date: 2021.10.07   Pass mark 50%   Time allocated: 03Hrs

1. With regards to **Moving Coil Meters**,

   a. Sketch the typical construction details of a Permanent Magnet Moving Coil Meter (PMMCM) and name its components.   (06 Marks)

   b. Describe **Full Scale Deflection Current** (I_{fsd}) and Sensitivity of **PMMCMs**   (04 Marks)

   c. A PMMCM which is having I_{fsd} of 100 mA and internal resistance of 5Ω, has to be used as,

      i. A Voltmeter that can measure up to 100 VDC   (05 Marks)
      ii. An Ammeter that can measure up to 20 ADC   (05 Marks)

   Find the values of required components for both above requirements.

2. With regards to **Moving Iron Meters**,

   a. Sketch and describe the construction of Moving Iron instruments for both,
      i. Attraction type   (08 Marks)
      ii. Repulsion type   (08 Marks)

   b. What are the applications of Moving Iron instruments in the industry?   (04 Marks)

3. With regards to the **Whetstone and AC bridges**,

a. Find the potential difference across points A and B (VAB) in following bridge circuit
(05 Marks)

b. Obtain the condition for balance (03 Marks)

c. Find the unknown impedance of following AC bridge at the balanced condition.
(12 Marks)

4. With regards to instrument transformers,
   a. Briefly describe the operating principle of
      i. Potential Transformers (03 Marks)
      ii. Current Transformers (03 Marks)
   b. Describe the connections and specifications of current transformers with the aid of sketches,
(06 Marks)

   c. A three-phase power meter has to be used to measure the power consumption of a shipboard power distribution panel with potential and current transformers. Sketch a typical wiring diagram for this requirement. (08 Marks)

5. With regards to other industrial measuring instruments,

   a. Sketch and explain the operation of Vibrating Reed Frequency Meter.
(07 Marks)

   b. Describe the purpose and the operating principle of the Synchroscope.
(07 Marks)

   c. Write a short note about AC clip on current meters and their applications.
(06 Marks)

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EXAMINATION QUESTION PAPER
ELECTRO TECHNOLOGY

- This question paper consist 06 questions.
- Answer any 05 Questions.

Date: 2021.10.06   Pass mark 50%   Time allocated: 03Hrs

Q01.
a. State what is meant by the terms 'Impedance' and 'Reactance'. (04 Marks)
b. The frequency of the a.c. supply is increased. Sketch a graph to show how the reactance of the inductor varies with the frequency of the output from the supply.
(04 Marks)
c. Draw the variation of capacitive reactance with frequency on the same graph. (04 Marks)
d. State what is meant by series resonance of a series RLC circuit. (04 Marks)
e. Get an expression for series resonance frequency of a RLC Circuit. (04 Marks)

Q02.
a. A 50 Ω resistor, 200uH capacitor and 100mH inductor are connected in series with an AC source of 230V, 50Hz. Find;
  i. Impedance (02 Marks)
  ii. Current through the circuit (03 Marks)
  iii. Draw the phasor diagram (03 Marks)
  iv. Phase angle between voltage and current (03 Marks)
  v. Power factor (03 Marks)
  vi. Find the potential difference through the inductor (03 Marks)
  vii. Find the potential difference through the capacitor (03 Marks)

Q03
a. Instantaneous voltage waveform equations are given as:

$v1 (t) = 2 \sin (120\pi t +30°)$

$v2 (t) = 6 \sin (120\pi t),$

$v3 (t) = 3 \sin (120\pi t - 60°)$

$v4 (t) = 4 \cos (120\pi t)$

$v5 (t) = 10 \sin (120\pi t+ 90°)$

  i. Calculate the period and the frequency of each. (03 Marks)
  ii. Calculate the peak and the peak-to-peak amplitude of v1 (t). (03 Marks)
  iii. Calculate the r.m.s. amplitude of v2 (t). (03 Marks)
  iv. Find the instantaneous voltage value after 0.004seconds of v3 (t). (03 Marks)

b. Find the resultant voltage waveform equation of the above voltage waveforms in part (a). Equation should be written in the same format of the given voltages. (08 Marks)

Q4.

a. State the Lenz's law in relation with Electromagnetic Induction? (05 Marks)

b. State the Faraday's Law in relation with electromagnetic Induction? (05 Marks)

c. Figure 4a and Figure 4b shows a solenoid coil is wound on a paper cylinder. The ends of the coil are connected to a zero galvanometer. A magnet moves towards the coil at the velocity of V m/s as shown in figure. Using Faraday's Laws and Lenz's Law explain the direction of current through the galvanometer. (05 Marks)
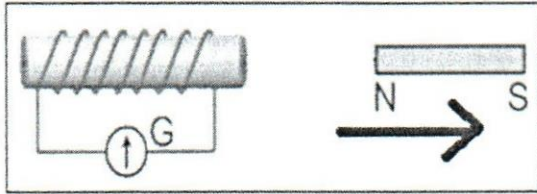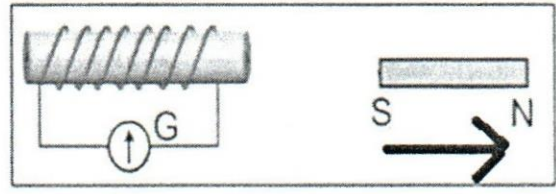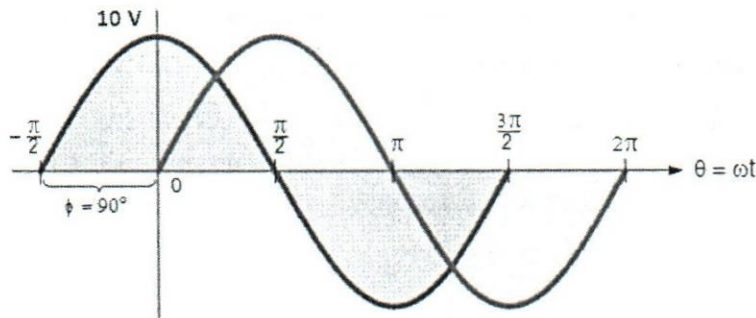
Figure 4a   **Figure 4b**

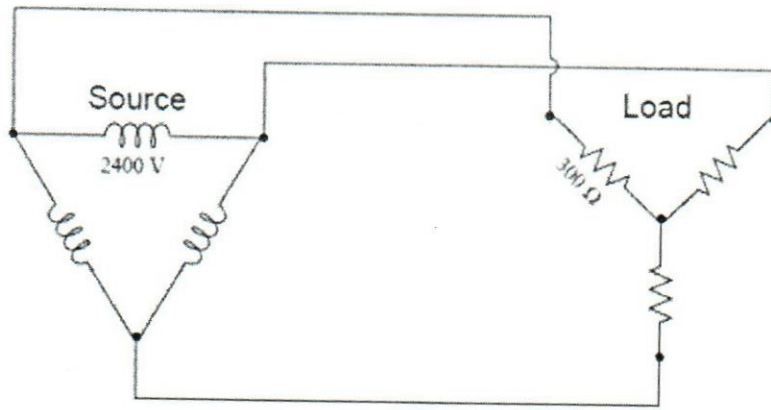d. Write down the equations of instantaneous voltages for the waveforms shown below. (05 Marks)

Q05.

a. Define power factor of a system. (03 Marks)
b. What causes low power factor? (03 Marks)
c. State four disadvantages of low power factor. (03 Marks)
d. What are the methods of improving power factor? (03 Marks)
e. A single phase motor connected to 400 V, 50 Hz supply takes 31·7A at a power factor of 0·7 lagging. Calculate the capacitance required in parallel with the motor to raise the power factor to 0·9 lagging. (08 Marks)

Q06.

a. For a three phase AC supply system
   i. Draw the star connected and Delta connected arrangements. (02Marks)
   ii. For the above arrangements in part (i), give the relationship between
       • phase voltage and line voltage
       • Phase current and line current (02Marks)
   iii. Total power equation with phase quantities (Vph and Iph) and line quantities (VL and IL) (02Marks)

b. Calculate all voltages, currents and total power in this balanced delta-Y system

i. E line
ii. I line
iii. E phase (source)
iv. I phase (source)
v. E phase (load)
vi. I phase (load)
vii. P total

(02 x 7 Marks)

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EXAMINATION QUESTION PAPER
WORKSHOP THEORY

- This question paper consists 06 questions.
- Answer all the Questions.

Date: 2021.10.05   Pass marks 50%   Time allocated: 03Hrs

01. a. What is rake angle of a drill bit?   (06 Marks).

   b. Name the twist drills different areas.   (04 Marks).

   c. What do understand by "feed"?   (04 Marks).

02. a. Draw and explain the temperatures and uses of three types of Oxy -Acetylene flames.
                                                                        (09 Marks).

   b. Briefly explain about "Stick welding".   (06 Marks).

03. a. What is the meaning of term "welding"?   (04 Marks).

   b. What are the principals of fusion welding?   (04 Marks).

   c. What is the meaning of weld metal protection?   (06 Marks).

   d. Briefly explain functions of fluxes with examples.   (08 Marks).

04. a. Name the types of holes.   (04 Marks).

   b. What are the types of drilling machines?   (06 Marks).

   c. What is the mostly used cutting tool in drilling operation?   (05 Marks).

   d. What is the cutting angle of a twist drill?   (04 Marks).

05. a. Why safety is so important while working in a workshop.   (04 Marks).

   b. Define the term "PPE", what are they and the use of each.   (06 Marks).

   c. What is the most essential item need to be kept in the workshop other than the

      PPE which is helpful after an injury.   (04 Marks).

06. a. What is a "thread"?   (04 Marks).

   b. Draw thread parameters on a diagram.   (06 Marks).

   c. Draw Isometric thread & name all details?   (06 Marks).

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EXAMINATION QUESTION PAPER
ELECTRICAL DRAWING

- This question paper consist 05 questions.
- Answer All the Questions.

