(3 Hours) [Total Marks : 100]

N.B. : (1) Question No. **1** is **compulsory**.
     (2) Attempt any **four** questions from remaining **six** questions.

1. (a) Explain with examples how is polymorphism achieved at compile time and   **10**
     run time.
  (b) Find the output of the following :—   **10**
     (i) int main ( )

```
{
        for ( int i = 0 ; i < 8 ; i++)
        {
                if ( i % 2 = = 0)
                cout < < i + 1 < < endl ;
                else if ( i % 3 = = 0)
                continue ;
                else if (i % 5 = = 0)
                break ;
                cout < < "\ n End of program \n" ;
        }
    cout < <"\n End of program \n" ;
}
```

     (ii) # include < iostream.h >

```
class abc
{
        int i ;
        public :
        abc (int v = 0)
         {
                cout < < "In the constructor \n";
                i = v ;
        }
        void print (void)
        {
                cout < < "The value of i is" < < i < < endl;
        }
} ;
void main ( )
{
        abc  a (10) ;
        abc b ;
        a. print ( ) ;
        b. print ( ) ;
}
```

2. (a) What is constructor ? Why it is called so ? What are the syntax rules for   **10**
     writing constructor ? Describe Inline constructor.
  (b) Write a C++ program to find the greatest Common Divisor of two numbers.   **5**
  (c) Write a program to accept a set of 10 numbers and print the numbers using   **5**
     pointers.

[TURN OVER

3. (a) Write a program to sort a set of 10 floats in descending order using bubble **10**
sort method.

(b) Explain storage classes with one programming example. **10**

4. (a) Define a structure called cricket that will describe the following information — **10**
player's name, country name, best score, Batting average.
Develop a program that will store information of 25 cricket players around
the world using this structure. Also display names of these cricketers in
descending order with respect to their batting average.

(b) Explain the following terms— **10**
   (i) setw()
   (ii) setprecision ()
   (iii) precision ()
   (iv) fill ()

5. (a) What are friendly function ? Give the characteristics of friend function. Write **10**
a program to demonstrate how a common friend function can be used to
exchange the private values of two classes. (Use call by reference method).

(b) Explain inline function with an example. **5**

(c) Write a program to display a series of 15 terms of fibonacci series. **5**

6. (a) Write a program in C++ to transpose a matrix. **10**

(b) Describe the following features of object oriented programming. **10**
   (i) Inheritance
   (ii) Polymorphism.

7. Write short notes on following :— **20**
   (a) Access specifiers
   (b) this pointer
   (c) virtual function
   (d) Function overloading.

14/6/2011

FE SEM-I (REV)
Basic Electrical & Electronics
Engineering.

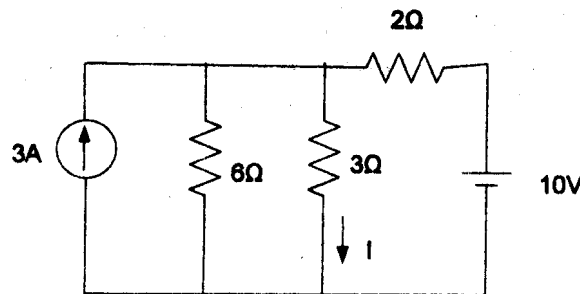Con. 3382-11.

RK-1065

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.

(2) Attempt any **four** questions from remaining **six** question.

(3) Assume **suitable** data if **necessary**.

(4) **Figures** to the **right** indicate **full** marks.