Date: 2021.10.05   Pass mark 50%   Time allocated: 03Hrs

01   Draw the circuit symbols for the following devices.
   a. Indication lamp   b. PTC Resistor   c. Electrical heater
   d. Inductor   e. PNP Transistor   f. Zener diode.
   g. V.D.R   h. D.C. Series wound motor i. D.C. Shunt generator
   j. 3 - ACB   k. 1 - Transformer (2 Separate winding)
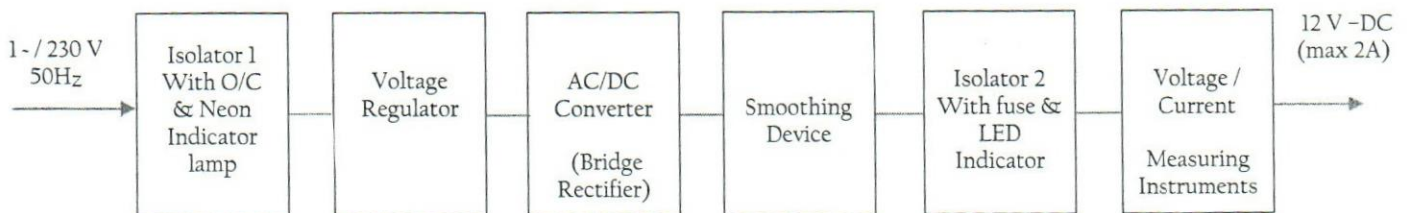   l. Induction motor with 6 tapings

(12 Marks)

02. Draw the circuit diagram of the following single line diagram
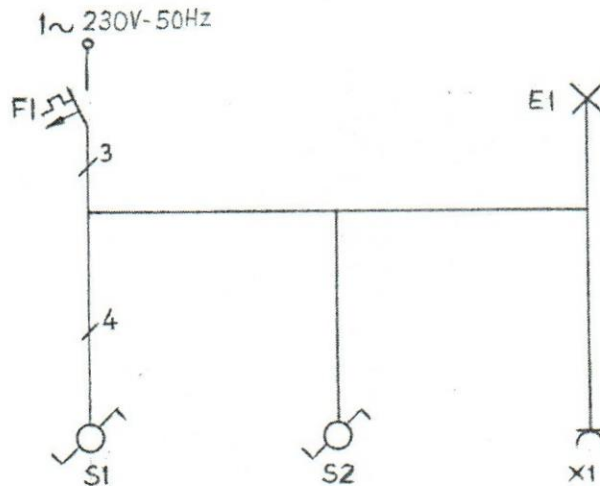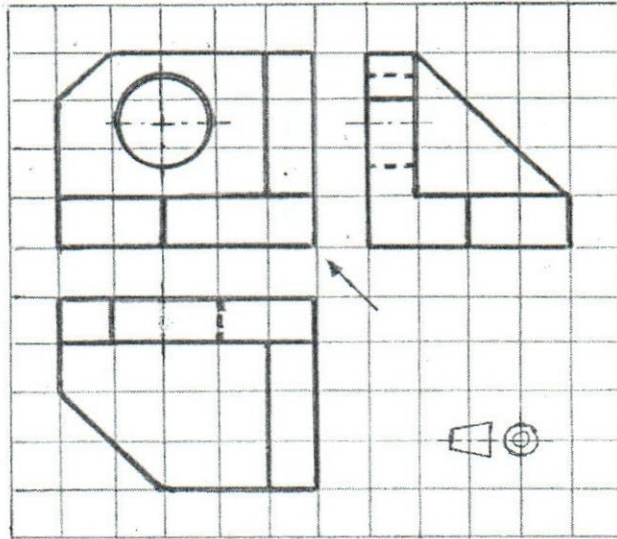

(20 Marks)

03. Figure below shows the block diagram of a Battery charger. Draw the circuit diagram by illustrating each block.
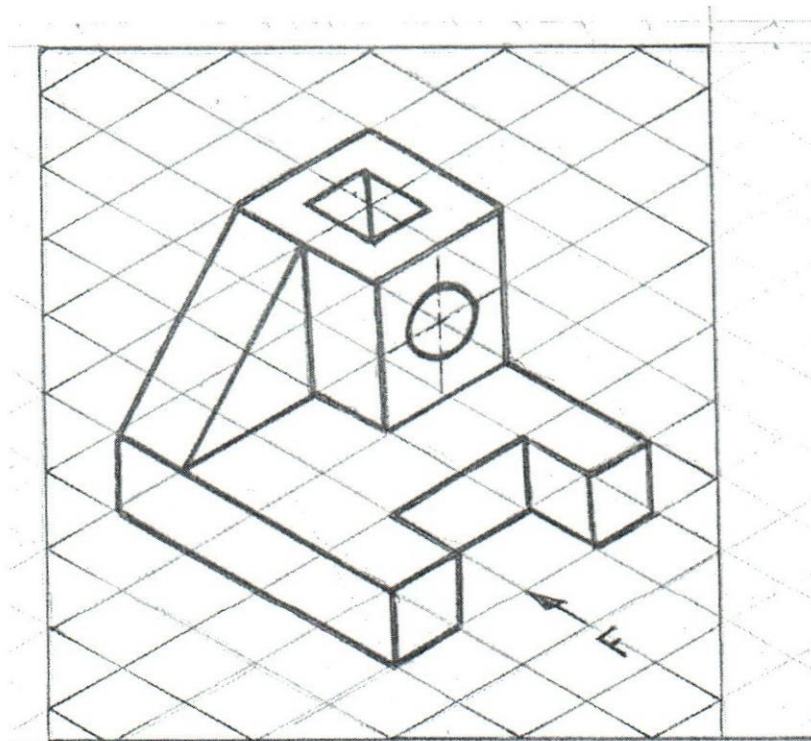

(24 Marks)

04. Draw the isometric view for the following orthographic views.(size of each square is 15mm x 15 mm) 00014

(20 Marks)

05. Figure below shows a isometric view of a block. Draw the orthographic views (first angle projection) to a full scale using. (Size of each rhombus is 12 x 12mm- Front elevation /Left elevation/Top elevation)

(24 Marks)

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COURSE CODE: EED -0475/ B008/P1/M1

EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

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

DATE: 2020.09. 28   Pass Mark : 50%   Time Allocated: 03 Hrs

1   (i)   Select the statement that defines an isotope
          (a)   Atoms of different elements having the same mass number
          (b)   Atoms of the same element differing only in their mass number
          (c)   Atoms of different elements having the same atomic number
          (d)   Atoms of the same element having the same mass number   (2 Marks)

    (ii)   If corrosion occurs due to the formation of an electrochemical cell, select the cathode
          reaction that occurs in an aerobic environment.
          (a) $M \rightarrow M^{n+} + ne$
          (b) $2H^+ + 2e \rightarrow H_2$
          (c) $M^{2+} + 2e \rightarrow M$
          (d) $4H^+ + O_2 + 4e \rightarrow 2H_2O$ (2 Marks)

    (iii) Dissolved carbon dioxide in water can be removed by
          (a)   Hydrazine treatment
          (b)   Ion exchange resins
          (c)   Lime treatment
          (d)   Sodium sulfite   (2 Marks)

    (iv)   Viscosity Index of an oil gives
          (a)   The variation of viscosity with pressure
          (b)   The variation of viscosity with chemical composition
          (c)   The variation of viscosity with additives used in the oil
          (d)   The variation of viscosity with temperature   (2 Marks)

    (v)   Tri sodium phosphate is added to boiler water to
          (a)   Remove bacteria
          (b)   Remove dissolved carbon dioxide
          (c)   Convert dissolved salts into a sludge
          (d)   Improve scale formation   (2 Marks)

    (vi)   Select the statement which defines a Bronsted-Lowry acid
          (a)   A proton donor
          (b)   A species that acts as an electron-pair donor
          (c)   A species that acts as an electron-pair acceptor
          (d)   A substance which dissolves in water to give H^+ ions   (2 Marks)

Page **1** of 3

(vii)   Corrosion fatigue occurs due to
         (a)   The application of a constant load on a material
         (b)   The application of a constant stress on a material
         (c)   The combined effect of impurities in a material and a corrosive environment
         (d)   The combined effect of a cyclic stress and a corrosive environment   (2 Marks)

(viii)   Fuel oils are graded by the
         (a)   Flash point
         (b)   Viscosity
         (c)   Density
         (d)   Pour point   (2 Marks)

(ix)   The pH value of 0.001 M NaOH is
         (a)   8.0
         (b)   3.0
         (c)   11.0
         (d)   10.0   (2 Marks)

(x)   Reverse Osmosis is carried out to remove
         (a)   Dissolved oxygen in water
         (b)   Dissolved carbon dioxide in water
         (c)   Suspended impurities in water
         (d)   Dissolved salts in water   (2 Marks)

2 (i)   A mixture of rubidium chloride (RbCl) and sodium chloride (NaCl) that weighed
         0.2380 g was dissolved in water. Enough silver nitrate was then added to the solution to
         precipitate all the chlorine as silver chloride. After filtering and drying the silver
         chloride, it weighed 0.4302 g. Calculate the weights of RbCl and NaCl in the initial
         mixture.
         The equations for the precipitation reactions are,

         $$NaCl + AgNO_3 \rightarrow AgCl \downarrow + NaNO_3$$

         $$RbCl + AgNO_3 \rightarrow AgCl \downarrow + RbNO_3$$
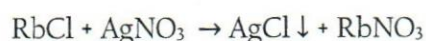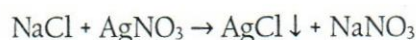
         Atomic weights: Na $=23$, Cl $=35.5$, Ag $=108$, N $=14$, O $=16$, Rb $=85.5$ (8 Marks)

   (ii) 10 g of KCl was dissolved in 75 g of water. Calculate,
         (a)   Weight percentage of Cl^- ions in the solution.   (2 Marks)
         (b)   Mole percentage of KCl in the solution.   (2 Marks)
         (c)   Molality, m, of the solution.   (2 Marks)
         (d)   Molarity, M, if the volume of the solution is 78.9 ml.   (2 Marks)

         Atomic weights: H$=1$, O$=16$, K$= 39$, Cl$= 35.5$

   (iii) State whether the following sets of quantum numbers are permissible for an electron in
         an atom. If not permitted explain why.
         (a)   n $=2$ l $=2$ m $=1$ s $=+ ½$
         (b)   n $=3$ l $=2$ m $=1$ s $= + ½$
         (c)   n $=0$ l $=2$ m $=0$ s $= - ½$
         (d)   n $=2$ l $=0$ m $=1$ s $= - ½$ (4 Marks)

3 (i) Explain how the following types of corrosion occur in metals and alloys.
(a) Dry corrosion
(b) Dealloying
(c) Erosion corrosion

00014

(9 Marks)

(ii) Indicate **three** methods used to minimize galvanic effects in sea water. (3 marks)

(iii) Explain why activated alumina and silica gel are used to protect metal parts from corrosion during shipping and storage. (2 marks)

(iv) Draw a labelled diagram to indicate the 'Impressed current method' used to protect a buried steel pipeline. (2 marks)

(v) Briefly explain what is meant by
(a) Electroplating (2 marks)
(b) Anodizing (2 marks)

4 (i) Explain the terms,
(a) Hard water (2 marks)
(b) Demineralised water (2 marks)

(ii) **Name** two methods used in ships to convert sea water to fresh water. (2 marks)

(iii) Explain the following.
(a) How boiler scale is formed (3 marks)
(b) How dissolved oxygen could be removed from boiler feed water (3 marks)

(iv) The analysis of a sample of water gave the following results in ppm.

Ca^{++}	30
Mg^{++}	6
HCO_3^-	97.6
SO_4^{--}	24
NO_3^-	1.9
Cl^-	8.9

Calculate,
(a) The ppm of Na^+ ions needed to bring an ionic balance in water. (2 marks)
(b) The total hardness, temporary hardness and permanent hardness of the sample of water in ppm of $CaCO_3$. (6 marks)

Atomic weights: Ca =40, Mg =24, Na =23, C =12, H =1, O =16, S =32,   N =14, Cl=35.5

5 (i) Explain what is meant by the following terms and indicate why it is necessary to know them in handling fuels and lubricants.
(a) Flash point (3 marks)
(b) Pour point (3 marks)
(c) Saybolt Universal Viscosity (3 marks)

(ii) Name the contaminants present in marine fuel oil and how they can be removed or reduced. (4 marks)

(iii) Indicate **three** purposes served by a lubricating oil. (3 marks)

(iv) The API gravity of a gas oil is given as 33.03. Calculate ρ_{60}^{60} of this oil. (4 marks)

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EXAMINATION QUESTION PAPER
COMPUTER & NETWORKING

- *This question paper consists of 06 Questions*
- ***Answering to Question 01 is Compulsory***
- Answer **any other three (03)** questions *excluding Question 01.*
- Explain in detail through diagrams, examples, and justification

Date: 2020.09.25   Pass mark 50%   *Time allocated: 03Hrs*

Question 01 (Compulsory)   (25 Marks)

1.1   What is the difference between **CSMA/CD** and **CSMA/CA**?   (05 marks)

1.2   Explain the difference between Master Slave Polling and **Master Slave Polling with Cyclical**?   (10 marks)

1.3   Explain how **Virtualization** is important in the modern day?   (10 marks)

Question 02   (25 Marks)

2.1   Through a diagram indicate **Transmission Media**   (05 marks)

2.2   Briefly explain all the layers of the **OSI Layers**   (10 marks)

2.3   How does **IDS** different from **IPS**?   (10 marks)

Question 03

                                                                  (25 Marks)
3.1   How does **Layer two (02) switches** different from **Layer three (03) switches**?
                                                                  (05 marks)

3.2   Explain the use of **Firewall**?   (10 marks)

3.3   How can a **Router** be used in a Computer Network   (10 marks)

Question 04   (25 Marks)

4.1   How does **RAM** different from **ROM**?   (05 marks)

4.2   Explain the definition of a **Computer**?   (10 marks)

4.3   How does **Hardware** different from **Software**?   (10 marks)

Question 05   (25 Marks)

5.1   What is a **CPU**?   (05 marks)

5.2   What is a **Hard disk**?   (10 marks)

5.3   Explain **computer memory measurements**   (10 marks)

Question 06   (25 Marks)

6.1   How does a **Trackball** different from a **Mouse**?   (05 marks)

6.2   How does a **Printer** different from a **Plotter**?   (10 marks)

6.3   What are the differences between **Operating System** and **Application Software**
                                                                 (10 marks)

--------------------END OF THE QUESTION PAPER-----------------

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EXAMINATION QUESTION PAPER
THERMODYNAMICS

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

Date: 2020.09.25   Pass mark 50%   Time allocated: 03Hrs

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

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

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

1.

a. State the *first law of thermodynamics*   (4 Marks)

b. Describe the *sign convention* of heat transfer and work transfer   (4 Marks)

c. During working stroke, an engine rejects *600 kJ/kg* of heat of the working substance. The internal energy of the working substance also decreases by *1350 kJ/kg*. Determine the work done by engine.   (4 Marks)

d. The temperature of *2.5 kg* of air in a piston connected cylinder is increased from $27^0\ C$ to $100^0\ C$ under *2 bar* of constant pressure. Estimate volume change, change in internal energy, heat transfer and work transfer for the air.   (8 Marks)

2.

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

b. A vessel of volume *0.62 m³* contains air and wet steam having *0.56* dryness fraction at a total pressure of *0.16 bar* and temperature *29 °C*. taking *R* for air = *0.287 kJ/kgK*. Determine

   i. The *partial pressure of steam* in the vessel   (3 Marks)

   ii. The *partial pressure of air* in the vessel   (3 Marks)

   iii. The *specific volume of wet steam* in the vessel   (3 Marks)

   iv. The *mass of air* in the vessel   (4 Marks)

   v. The *mass of steam* in the vessel   (4 Marks)

3.

a. Write down the *characteristic gas equation* and name each term in its   (3 Marks)

b. Describe the specific capacity of gas under constant pressure (*Cp*) and constant volume (*Cv*). Hence, write an expression for *gas constant* using specific heat capacities(*Cp* and *Cv*)   (5 Marks)

c. A cylinder contains *2 kg* of gas at *42 bar* and *102 ^{0}C*. If the gas is heated to *125 ^{0}C*. The specific heat capacities of the gas under constant pressure and constant volume are *0.7075* and *0.6261 kJ/kg K* respectively. Calculate

   i. The gas constant   (2 Marks)

   ii. The volume of the gas reservoir   (3 Marks)

   iii. The new pressure   (3 Marks)

   iv. The heat energy transfer and internal energy change   (4 Marks)

Neglect any expansion of the cylinder

4.

a. Describe the *adiabatic index, γ* of a gas.   (2 Marks)

b. *0.015 m^3* of gas at *4200 kPa* and *105 ^{0}C* is compressed adiabatically in a close system to *one quarter of its original volume*. The gas is then cooled at constant volume until its pressure is *4200 kPa*.

   i. Draw the *P-V* diagram for the process   (3 Marks)

   Calculate the following

   ii. The *adiabatic index, γ*   (3 Marks)

   iii. The *temperature* and *pressure* at the end of compression   (4 Marks)

   iv. The *temperature* at the end of heat rejection   (4 Marks)

   v. The *work transfer* during compression and constant volume cooling   (4 Marks)

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

5.

a. Describe the following terms of a fuel

   i. Calorific value

   ii. Flash point

   iii. Auto-ignition temperature

   iv. Stoichiometric air/fuel ratio   (8 Marks)

b. A fuel consists of *70 %* of *C, 20 %* of *H$_2$, 6%* of *S* and *4%* of *O$_2$* by mass. Take the calorific values of *C, H* and *S 33.7, 144* and *9.3 MJ/kg* respectively. Taking the molecular mass of *C, H, S* and *O 12, 1, 32* and *16* respectively, determine

i. Calorific value of the fuel (4 Marks) 00014

ii. Stoichiometric air fuel ratio (4 Marks)

iii. Actual air fuel ratio if the excess air supplied is *40 %* (4 Marks)

6.

a. Draw the *PV diagram* of the *Carnot cycle* and write an equation of the *Carnot efficiency* using the operating temperature of the cycle (4 Marks)

b. A Carnot engine absorbs heat by a source at *1000 ^0C* and rejects *240 kJ* of heat to sink at *200 ^0C*. Find the thermal efficiency, heat supplied and work done. (6 Marks)

c. Define the *Coefficient of Performance* of the reversed *Carnot cycle* operating refrigerant plant. (4 Marks)

d. A refrigerator working on reversed Carnot cycle rejects heat at the rate of *2.5 kW* from a cold chamber maintained at *277 K* and discharges it to the atmosphere at *305 K*. Find the Coefficient of performance, refrigerating effect and work done. (6 Marks)

7. The pressure, volume and temperature at the beginning of the compression of *Otto cycle* are *0.95 bar, 0.001 m^3* and *20 ^0C* respectively. The maximum pressure of the cycle is *18 bar*. The volume ratio of the cycle is *6:1*.

i. *Pressure, volume* and *temperature* of each cardinal point of the cycle

(12 marks)

ii. The *thermal efficiency* (4 Marks)

iii. The *Carnot efficiency* within the same temperature limits (4 Marks)

8.

a. Describe the three modes of heat transfer (3 Marks)

b. State the *Fourier law in heat transfer*. (3 Marks)

c. A refrigerator wall is made up of outer surface by *2 mm* of Aluminum foil and inner surface by *4 mm* of Fiberglass and *20 mm* of Mineral wool layer is sandwiched between them. One side of wall is *2 m* long and *1.2 m* high. The coefficients of thermal conductivity of Aluminum, Fiberglass and Mineral wool *180, 0.045* and *0.04 W/m K* respectively. Determine

i. The *overall heat transfer coefficient* in of the wall. (4 Marks)

ii. The *heat transfer per hour* through the wall if the outside temperature is *32 ^0C* and the inside temperature is *4 ^0C* (4 Marks)

iii. The *interface temperatures* (6 Marks)

9.

a. Draw a Temperature-Enthalpy diagram representing the following terms of vapours.

   i. Saturated liquid

   ii. Wet vapour

   iii. Dry vapour

   iv. Superheated vapour

   v. Critical temperature   (8 Marks)

b. Some thermodynamic and transport properties of **R -134a** contain in the table below. Using the properties of vapour complete the table   (6 Marks)

Pressure, bar	Saturation temperature, ^0C	Enthalpy, kJ/kg		
		h_f	h_{fg}	h_g
3.146	2	… ……	197.07	251.62
3.377	4	57.25	… …… .…	252.78
3.620	6	59.97.	193.95	… … ……
7.702	30	93.58	… … … ……	266.67
8.154	32	… … … ……	171.16	267.64
8.626	34	99.40	169.18	… … … ……

c. **R - 134a** uses to operate refrigerant plant in the temperature range between **32 ^0C** and **4 ^0C**. The refrigerant leaves the condenser as a saturated liquid and expands without an enthalpy change through the throttling valve. Then the wet vapour enters the evaporator and leaves it as a dry vapour. Find the enthalpy change in the evaporator   (6 Marks)