1 A) Using source transformation find I. 05

B) A voltage of 125V at 50Hz is applied across a non-inductive resistance connected in series with a capacitance. The current is 2.2A. The power loss in resistance is 96.8 watts. Find R and C. 05
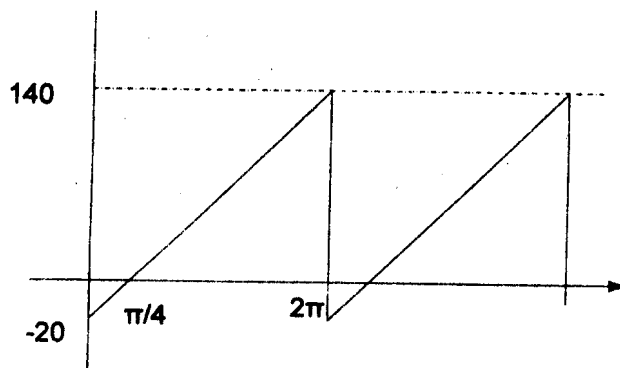
C) A 3 phase motor load has a p.f. of 0.397 lagging. Two watt meters connected to measure power show the input as 30KW. Find reading of each watt meter. 05
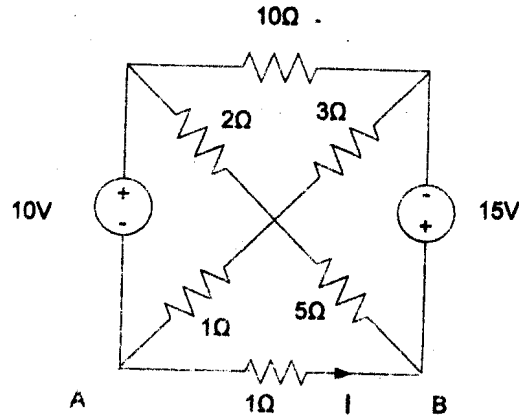
D) Find the average and rms value for the wave form given below. 05

2 A) Using Norton's Theorem find I.

08

10Ω

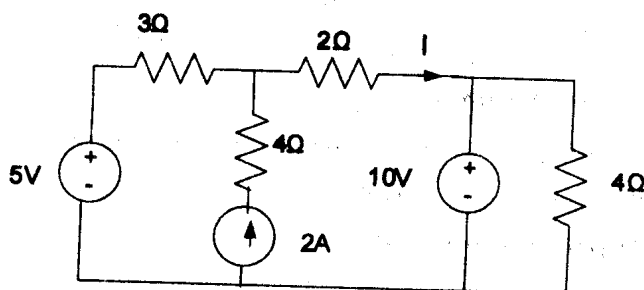2Ω 3Ω

10V
+
−

−
+
15V

1Ω 5Ω

A

1Ω I B

B) Derive the expression for star –delta and vice-versa conversion of three resistances.   06

C) Explain Input and output characteristics of BJT in common emitter configuration.   06

3 A) Using superposition principle Find I. 08

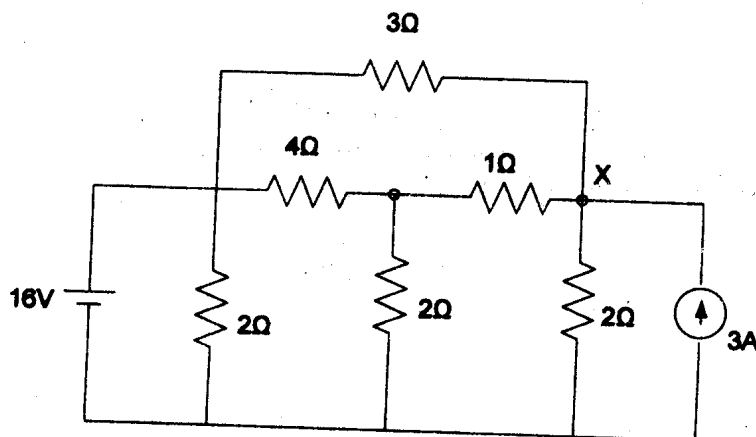B) Explain construction , working and characteristic of zener diode. 04

C) A series circuit with R=5Ω, C= 20µf and a variable inductor has an applied voltage of 10v with frequency of 1000 rad/sec. The inductor is adjusted until voltage across resistance is maximum. Find voltage across each element. 08

4 A) For the circuit below , using nodal analysis, Find voltage at X. 08

B) Each of the star connected load consists of a non-reactive resistance of 100Ω in parallel with a capacitance of 31.8µf. Calculate the line current, power absorbed, the total KVA and power factor when connected to a 416V,3 phase, 50Hz supply. 06

C) Explain with help of neat labeled diagram and wave forms the working of 1 phase rectifier with centre tap transformer. 06

5. (a) A 100 kVA, 1000/10,000V, 50Hz 1-phase transformer has iron losses of 1100 watts the copper loss with 5A in high voltage winding is 400watts. Calculate the efficiency at 25% of full load at (i) UPF (ii) 0.8 lagging pf the ouput being maintained at 10,000V. 10