Hint : Use the properties of **R - 134a** in the table above

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EXAMINATION QUESTION PAPER
HYDRAULIC SYSTEMS

- *This question paper consists of Six (06) questions.*
- *Answer all the questions.*

Date: 2020.09.26   Pass mark 50%   Time allocated: 03Hrs

01). a. Briefly explain the fundamental theory behind the hydraulic systems to work.   (10 Marks)
b. Draw schematic diagram of a Hydraulic power pack & name all the components.   (08 Marks)
c. What are the things you check & observe daily as a routing on board a ship steering gear?
(07 Marks)

02). a. Briefly explain the simple practical test to proof the hydraulic pump does not directly involved to build up any pressure in hydraulic system.   (08 Marks)
b. What is the reason to decrease flow rate of a pump with increase of system pressure?
(06 Marks)

03). a. With the aid of a schematic diagram briefly explain how you set the direct acting pressure relief valve to 35 Bar.   (06 Marks)
b. What is the overpressure margin of a direct acting pressure limiting valve?   (04 Marks)
c. Overpressure margin depend due to what property?   (03 Marks)

04). a. Write down the four properties of a hydraulic oil.   (04 Marks)
b. What are the additional functions provided by hydraulic oil tank?   (06 Marks)
c. What are the additional functions provided by hydraulic oil?   (04 Marks)

05). a. What is the function of a pressure compensated flow rate regulation valve?   (04 Marks)

b. Explain how you set a pressure of a direct acting pressure relief valve with aid of hydraulic schematic diagram.   (06 Marks)

06). a. What is the meaning of counterbalancing of a hoisting winch of a deck crane which is having mechanical brake?
(06 Marks)
b. Draw ISO symbol for solenoid operated hydraulic internal piloted spring cantered 4 ports 3-way directional control valve with float centred facility. Clearly name all the ports.
(06 Marks)
c. If the hydraulic windlass cannot pick up the anchor with either speeds what can be the possible cause/causes for the failure.   (06 Marks)

d. What are the advantages of having Radial piston pump & Axial piston pumps rather than gear? pump of an electrohydraulic machinery?   (06 Marks)

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EXAMINATION QUESTION PAPER
MARINE ENGINEERING KNOWLEDGE

- *This question paper consists of **07 questions. Question 01 is Compulsory.***
- Answer **any other five (05)** questions.

Date: 2020.09.26   Pass mark 50%   Time allocated: 03Hrs

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1. Write short notes on the following topics   (20 Marks)
   (a) Draught   (b) Trim   (c) Heel

   (d) Bulkhead.   (e) List   (f) Ballast tank.

   (g) Double Bottom Tank.   (h) LNG Carrier   (i) RO /RO Ships

   (j) Fore Peak.

2. Briefly explain the components fitted in a Elevator system used onboard a ship, their purpose and the function.   (16 Marks)

3. a. With a aid of a diagram explain the details of a Drinking water system used onboard a ship, how they are stored, transferred, cleaned and filtered.   (08 Marks)

   b. With a suitable diagram explain the main components and their function of a fresh Water Generator.   (08 Marks)

4. a. Explain the procedure of Testing the boiler gauge glass. Why regular testing need to be carried out to test Boiler gauge glass   (05 Marks)
   b. Why it is so important Boiler should be well looked after.   (05 Marks)
   c. Explain the device fitted to regulate the boiler level inside the boiler.   (06 Marks)

5. a. Explain why Inert gas systems are used in ships which carry dangerous cargo.   (04 Marks)
   b. Draw a diagram of such inert gas system and explain their function.   (06 Marks)
   c. State what alarms and trips fitted in a systems.   (06 Marks)

6. a. Explain briefly Main engine modes (Location) of operation and Why.   (05 Marks)
   b. With a aid of a diagram explain how Main engine is operated from 5 (a) locations.
                                                                       (05 Marks)

   c. State what are the Alarms and trips fitted in the Main Engine.   (06 Marks)

7. a. Explain the types of Propulsion available for the ships propulsion and explain one system in detail from the prime mover to the propeller.   (08 Marks)

   b. Explain three differences between 2 Stroke Diesel engine and 4 Stroke Diesel Engine.

                                                                       (08 Marks)

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EXAMINATION QUESTION PAPER
BRIDGE & NAVIGATIONAL EQUIPMENT

- This question paper consists of 08 questions.
- Answer **all** questions.

Date: 2020.09.26   Pass mark 50%   Time allocated: 03Hrs

01). Draw a Block diagram of Marine Radar Transmitter section with expected output waveforms   (10 Marks)

02). Explain the operation of DTMF encoder and Decoder in Telephone networks

(15 Marks)

03). What are the main antenna types found in ships and indicate their maintenance.   (10 Marks)

04). Explain the principle of electromagnetic distance measurement in relation to GPS   (10 Marks)

05) Explain the system of ship position data is connected to the Navigational Instruments and Radio Communication Equipment   (15 Marks)

06). LRAIT has been established for security of countries. Draw a diagram showing the LRIT system with correctly marked component parts   (15 Marks)

07). a. What are the Internal Circuit Blocks of an AIS transceiver systems.   (10 Marks)
      b. What is meant by "Satellite based AIS"   (05 Marks)

08). What are the main GMDSS Radio Communication equipment available for Ships   (10 Marks)

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EXAMINATION QUESTION PAPER
AUTOMATION, CONTROL & INSTRUMENTATION 1

- This question paper consists of 05 questions.
- Answer *all* questions.

Date: 2020.09.27   Pass mark 50%   Time allocated: 03Hrs

1. With regards to the control systems,

    a. Define the term "**Transfer Function**" of a control system.   (02 Marks)

    b. Find the transfer function of following control-block diagram.   (06 Marks)
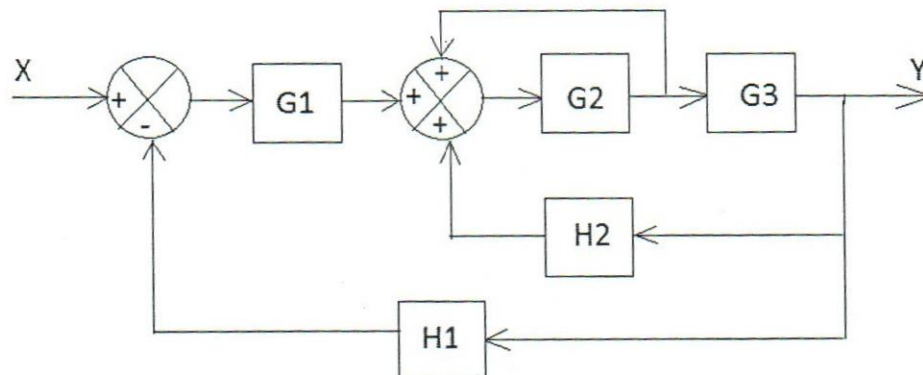
    c. Draw the typical control curve and name its important parameters.
                                                                              (06 Marks)
    d. Draw control block diagrams of a **PI, PD** and **PID** controllers.   (06 Marks)

2. With regards to the digital technology,

    a. Convert the following numbers to their decimal equivalents.
        (a) 111101011_2 (03 Marks)
        (b) 631_8 (03 Marks)
        (c) $EF8B_{16}$ (03 Marks)

    b. Explain the difference between combinational logic system and sequential logic system   (05 Marks)

c. Find Boolean expression for following logic circuit (06 Marks) 00014
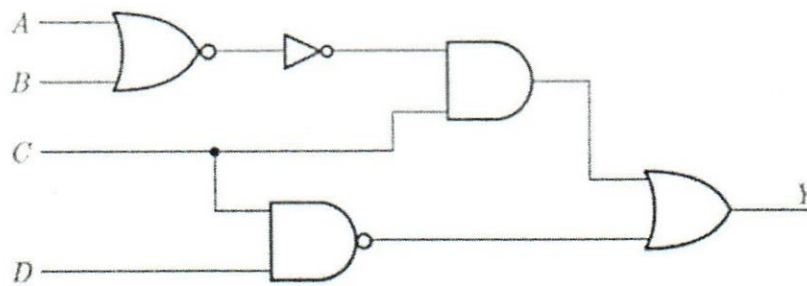
3. With regards to the Programmable logic controllers,

   a. Draw the internal structure of a typical PLC and state available types of PLCs based on the structure. (06 Marks)

   b. What are the advantages of using PLCs than hard wired control panels? (04 Marks)

   c. A Forward-Reverse Induction Motor controller to be implemented by using a PLC with following requirements. (10 Marks)
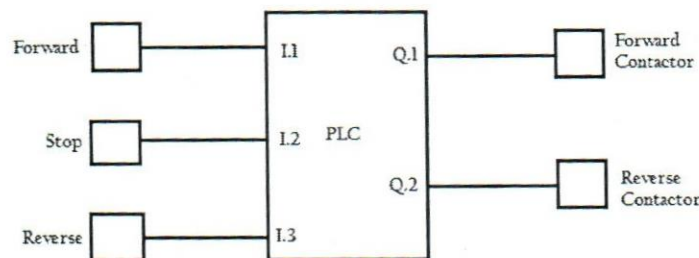
   - When the Motor is running on one mode (either Forward or Reverse), directly change to the other mode is disabled. That means the change of the rotating mode should enabled after the Stopping of the Motor.

   - After pressing Stop button after any mode of rotation, the time period of 10 seconds should be given for the deacceleration of the Motor before enabling other rotating modes.

4. With regards to the measurement systems available in ships,

   a. Describe the principal of liquid level measurement, using capacitive liquid level probe. (08 Marks)

   b. Describe construction of a 3-wire PT-100 probe with the aid of sketches and explain how the errors due to wire resistance are compensated in the 3-wire system. (08 Marks)

   c. What are the possible measurement errors that can be occurred practically, when using thermocouples? (04 Marks)

5. With regards to the SMART sensors used in ships,

    a. What is a protocol?   (02 Marks)

    b. What is a SMART sensor and describe its specifications   (08 Marks)

    c. Describe the multiple parameter measurement using SMART sensors and HART protocol with the aid of sketches.   (10 Marks)

EXAMINATION QUESTION PAPER
MARINE ELECTRICAL SYSTEM

- *This question paper consists of 06 questions.*   *Date: 2020.09.29*
- *Answer all Six (06) Questions.*   *Pass mark 50%*   *Time allocated: 03Hrs*

1. a. With reference to navigational lights

    i. Sketch navigational light and anchor light arrangement onboard ship and state color of each angle degree of vision and minimum visible distance.   (05 marks)

    ii. Sketch the basic Electrical circuit diagram of the Navigation Lamp Monitoring system and Explain how it works to monitor the working lamp   (05 marks)

    b. With reference to Signal mast Lights.

    i. What is the color and the degree of vision of NUC Lamps.   (04 marks)

    ii. What are the alarms associated to signal mast and navigational lights   (04 marks)

2. a With reference to Fire and Smoke alarm system

    i. List four Fire heads used with fire alarm to monitor fire or smoke   (06 marks)

    ii. Which of the Electrical loads are shut down automatically as soon as CO_2 Pilot cabinet is opened?   (05 marks)

    iii. List safety steps to be followed prior to enter CO_2 battery room   (05 marks)

3. With reference to Main switch board and Generators.

    i.   List Instruments required at the Generator Panels and synchronizing panel.   (06 marks)

    ii. What is the main purpose of preferential trip.   (04 marks)

    iii. What is the purpose of reverse power relay.   (04 marks)

    iv. What are the devices Suitable for Three phase Short Circuit Protection   (04 marks)

4. With reference to hotel and laundry equipment

    i.   Sketch an Electrical circuit (connection) arrangement of hot plate of Cooking range for low heat, medium heat and high heat using two heating elements.   (06 marks)

    ii. Where the cold room trap alarm warning is sends to alert duty officer   (06 marks)

    iii. Why the Electrical equipment's are IR tested on routine basis   (04 marks)

5. With reference to the Low Voltage shipboard Alternators,

    a. State for conditions to be checked for synchronizing an alternator with live bus bar. (06 marks)

    b. What are the different indication methods used for synchronizing alternators manually Describe any one of the routine method and emergency method with neat sketch. (06 marks)

    c. What are the permits used to work on LV Electrical systems onboard ship? (04 marks)

6. With reference to electrical equipment's in tankers and deck machineries

    a. Draw the intrinsically safe barrier circuit (Zener barrier) with main component. (04 marks)

    b. Where Ex type enclosures are required /installed compulsory (04 marks)

    c. Which device of a three phase induction motor (All Electric Deck Cargo Crane hoist motor) prevent turning or dropping any lifted cargo during power failure (04 marks)

    d. What should be the IP code of enclosure suitable for Electrical motors and controller installed on open Deck (04 marks)

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EXAMINATION QUESTION PAPER
MARINE ELECTRICAL PRACTICE

- *This question paper consist of 06 questions..*
- *Answer all the Questions.*   **Pass mark 50%**   *Time allocated:*   03 Hrs
  Date   : 2020.09.29

01. a. Explain the following electrical terms.

     i.   "Efficiency "of incandescent lamp

     ii.   "Single phasing" of a three-phase induction motor.

     iii.   "Stroboscopic" effect of a fluorescent lamp circuit.   (12 Marks)

   b. Describe construction and operating principle of a single pole M.C.B.   (06 Marks)

02. a. Figure shows a rating plate data of an definitions of a electric machine. Explain the terms in each case 1 to 11.

                                                          (11 Marks)

BBC BROWN BOVERY		
1 → 3- Mot	16C78-180M ← 2	
3 → Δ / Y 230/400V	42/24A ← 4	
5 → 11 kW	Cos φ - 0.82 ← 6	
7 → 1720 r.p.m	60Hz ← 8	
9 → IP- 54	S1	Insul. Cl. E ← 11
	↑ 10	
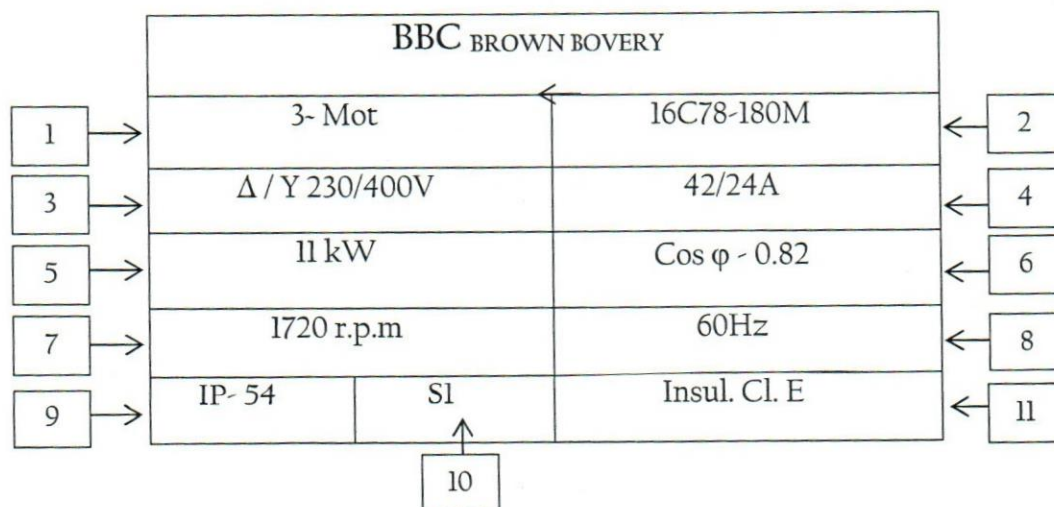
   b.   What are the following values of this machines.

       i.   Apparent power at full load
       ii.   Numbers of magnetic poles.
       iii.   Slip at full speed.
       iv.   Efficiency at full load.   (08 Marks)

03. a What is a transformer?. Explain its working principle what do you understand by step down and isolation transformer.

(06 Marks)

b. A 33000/1100V , 330kVA step down transformer is star connected on the primary side and delta connected on secondary side. Find the ratio between the number of turns of primary and secondary. also calculate the value of line and phase current in both the windings.

(09 Marks)

04. a. A three phase wound rotor motor has been flooded with sea water and its insulation resistance is down to zero MΩ.What is the procedure for putting the motor back in to service.

(06 Marks)

b. Describe the methods of speed and changing direction of rotation of D.C. shunt motor.

(07 Marks)

05. Draw " Power " and Control circuit for single winding two speed (DHAHLANDER) magnetic contactor starter circuit (direct). (Mark the all terminal numbers and equipment identification letters)

Specification
   i. Power circuit supply 3 - 400/50Hz with E (Insulated neutral system)
   ii. Motor rating plate.

3- Mot		IEC 978 - 2
400 Δ / YY		2.4/2.8 Δ/YY
0.9/1.1 kW		Cos φ - 0.9/0.88
1440/2880 r.p.m		50Hz
IP- 54	S1	Insul. Cl. F

   iii. Control Circuit supply 230V- - 50Hz
   iv. Indicator lamp: "Green" for Low speed
                       "Yellow" for High speed
                       "Red" for control circuit power

(20 Marks)

06. a. Explain meaning of three digits in IP code of an Elect motor installed on Main deck

(05 Marks)

b. Where the EXd type Electrical Enclosures are used in Ships   List few applications

(04 Marks)

c. Explain advantages of Wound rotor motor compared to Squirrel cage Induction Motor

(03 Marks)

d. Why Motors installed on open deck should be TEFC type

(03 Marks)

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EXAMINATION QUESTION PAPER
PNEUMATIC SYSTEM

- *This question paper consists of 06 questions.*
- *Answer all the Six (06) Questions.*

Date: 2020.09.30   Pass mark 50%   *Time allocated: 03Hrs*

01). a. What are the essential sections of a pneumatic systems?   (06 Marks)

    b. Name 02 no's signal processing elements & 02 no's signal in put elements.   (05 Marks)

    c. Explain the importance of F.R.L. unit for the pneumatic system.   (08 Marks)

02). a. Draw I.S.O. symbols for following pneumatic components.

      i. Quick exhaust valve.

      ii. Double acting actuator with both ends cushioning.

      iii. Push button & pilot air actuate, 5 ports, 2-way directional control memory valve.

      iv. Adjustable pressure sequence valve.   (04 x 04 Marks)

03). a. Draw the schematic pneumatic diagram for indirect control of a double acting actuator both directions with maximum speed.   (08 Marks)

    b. Briefly explain the working principal of the following pneumatic components.

      i. two pressure valves.

      ii. "or" gate valve.

      iii. "off delay" time delay valve.   (03 x 03 Marks)

04). a. What is the meaning of "signal overlap"?   (04 Marks)

    b. Name the two types of sequential circuits. Give examples for each.   (03 Marks)

    c. Write the difference between adjustable pressure regulating valve relieving type & non-reveling type.   (07 Marks)

05). Draw control circuit for exhaust air control of a double acting actuator for both directions.

                          (10 Marks)

06). Read the following pneumatic control circuit and answer the following questions.
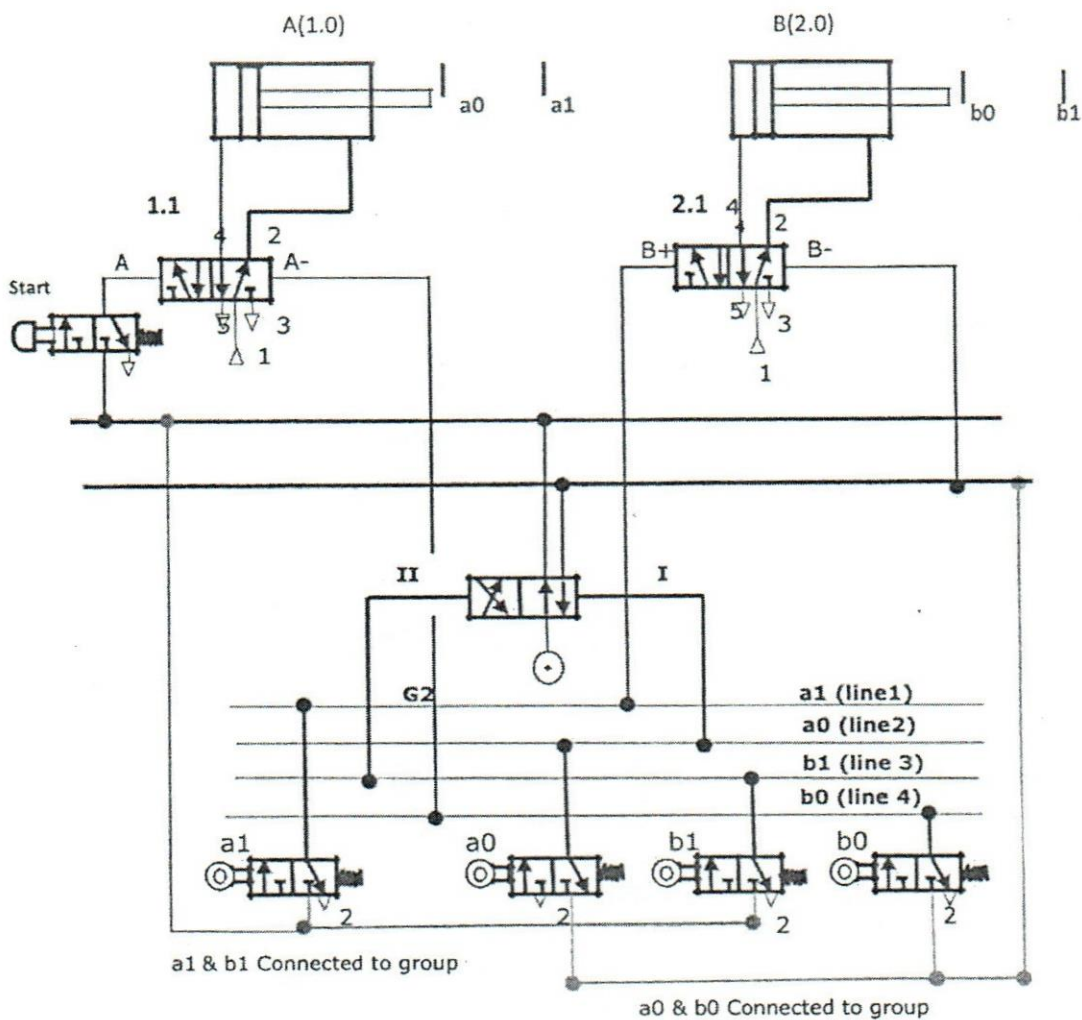
a. What is the sequence of above actuators?