(b) Explain construction of 3 phase induction motor (both types) and state it's working Principle. 10

6. (a) Explain how to get the approximate equivalent circuit of 1 phase transformer by open circuit and short circuit test.   12

   (b) Explain using neat labeled diagram and phasor diagram to show 2 wattmeters can be used to measure power and power factor in a star connected load.   8

7. (a) Explain double field revolving theory for 1 phase induction motors. Explain any type of split phase induction motor.   10

   (b) Derive the expressions for resonant frequency, band width, condition for resonance in a series R-L-C circuit. Show variation of R,L,C,Z and current with respect to Frequency. Mark band width also.   10

Con. 3283–11.

RK–1077

(3 Hours)

[Total Marks : 100

1) Question No.1 is compulsory.
2) Answer any FOUR from the remaining SIX questions.
3) Assume suitable data if necessary.
4) Take $g = 9.81 \ m/s^2$.

Q1) Answer All Questions.

   a) State and prove Varignones theorm. (5)

   b) Find the centrod of shaded area of the semicircle of diameter 100 cm. (5)
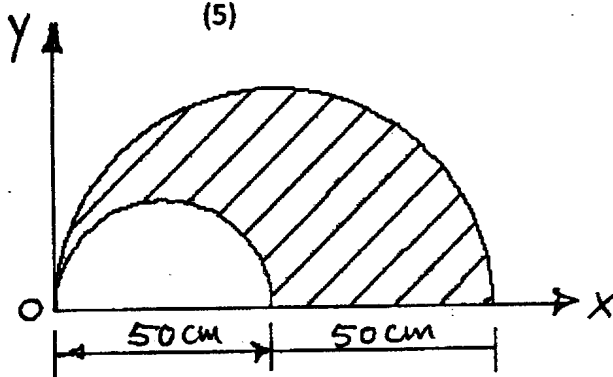
   c) In an Asian games event an athlete accelerates uniformly from the start to his maximum velocity in a distance of 4m and runs the remaining distance with that velocity. If the athlete complete the race in 10.4 seconds, determine his initial acceleration and his maximum velocity. (5)

OR

A ball is dropped on to a smooth horizontal floor from a height of 4m. On the second bounce it attains a height of 2.25 m. Find the coefficient of Restitution between the Ball and Floor. (5)

   d) A particle travels along the path defined by the parabola $y = 0.5 \ x^2$. If the x-component of velocity is, $v_x = 5t \ m/s$, determine the distance of particle from the origin O and the magnitude of acceleration when t=1 seconds. At t =0, x=0 and v=0. (5)

OR

Writ short notes on Motion Curves. (5)

[TURN OVER

Q2. a) Determine the force P required to move the block A of weight 5000 N up the inclined plane. Coefficient of friction between all contact surfaces is 0.25. Neglect the weight of the wedge and the wedge angle is 15 degrees.   (10)
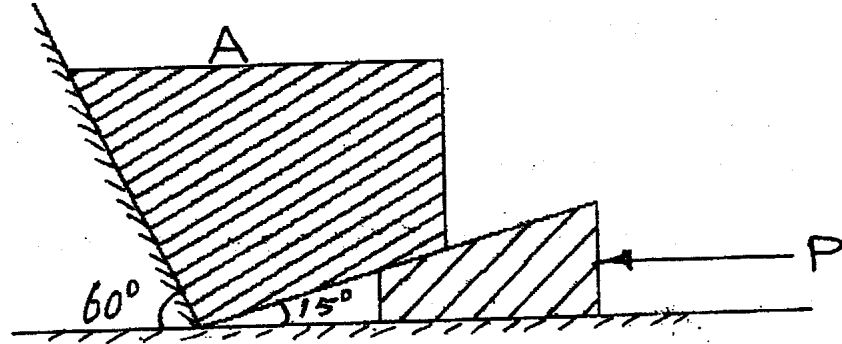