b. Highlight the working powerlines with red pen.

c. Draw the complete stepper diagram for these 2 actuators.

d. Write the example marine applications similar to above circuit on board.   (04 x 6 Marks)

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EXAMINATION QUESTION PAPER
ENGINEERING SCIENCE

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

Date: 2019.09.30   Pass mark 50%   Time allocated: 03 Hrs

1. With regards to the Moment of Inertia,

   a. What are the rotational inertias of following two objects, along the given axis?

   (10 Marks)
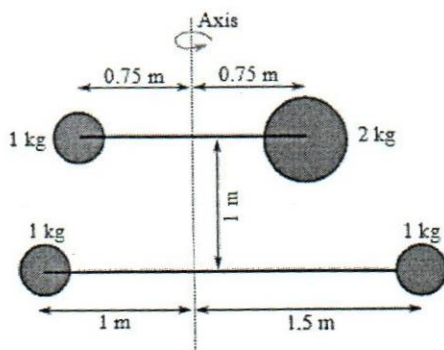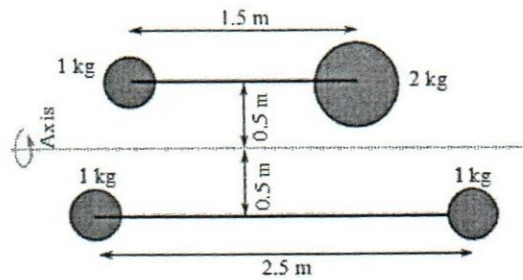
(A)   (B)

   b. A motor capable of producing a constant torque of **200 Nm** and a maximum rotation speed of **300 rad/s** is connected to a flywheel with rotational inertia **0.15 kgm^2**.
      i. What angular acceleration will the flywheel experience as the motor is switched on?

      (05 Marks)

      ii. How long will the flywheel take to reach a steady speed if starting from rest?

      (05 Marks)

2. With regards to the linear motion,

   a. Define following terms   (06 Marks)
      i. Displacement
      ii. Velocity
      iii. Acceleration

b. A train is travelling along a straight path between two stations A and B. Initially at station A, the train accelerates uniformly from rest to a speed of $18mS^{-1}$ and maintains this speed for 5 mins. It then decelerates uniformly until it comes to rest at station B. The acceleration and deceleration are $5mS^{-2}$ and $3mS^{-2}$ respectively,

    i. Draw a Velocity time graph for this movement, (06 Marks)

    ii. Hence or otherwise, find the total journey time and the total distance between the two stations. (08 Marks)

3. With regards to the angular dynamics,

   a. Define following terms. (06 Marks)

     i. Angular displacement

     ii. Angular velocity

     iii. Angular acceleration

   b. Two different pullies are attached through a belt as follows. The pully A is having a radius of 600mm and B is having 150mm and the pully A is rotating at 40 rad/s.

     i. Find the angular velocity of the pully B. (04 Marks)

     ii. Find the speed of the belt. (04 Marks)

     iii. Now, if the pully A is angularly accelerated by $6 \ radS^{-2}$, what is the angular velocity of the pully B after 16 seconds. (06 Marks)
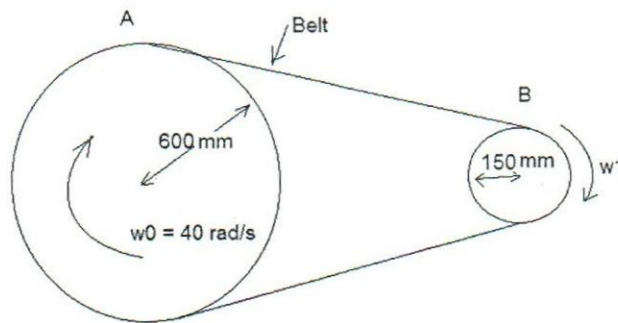
4. With regards to the heat transfer,

   a. Define following terms (04 Marks)

     i. Specific heat capacity.

     ii. Specific latent heat.

   b. The heater in an electric kettle has a power of 3.3 kW. When the water in the kettle is boiling at a steady rate, the mass of water evaporated in 10 minutes is 530 g. The specific latent heat of vaporization of water is 2.26 Jkg^{-1}. Calculate the rate of loss of thermal energy to the surroundings of the kettle during the boiling process.

(08 Marks)

   c. A rigid container of internal volume 0.85 m3 contains a gas at a pressure of 275 kPa and temperature 15°C. What will be the pressure of the gas in the container if an additional 2.1 kg of the gas is pumped into the container at the same temperature? The gas has a characteristic gas constant of 290 J kg^{-1} K^{-1}.

(08 Marks)

5. With regards to the friction,
   a. State the laws of friction   (06 Marks)
   b. Following system is formed by using rough surfaces and smooth pullies. All weights are connected by a smooth code. Find,
      i. The acceleration of the total system and mark the direction. (4 Marks)
      ii. Friction forces between the surfaces and the 10kg and 20kg objects.

                                                                                          (04 Marks)

      iii. Tensions of each and every cord

                                                                                          (06 Marks)
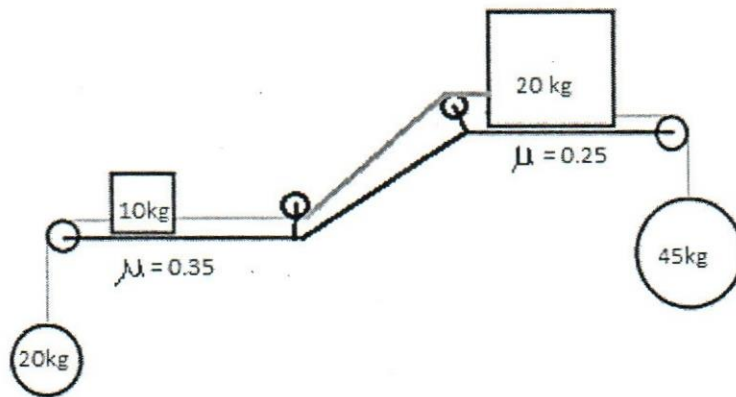
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EXAMINATION QUESTION PAPER
MARINE LEGISLATION & SAFETY MANAGEMENT SYSTEMS

- This question paper consist of 06 questions..
- Answer all the Questions. **Pass mark 50%** Time allocated: 03 Hrs
Date : 2020.09.30

1. With regard to the Risk Assessment process;
   a. Name the key steps of Risk Assessment? (06 Marks)
   b. Briefly define each of above. (10 Marks)

2. As per the SOLAS Ch II -1 Electrical Installations:
   a. How many "Parts" are there in that chapter and state the areas covered each part. (04 Marks)
   b. State the essential features of an electrical installation system on board ship. (06 Marks)
   c. What should be the capacity of main source of electrical power on board ship? (04 Marks)
   d. State the minimum number of generating sets should be installed in marine electrical system. (02 Marks)

3. Regarding emergency source of electrical power in ships,
   a. State the duration of emergency power requirement for passenger ship. (02 Marks)
   b. State the duration of emergency power requirement for cargo ship. (02 Marks)
   c. State the names of various equipment & systems to be powered by emergency electrical source on board ships. (12 Marks)

4. Regarding SOLAS Ch II-2
   a. State the fire safety objectives. (06 Marks)
   b. Briefly define the types of fire safety bulkheads used in ship construction. (10 Marks)

5. Regarding watertight doors fitted on board ship,
   a. State the locations of the ship require to be fitted with watertight doors. (02 Marks)
   b. State the various types (Classes) of such doors as per SOLAS. (04 Marks)
   c. What are the safety requirements regarding watertight door operation? (10 Marks)

6. With reference to Marpol Annex I;
   a. State the name of the Certificate and Record issued to ships to show the compliance with above annex. (03 Marks)
   b. State the requirement to be met by an Oil filtering Equipment fitted to ships above 10,000 GT. (05 Marks)
   c. State the data storage requirement for oil content monitoring equipment on an Oily Water separator in a machinery space of a ship. (08 Marks)

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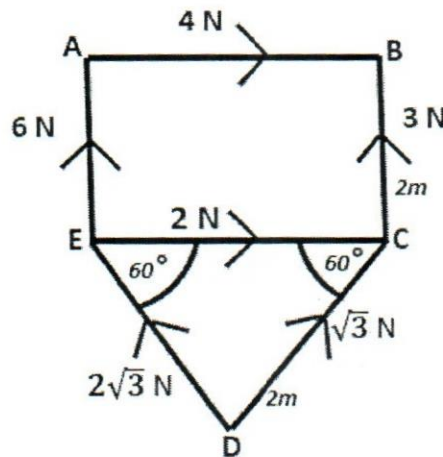EXAMINATION QUESTION PAPER
MECHANICAL SCIENCE.

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

Date: 2019.10.02   Pass mark 50%   Time allocated: 03 Hrs

01). Regarding System of Forces

a. Find the resultant force of the system   (05 Marks)

b. Find the angle of the resultant force   (05 Marks)

c. What is the point (X value) where resultant force meets CE produced (Take E as the origin (0,0))

(05 Marks)

d. Get an equation for the line of action   (05 Marks)

02). Regarding Hydraulics

a. Define following terms   (06 Marks)

    i   Turbulent flow
    ii   Laminar flow
    iii Uniform flow

    iv   Steady flow

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

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

d. Consider the following water pipe and find
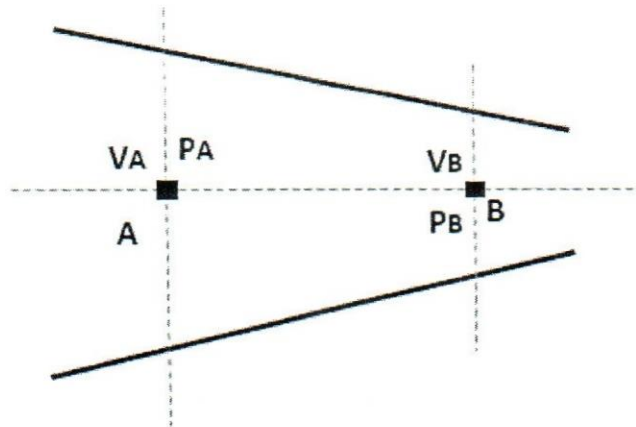
i   Velocity at point A
ii   Velocity at point B
iii   Mass flow rate

Details:

Diameter at point A = 125 mm

Diameter at point B = 375 mm

Pressure difference of point A and B = 1.6 kPa

03). Regarding Friction and linear motion   (12 Marks)

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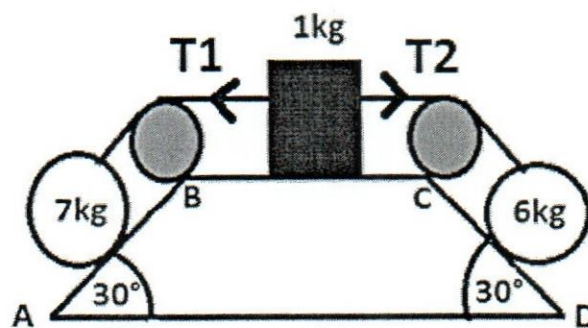
i   What is the acceleration of the system?
ii   Find the tension T1 and T2
iii   If the BC plane is rough with a coefficient of friction (μ) 0.5 what will happen to the
         system?

b. Sunil is cycling his bike initially at 1.5 m/s before he decides to accelerate at 0.6 m/s^2. What will
   be the time taken to cover 150m on a 500m straight road leading to his school?

(08 Marks)

04) Regarding stability of a ship and center of gravity

    a. A uniform solid composite body consists of a right circular cone of base radius **4r** and height **2h** and a rigid circular cylinder of radius r and height **2h** fixed together as shown in the figure. Find the center of mass of the composite body from the vertex of the cone. (10)
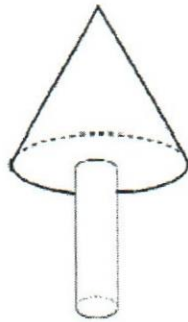
    b. Consider the following cross section of a hull
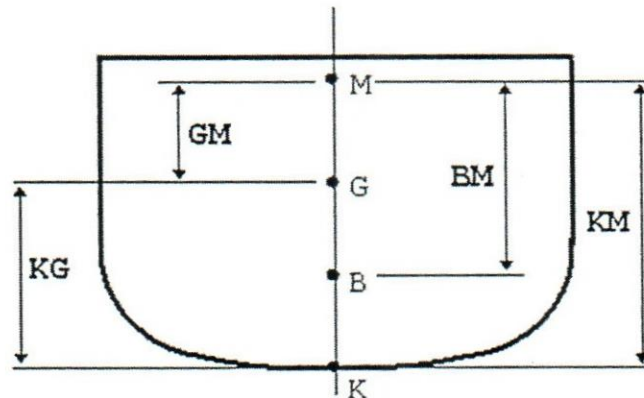
    i   Name the points **M, G, B and K**   (03 Marks)
    ii   Briefly describe the following linear measurements in stability of a ship
        GM, BM, KG and KM   (03 Marks)
    iii Define the following types of stabilities by using diagrams   (04 Marks)

         • Positive stability
         • Negative stability
         • Neutral stability

05) Regarding Hydrostatics   (04 x 05 Marks)

    i   State two applications of pascal's law and describe one of them using diagrams
    ii   What is the difference between gauge pressure and absolute pressure?
    iii What is the usage of following meters?
         • Manometer
         • Barometer

    iv Calculate the pressure and force on an inspection hatch of 1 m diameter located on the bottom of a tank when it is filled with oil of density 900 kg/m3 to a depth of 10m.

    v   The gauge pressure of fluid in a pipe is 70 kPa and the atmospheric pressure is 100 kPa. Find the absolute pressure of the fluid in the pipe

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EXAMINATION QUESTION PAPER
MATHEMATICS.

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

Date: 2019.09.29   Pass mark 50%   Time allocated: 03 Hrs

01). a. Factories following equations

    i $2x^2 - x = 3$

    ii $x^2 + 6x + 5 = 0$ (02 X 2 Marks)

  b. Solve the following equations by the method of completing square

    i $3x^2 - 6x + 5 = 0$

    ii $2x^2 - 7x + 6 = 0$ (03 X 2 Marks)

  c. Without the use of differentiation, draw a rough sketch of the graph $x^2 - 2x - 3 = 0$, and indicate all critical points on the graph

                   (05 Marks)

02). a. Differentiate with respect to x

    i $2x^2 - 7x$

    ii $\sqrt{x} - \frac{1}{x^3}$

    iii $\frac{(3x-2)^2}{\sqrt{x}}$ (03 X 3 Marks)

  b. Differentiate with respect to x using <u>chain rule</u>

    a. $(x^2 + 3x - 5)^4$

    b. $\sqrt{3x^2 - 2x + 4}$ (03 X 2 Marks)

  c. A curve is given by the parametric equation $x = t^2 + 1, y = 2 - t^3$. Find the gradient of the curve at the point whose parameter is 2. Find also the equation of the tangent to the curve at that point.

                   (05 Marks)

03). a. Integrate the following functions with respect to x

    i $\int (x^{-4} - 4x)\, dx$

    ii $\int (x + 3)\sqrt{x - 2}\, dx$ (03 X 2 Marks)

b. Find below definite integrals

    i $\int_{-3}^{-1} \frac{(x-1)}{x^4} dx$

    ii $\int_{-1}^{-2} \frac{x^2}{\sqrt{x+2}} dx$ (03 X 2 Marks)

c. Roughly sketch the curve $y = 4x - x^2$ and find the area between the x axis and the curve.

                        (08 Marks)

04). a. If $r = 3 + i, s = 1 - 2i,$, find,

    i $\frac{r+s}{r-s}$

    ii $\frac{s}{1+i}$ (02 X 2 Marks)

b. Solve completely the equations;

    i $x^2 + 8 = 0$

    ii $x^2 - 2x + 3 = 0$ (03 X 2 Marks)

c. Show that $\frac{1+2i}{3-i} + \frac{1-2i}{3+i}$ is real   (05 Marks)

05). a. A thin wire of length 32 cm is bent in the form of a sector of a circle having a radius of 8 cm. Find the area covered by the sector.

                        (05 Marks)

b. Using $sin^2x + cos^2x = 1$, prove that;

    i $tan^2x + 1 = sec^2x$

    ii $cot^2x + 1 = cosec^2x$ (02 X 2 Marks)

c. In the triangle ABC, a=9cm, c=7cm, and $B = 75^0$. Solve the triangle.   (06 Marks)

06). a. Given that;

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

$$E = \begin{bmatrix} 5 & -2 \\ 2 & 1 \end{bmatrix}, F = \begin{bmatrix} 2 & 4 \\ 1 & 5 \\ 3 & 2 \end{bmatrix}, G = \begin{bmatrix} 1 & 0 & 1 \\ 2 & 3 & 3 \end{bmatrix}, H = \begin{bmatrix} 1 & -1 \\ 2 & 3 \\ 4 & 1 \end{bmatrix}$$

Find if possible;

    i $2A$
    ii D^T
    iii $2B + 3G + H^T$
    iv EC
    v $3F + 5H$ (02 X 5 Marks)

b. Given that $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ find $A^2 - 2A + 3I$ (05 Marks)

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REPEAT EXAMINATION QUESTION PAPER
ELECTRICAL POWER & MACHINES

- This question paper consist 05 questions.
- Answer all the questions. Pass mark 50%

Date: 2020.07.11
Time allocated: 3Hrs

01. With reference to Synchronization and paralleling of AC generators.

    a. List criteria to be matched to synchronize an incoming generator to the live bus bar (04 marks)

    b. List three simple synchronizing lamp method and emergency synchronizing method (03 marks)

    c. What are the advantages of Synchro scope and the check synchronizer (04 marks)

    d. Why Analog Synchro scope does not rotate as soon as the incoming ACB is closed. (03 marks)

02 . a. Explain brief paralleling and specially what kind of protection required for it (05 marks)

    b. Sketch with busbar, ACB of incoming generator and required accessories and Explain emergency synchronizing method (06 marks)

    c. List Generator protections (05 marks)

    d. List six Essential ships Electrical loads (03 marks)

03. a. List Voltages used on board ships indicating LV range and HV range voltages (04 marks)

    b. Write Equations and units of Active, Reactive and Apparent Power (Three phase) (06 marks)

    c. Alternators and transformers are rated in which unit and what is the reason for it (03 marks)

    d. Explain the purpose of Sequential Starting system (03 marks)

04. a. Sketch and name each component of Static Excitation System (12 marks)

    b. Compare Error operated AVR and Functional AVR (05 marks)

    c. Sketch and Name each component of Brush less Generator (12 marks)

    d. Sketch and explain the purpose of Preferential tripping (04 marks)

05. a. Sketch and name main components of the DOL motor starter Power circuit (07 marks)

    b. List reduced voltage starting method of Three phase motors (03 marks)

    c. List type of motors used for important Deck machineries (04 marks)

    d. List AC three phase Motor Protections (04 marks)

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REPEAT EXAMINATION QUESTION PAPER
ELECTRICAL DRAWING

- This question paper consist 05 questions.
- Answer All the Questions.