b. Refer the truss loaded as shown in the Figure. Determine (i) The reactions at the supports. (ii)Forces on members BC, BF, FG by Method of Section. (ii) Remaining member forces by Method Joints.   (10)
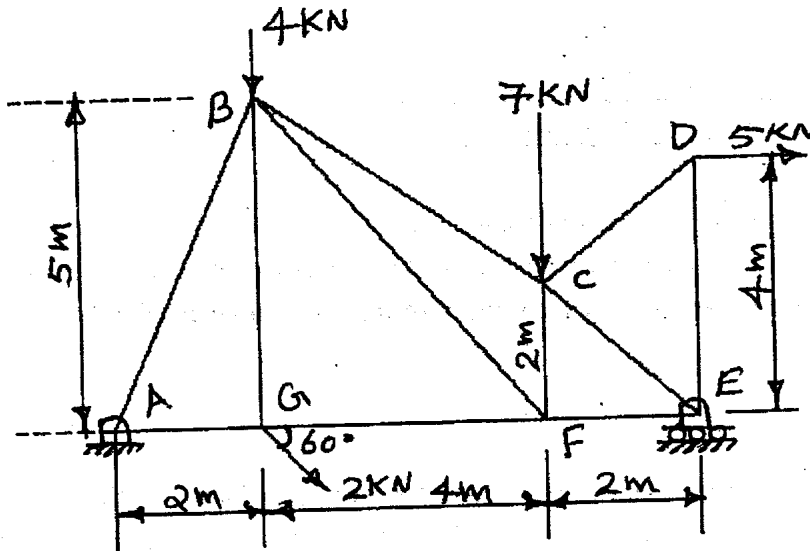
Q3)   a)Derive An equation to find the centrifugal tension in a Belt Drive   (4)

b) A leather Belt of width 200mm and thickness 10mm has a maximum permissible tension as 2×10^6 N/m2. If the ratio of tension is 1.8, determine at what velocity should it be run so as to transmit maximum power? Also determine maximum value of power. Take mass of the belt material as 2.2 kg / m.   (8)

c) Find the reactions at the supports of the Beam AB loaded as shown in the figure below. (8)
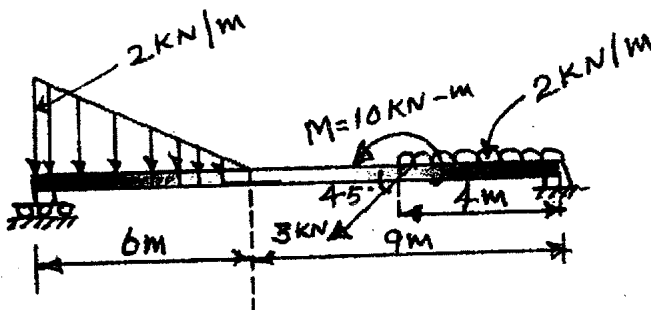
Q4) a). Find the Moment of Inertia of the shaded area about X and Y axis.
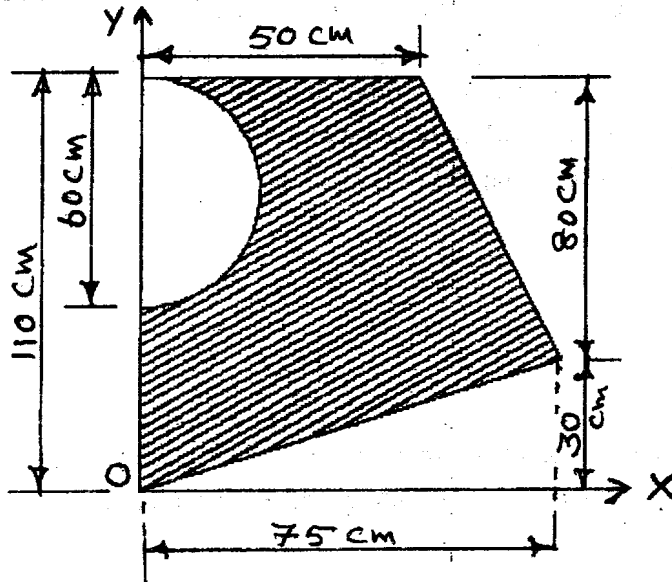
(8)

b)

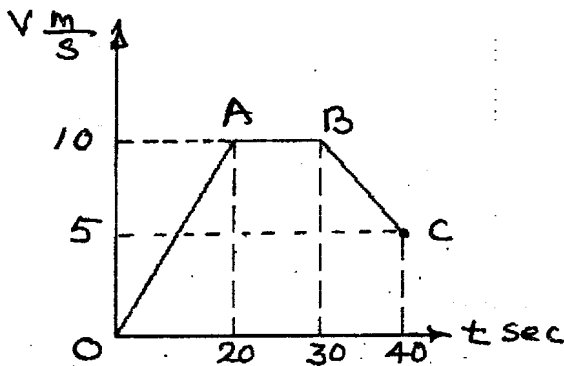Velocity -Time Graph for a particle moving along a straight line is given below. Draw Displacement- Time and Acceleration -Time graphs. Also find the Maximum Displacement of the Particle.   (12)

Q5)   a).A   ball is projected from the top of a tower of 110 m height with a velocity of 100 m/s and at an angle of elevation 25 degrees to the horizontal. Neglecting the air resistance find (1)The maximum height the Ball will rise from the ground (2) The horizontal distance it will travel just before it strikes the ground (3) the velocity with which it will strike the ground.   (10)

     b)   Two spheres A and B of weight 1000N and 750 N respectively are kept as shown in the figure. Determine the reactions at all contact points 1,2,3 and 4. Rad. Of A = 400 mm & Rad. Of B =300mm   (10)
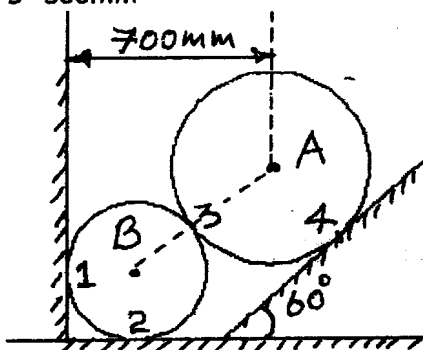
[TURN OVER

Q6) a) A pile of 400 Kg mass is being driven in to ground with the help of a
hammer of mass 1000 Kg. Hammer falls through a height of 2.5 m. Assuming
plastic impact between hammer and Pile, find the number of blows required
to drive the pile by 1m when the resistance offered by the ground to
penetration is 300 KN. (Refer the adjacent figure)   (10)
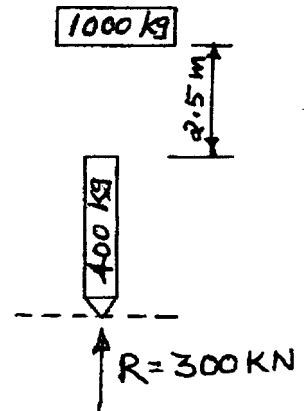
b)The motion of a particle is defined by the position vector, $\bar{r} = 6t\,i + 4t^2\,j$ where 'r' is in meters and 't' is
in seconds. At the instant when t=3 seconds, find (i) Tangential and Normal components of accelerations
(ii) Radius of curvature.   (10)

Q7) a)Three weights A,B and C of weights 3Kg,2Kg and 7Kg are connected
as shown in the figure. Determine the accelerations of A,B and C. Also find
the tension on the strings.

(8)
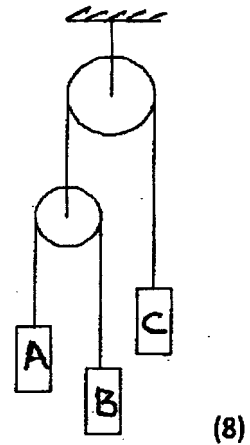
b)   Write short notes on Instantaneous center of Rotation.   (4)

c)   Rod AB of length 3m is kept on smooth planes as shown in the figure. The velocity of the end A is
· 5 m/sec. along the inclined plane. Locate the ICR and find the velocity of the end B   (8)
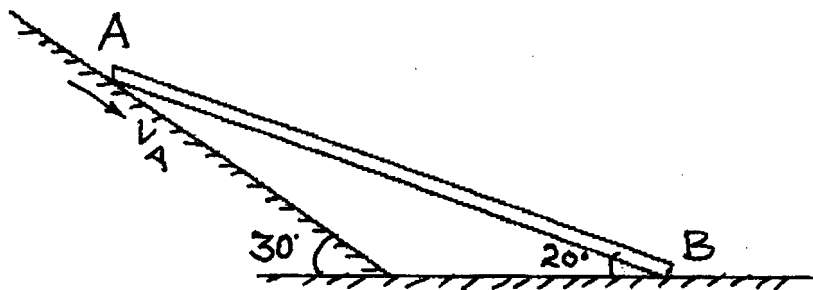
Con. 3280-11.