Date: 2020.07.11   Pass mark 50%   Time allocated: 03Hrs

02. Draw symbols for the following devices.
   a. Inductor with core.
   b. PTC Resistor
   c. Electrolytic capacitor
   d. PNP Photo Transistor
   e. D.C Series motor
   f. Incandescent Lamp
   g. 1 - Auto transformer
   h. Variable resistor
   i. V.D.R
   j. 1 - Capacitor running motor
   l. Buzzer
   k. 3 ~ Δ/Y Transformer

   (24 Marks)

03. Draw the circuit diagram of the following single line diagram.

1~ / 230V/50Hz
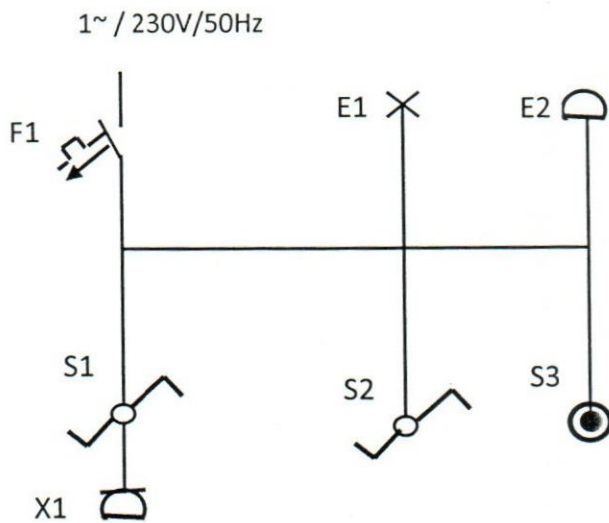
(16 Marks)

03. Figure Q3 shows the block diagram of a single-phase AC to DC conversion system. Draw the circuit diagram by illustrating each block. .
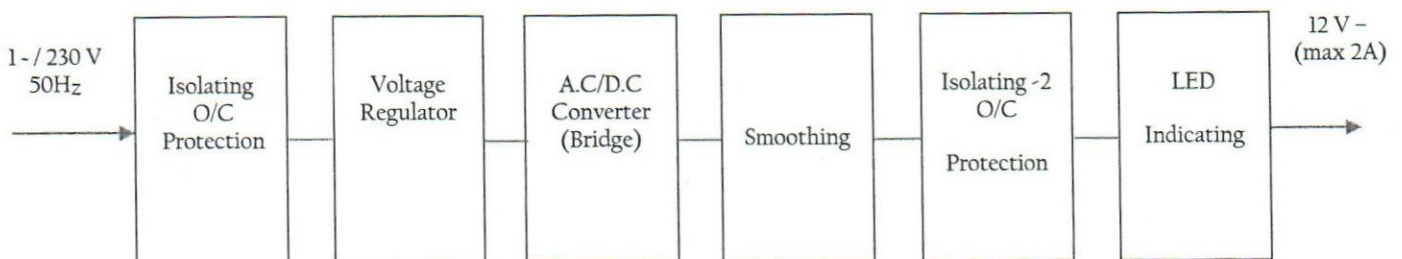

Figure Q3   (20 Marks)

04. Geometrically construct below C – Wrench

C–WRENCH   GEOMETRICAL SHAPE (FULL SCALE)

(20 Marks)

05.   Draw the isometric view for the following orthographic views. (Size of each square is 12 x12mm)

(20Marks)

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REPEAT EXAMINATION QUESTION PAPER
ELECTRO TECHNOLOGY

- This question paper consist 06 questions.
- Answer any 05 questions.

Date: 2020.07.05   Pass mark 50%   Time allocated: 03Hrs

Q1. a. Apply Kirchhoff's current law (KCL) for node a, b, c and d shown in **Figure 1a**.
Write down the current equations clearly with correct sign convention. **(04 Marks)**

b. Re draw the circuit diagram to show the branch currents in terms of I_1, I_2 and I_3 only **(04 Marks)**

c. Apply Kirchhoff's voltage law (KVL) for the closed circuit of **e , a, f ,d, c, b, e** in clockwise direction. **(04 Marks)**
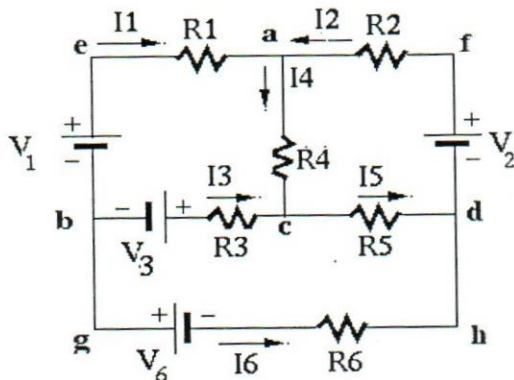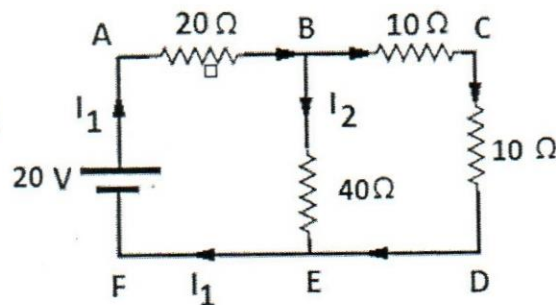

Figure 1a   **Figure 1b**

d. Find the current through BCDE branch shown in **Figure 1b**. **(08 Marks)**

Q2. a. Instantaneous voltage waveform equations are given as:
$v_1(t) = 6 \sin (100\pi t + 30^0)$
$v_2(t) = 4 \sin (100\pi t)$,
$v_3(t) = 3 \sin (100\pi t - 60^0)$ and
$v_4(t) = 8 \cos (100\pi t)$

i. Calculate the period and the frequency of each. **(03 Marks)**

ii. Calculate the peak and the peak-to-peak amplitude of $v_1(t)$. **(03 Marks)**
iii. Calculate the rms amplitude of $v_2(t)$. **(03 Marks)**
vi. Time from the instant the current is zero and becoming positive, find the instantaneous value after **0.004seconds** of $v_3(t)$. **(03 Marks)**

b. Find the resultant voltage waveform equation of the above voltage waveforms in part (a). Equation should be written in the same format of the given voltages. **(08 Marks)**

Q3. a. State the Lenz's law in relation with Electromagnetic Induction? **(05 Marks)**

b. State the Faraday's Law in relation with electromagnetic Induction? **(05 Marks)**

c. **Figure 4a** and **Figure 4b** shows a solenoid coil is wound on a paper cylinder. The ends of the coil are connected to a zero galvanometer. A magnet moves towards the coil at the velocity of V m/s as shown in figure.

Using Faraday's Laws and Lenz's Law explain the direction of current through the galvanometer. **(10 Marks)**
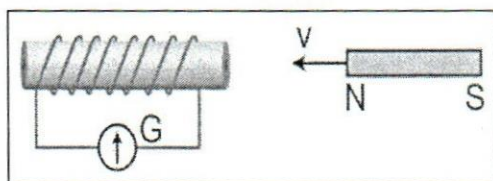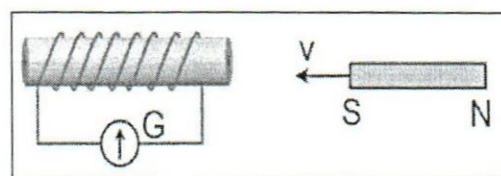

Figure 4a   **Figure 4b**

Q4. a. State what is meant by the term 'reactance'. **(05 Marks)**

b. The frequency of the a.c. supply is increased. Sketch a graph to show how the reactance of the inductor varies with the frequency of the output from the supply. **(05 Marks)**

c. On the same graph, draw the variation of capacitive reactance with frequency. **(05 Marks)**

d. State what is meant by **series resonance** of a series RLC circuit **(05 Marks)**

Q5. a. A 50 Ω resistor and 100mH inductor are connected in series with an AC source of 230V, 50Hz. Find;
    i. Impedance **(02 Marks)**

    ii. Current **(03 Marks)**

    iii. Phase angle between voltage and current **(03 Marks)**

    iv. Power factor **(03 Marks)**

    iv. Calculate the value of the capacitor needed to improve the power factor to unity. **(03 Marks)**

    vi. Calculate the supplied power from the source before and after connecting the capacitor. **(03 Marks)**

    Vii. Discuss the advantages after improving the power factor. **(03 Marks)**

Q6.　a.　Write down the equations of instantaneous voltages for the waveforms shown in figure 6.
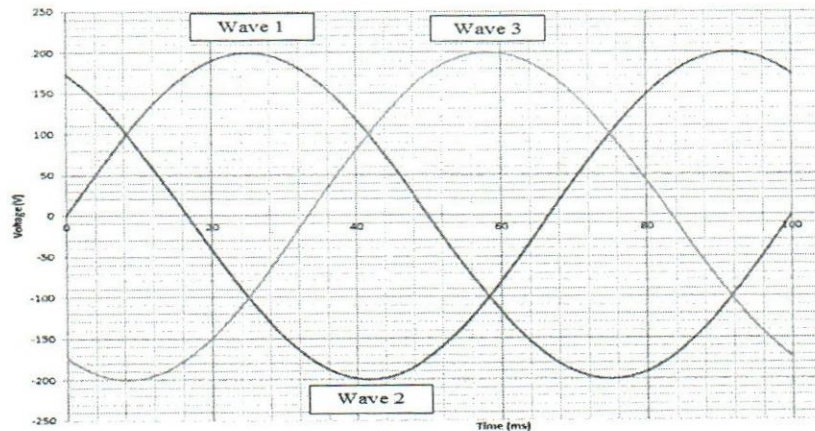
(06 Marks)

Figure 6

　b.　For a three phase AC supply system
　　　　i.　Draw the star connected and Delta connected arrangements.
　　　　ii.　For the above arrangements in part (i), give the relationship between
　　　　　　• phase voltage and line voltage
　　　　　　• Phase current and line current

　　　　iii.　Total power equation with phase quantities (V_{ph} and I_{ph}) and line quantities (V_L and I_L)

(06 Marks)

　c.　Three similar coils, each having a resistance 0f 10 ohms and an inductance of 0.01H are connected first in star formation and then in delta formation to a three phase, 50 Hz supply with 400V between lines. Calculate the total power absorbed and the line current in each case of star and delta.

(08 Marks)