(2 Hours)

[Total Marks : 75

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining **six** questions.
(3) **Figures** to the **right** indicate **full** marks.
(4) **All** questions carry **equal** marks.
(5) **At·wts :–** H = 1, Mg = 24, C = 12, O = 16, S = 32, Ca = 40, Cl = 35·5, Na = 23.

15

1. Attempt any **five** :—
   (a) Distinguish between thermoplastic and thermosetting resins.
   (b) Find the acid value of a used oil sample whose 6 ml required 2·6 ml of 0·02 N KOH for titration (density of oil = 0·91) and state whether the oil is suitable for lubrication or not.
   (c) Explain the Nickel-Hydrogen batteries with the help of chemical reactions.
   (d) State the limitations of the phase rule.
   (e) What are carbon-nanotubes ? Explain different types of carbon-nanotubes.
   (f) What is shape memory effect ? Name a few shape memory alloy types.
   (g) A water sample on analysis has been found to contains :
      $MgCl_2$ = 19 mg/lit, $CaCO_3$ = 05 mg/lit
      $Ca(HCO_3)_2$ = 29·5 mg/lit $CaSO_4$ = 13·0 mg/lit.
   Calculate temporary, permanent and total hardness.

2. (a) What is meant by fabrication of plastics ? Explain Extrusion moulding with the help of neat diagram.   **5**
   (b) Define lubrication and explain the mechanism of hydrodynamic lubrication.   **5**
   (c) Describe the method for production of bio-gas from waste. Give its composition and uses.   **5**

3. (a) Calculate the amount of lime (90% pure) and soda (95% pure) required to soften 50,000 litres of same water containing the following impurities in ppm :   **5**
      $Mg (HCO_3)_2$ = 155 $MgCl_2$ = 23
      NaCl = 6·9 H_2SO_4 = 5
      Na_2SO_4 = 18·4 $CaCl_2$ = 111.
   (b) Give the synthesis and uses of :—   **5**
      (i) Polystyrene   (ii) Urea formaldehyde.
   (c) State condensed Phase Rule ? Explain the Lead-Silver System with phase diagram.   **5**

4. (a) 50 ml sample of water required 7·2 ml of N/20 disodium EDTA for titration. After boiling and filtration the same volume required 4 ml of EDTA. Calculate each type of hardness.   **5**
   (b) Write a note on Solid Lubricants.   **5**
   (c) What are the main constituents of plastics ? Wirte the functions and examples of each constituent.   **5**

5. (a) The hardness of 3500 litres of water was completely removed by zeolite softner. **5**
The zeolite had required 25 litres of 100 gm/lit of NaCl to regenerate. Calculate
the hardness of the water.
(b) What is solar energy ? Explain the working of solar heating system using flat **5**
plate collectors.
(c) Explain the reverse osmosis and ultrafiltration. **5**

6. (a) What are stainless steels ? Explain the specific effects of the following elements **5**
on the properties of steels :—
(i) Chromium (ii) Molybdenum.
(b) What are nano-materials and explain the structural details of Hackelites. **5**
(c) Write a note on Conducting Polymers. **5**

7. Write a short notes on (any **three**) :— **15**
(a) Applications of Nanomaterials in the Medicines and Catalysis.
(b) Blended Oils.
(c) Nano Cones
(d) One Component System.

Con, 3383-11.   **RK-5046**

(3 Hours)   **[Total Marks : 100**

N.B. : (1) Question No. **1** is **compulsory**.

       (2) Attempt any **four** questions from the remaining **six** questions.

Q.1 a) If z_1 and z_2 are two complex numbers such that $|z_1 + z_2| = |z_1 - z_2|$;   05

prove that the difference of their amplitude is $\dfrac{\pi}{2}$.

b) If $z = \sin^{-1}(x - y)$, $x = 3t$, $y = 4t^3$ then prove that $\dfrac{dz}{dt} = \dfrac{3}{\sqrt{1 - t^2}}$ 05

c) Find the value of n for which the vector $r^n \bar{r}$ is solenoidal, where $\bar{r} = x\hat{i} + y\hat{j} + z\hat{k}$ 05

d) Find n^{th} order derivative of $y = \sin 2x \sin 3x \cos 4x$ 05

Q.2 a) If α and β are the roots of the equation $x^2 - 2x + 4 = 0$ then show that   06

$\alpha^n + \beta^n = 2^{n+1} \cos\left(\dfrac{n\pi}{3}\right)$ and hence find the value of $\alpha^{15} + \beta^{15}$

b) If $x = \cosh\left(\dfrac{1}{m}\log y\right)$, prove that $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$ 06

c) If $v = x\log(x + r) - r$ where $r^2 = x^2 + y^2$, prove that $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = \dfrac{1}{x + r}$ 08

Q.3 a) If $z = x^2 \tan^{-1}\left(\dfrac{y}{x}\right) - y^2 \tan^{-1}\left(\dfrac{x}{y}\right)$, prove that $\dfrac{\partial^2 z}{\partial x \partial y} = \dfrac{\partial^2 z}{\partial y \partial x} = \dfrac{x^2 - y^2}{x^2 + y^2}$ 06

b) If ω is a complex cube root of unity, prove that $(1 - \omega)^6 = -27$ 06

c) Find the constants a, b such that the surfaces $5x^2 - 2yz - 9x = 0$ and   08

$ax^2 y + bz^3 = 4$ cut orthogonally at $(1, -1, 2)$

[TURN OVER

Q.4 a) Prove that $\cos^{-1}\left[\tanh(\log x)\right] = \pi - 2\left(x - \dfrac{x^3}{3} + \dfrac{x^5}{5} - \cdots\cdots\right)$ 06

b) If $x^2 = au + bv,\ y^2 = au - bv$, prove that $\left(\dfrac{\partial u}{\partial x}\right)_y \left(\dfrac{\partial x}{\partial u}\right)_v = \dfrac{1}{2} = \left(\dfrac{\partial v}{\partial y}\right)_x \left(\dfrac{\partial y}{\partial v}\right)_u$, where a, b 06

are constants.

c) Prove that $\cos^6\theta + \sin^6\theta = \dfrac{1}{8}(3\cos 4\theta + 5)$ 08

Q.5 a) If $0 < a < b$, prove that $\left(1 - \dfrac{a}{b}\right) < \log\dfrac{b}{a} < \left(\dfrac{b}{a} - 1\right)$. Hence prove that   06

$\dfrac{1}{6} < \log(1.2) < \dfrac{1}{5}$ and $\dfrac{1}{2} < \log 2 < 1$

b) Prove that $\tanh^{-1} x = \sinh^{-1}\dfrac{x}{\sqrt{1 - x^2}}$ 06

c) At a distance 120 feet from the foot of a tower, the elevation of its top is $60°$. If the   08

possible error in measuring the distance and elevation are 1 inch and 1 minute

respectively, find the approximate error in the calculated height of the tower.

Q.6 a) If $\tan(x + iy) = \alpha + i\beta$, show that $\dfrac{1 - \alpha^2 - \beta^2}{1 + \alpha^2 + \beta^2} = \dfrac{\cos 2x}{\cosh 2y}$ 06

b) If $z = \log(x^2 + y^2) + \dfrac{x^2 + y^2}{x + y} - 2\log(x + y)$, find the value of $x\dfrac{\partial z}{\partial x} + y\dfrac{\partial z}{\partial y}$ 06

c) If $\overline{A} = (\sin t)\hat{i} + (\cos t)\hat{j} + t\hat{k},\ \overline{B} = (\cos t)\hat{i} - (\sin t)\hat{j} - 3\hat{k},\ \overline{C} = 2\hat{i} + 3\hat{j} - \hat{k},$ 08

find $\dfrac{d}{dt}\left[\overline{A} \times (\overline{B} \times \overline{C})\right]$ at $t = 0$.

Q.7 a) If $(a + ib)^p = m^{x + iy}$, prove that $\dfrac{y}{x} = \dfrac{2\tan^{-1}\dfrac{b}{a}}{\log(a^2 + b^2)}$ 06

b) Prove that $\lim\limits_{x \to 0}\left(\dfrac{a}{x} - \cot\dfrac{x}{a}\right) = 0$ 06

c) Find the extreme values of $u = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$, if any.   08

_____

AGJ 1st half (I) 28

Con. 3088-11. **RK-1068**

(2 Hours) **[Total Marks : 75**

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Question Nos. **2** to **7**.
(3) Assume **suitable** data and symbols if **required**.
(4) **Figures** to the **right** indicate **full** marks.
$h = 6 \cdot 63 \times 10^{-34}$ J–sec, $c = 3 \times 10^8$ m/s, $m_e = 9 \cdot 1 \times 10^{-31}$ kg, $e = 1 \cdot 6 \times 10^{-19}$ c,
$N = 6 \cdot 023 \times 10^{26}$.

1. Attempt any **three** :– 15
   (a) Derive an expression for the edge element of a cubic crystal in terms of the density of the crystal material.
   (b) Explain : Drift current and diffusion current.
   (c) Explain the application of ultrasonic in Agglomeration and non-destructive testing.
   (d) How can the Lissajous figures be obtained on CRO screen and how are they used to find unknown frequency ?

2. (a) An impurity of $0 \cdot 01$ ppm (particles per million) is added to Si. The semiconductor has a resistivity of $0 \cdot 25$ ohm/m at 300 k. Calculate the hole concentration and its mobility. Also comment on the result. Atomic weight of Si $28 \cdot 1$, density of Si = $2 \cdot 4 \times 10^3$ kg/m^3. 7
   (b) What are ferro-electric materials ? Explain the Hysteresis curve for a ferro-electric material. Define ferro-electric curic temperature. Give two examples of ferro-electric materials. 8

3. (a) State direct and inverse piezoelectric effect. Explain with neat labelled diagram, the construction and working of piezoelectric oscillator. 8
   (b) Explain the difference between Schottky and Frankel defect.
       Calculate the ratio of the number of vacancies to the number of atoms when the average energy required to create a vacancy is $1 \cdot 95$ eV at 500 k $(k - 1 \cdot 38 \times 10^{-23}$ J/k). 7

4. (a) Explain zero resistance and persistant current in lieu of superconductor. Explain with proper equations that a superconductor is perfectly diamagnetic. 8
   (b) The radiation of an X-ray tube operated at 50 kV are diffracted by a cubic KCl crystal of molecular weight $74 \cdot 6$ and density $1 \cdot 99 \times 10^3$ kg/m^3. Calculate: 7
       (i) the shortest wavelength of the spectrum from the tube and
       (ii) glancing angle for first order reflection from the reflecting planes of the crystal for that wavelength.

[TURN OVER

5. (a) Explain the principle of Electrastatic Lens while proving Bethe's Law.   8
   (b) What is echelon effects ?   7
   The noise from an acroplane engine 100 m from on observer is 40 dB in intensity. What will be the intensity when the aeroplane flies overhead at an attitude of 2 km.

6. (a) Show that in uniform magnetic field pitch remains constant.   8
   In a CRT the distance from screen to the centre of the coil is 0·2 m. The length of the magnetic field along the axis is 5 cm. Calculate the flux density 'B' required to produce a deflection of 1cm on the screen, if the anode voltage is 1000 volt.
   (b) What is Hall effect ? Define Hall voltage. The Hall coefficient of a specimen   7
   is $3·66 \times 10^{-4}$ m^3/c. Its resistivity is $8·93 \times 10^{-3}$ Ω m. Find μ and n.

7. (a) Show that the atomic packing for FCC and HCP Lattices are the same.   8
   (b) The volume of room is 600 m^3. The wall area of the room is 220 m^2, the   7
   floor area is 120 m^2 and the ceiling area is 120 m^2. The average sound absorption coefficient :
        (i)   for the walls is 0·03
        (ii)   for the ceiling is 0·8
        (iii)   for the floor is 0·06.
   Calculate the average sound absorption coefficient and the reverberation time.