FE | Sem-I (OLD) 7 | 6 | 2013
C.P.I

P3-upq-Feb.-13KL-331 A4 E

Con. 6925–13. **(OLD COURSE)** **GS–5076**

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

N.B. :(1) Q. No. **1** is **compulsory.**
(2) Attempt any **four** questions out of **remaining six** questions.

1. (a) What is object oriented programming ? List and explain the basic concepts of it. **8**

(b) Find the o/p of the following :— **12**

(i)
```
main ( )
{
    int i = 1, j = 1;
    for (; ;)
    {
        if (i > 5)
            break;
        else j + = i;
        cout < < j;
        i + = j;
    }
}
```

(ii)
```
main ( )
{
    int i = 5, j = 2;
    junk (& i, & j);
    printf (" \n % d % d ", i, j);
}
junk (int  * i, int * j)
{
    *i = *i  *  * i;
    *j = *j  *  * j; }
```

(iii)
```
main ( )
{
    int c = – – 2;
    printf (" C = % d ", c);
}
```

(iv)
```
# define square (x) x * x
main ( )
{
    int i;
    i = 64/square (4);
    printf (" % d ", i);
}
```

2. (a) Explain the difference between constructor and destructor in C++. **5**
   (b) Explain conditional operators ? and : with the help of example. **5**
   (c) Write a program to print Floyd's triangle using control structures (Number of rows of Floyd's triangle to print is entered by the user). **10**

```
1
2   3
4   5   6
7   8   9   10
```

3. (a) Explain bitwise operators in C++ with the help of example. **5**
   (b) What is recursion ? Write a recursive program to find factorial of a given number. **5**
   (c) Differentiate between structure and union. **5**
   (d) How to declare one dimensional and two dimensional array in C++. **5**

4. (a) Write a program to find largest of three numbers using conditional operator. **5**
   (b) What is operator overloading ? Explain advantages of it. **5**
   (c) Write a program to demonstrate inline function. Discuss its advantages and disadvantages. **10**

5. (a) What is the scope and life of automatic storage class. **5**
   (b) Write a program to display the transpose of a matrix. **5**
   (c) Explain the concept of parameterized constructor. **5**
   (d) Explain the concept of dynamic binding. **5**

6. (a) Explain call by reference with one programming example. **5**
   (b) Define a structure consisting of following elements : **5**
   Student Roll No, Student Name, Student Age, Student date_of_admission.
   Write a program in C++ to read 5 records and display them.
   (c) Write a program to find area of square and circle using ~~operator~~ overloading. **5**
   (d) Explain inheritance visibility. function **5**

7. (a) What is the difference between declaration and definition. **5**
   (b) Write a C++ program to implement multilevel inheritance. **5**
   (c) What is function overriding ? Explain with example. **5**
   (d) Differentiate between static binding and dynamic binding. **5**

FE- SEM I (old) Engg. Mechanics - I

P4–RT–Exam.–Con No.–Feb.–13–33

Con. 9746–13. **(OLD COURSE)** **GS–5004**

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

N.B: 1. Question No. 1 is **compulsory.**
2. Attempt any **four** questions out of remaining 6 questions.
3. Take value of g as 9.81 m/s^2

Q.1. Solve all the sub-questions. **[20]**

(a) If force R is the resultant of the remaining 3 concurrent forces shown in Figure1, find the angle **θ** at which the force 200 N be applied. Also find R.

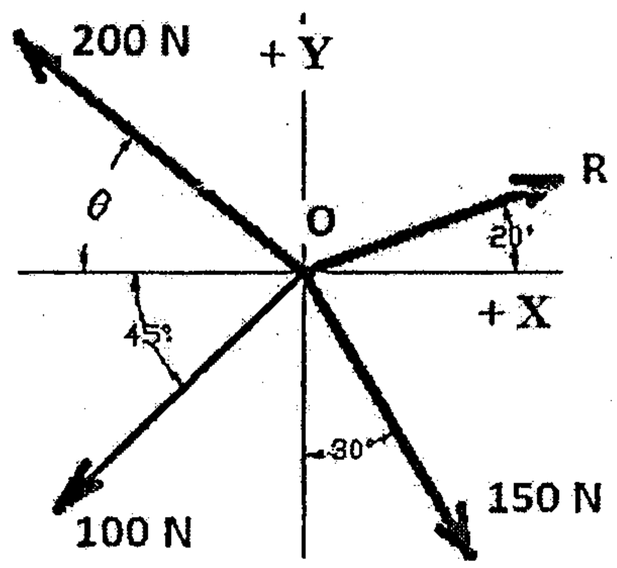


Figure1

(b) State and explain any four assumptions made during analysis of Plane Trusses.

(c) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between the pulley and the belt is 0.25, angle of wrap is 160° and the maximum tension in the belt is 2.5 kN. Neglect the centrifugal tension.

(d) The motion of a particle along a straight line is given by, $x = t^3-3t^2-9t+12$ m, where x is the displacement and t is the time. Determine the time, position and acceleration of the particle when it reverses the direction of travel.

(e) A 1 kg steel ball is dropped onto the floor from certain height. It was found that after 2^{nd} bounce the ball lost $3/4^{th}$ of its original height. Find the coefficient of restitution between the ball and the floor.

[TURN OVER

Q.2.

(a) Replace the given force system (refer Figure2) with a Force and a Couple at point 'F'. **[08]**

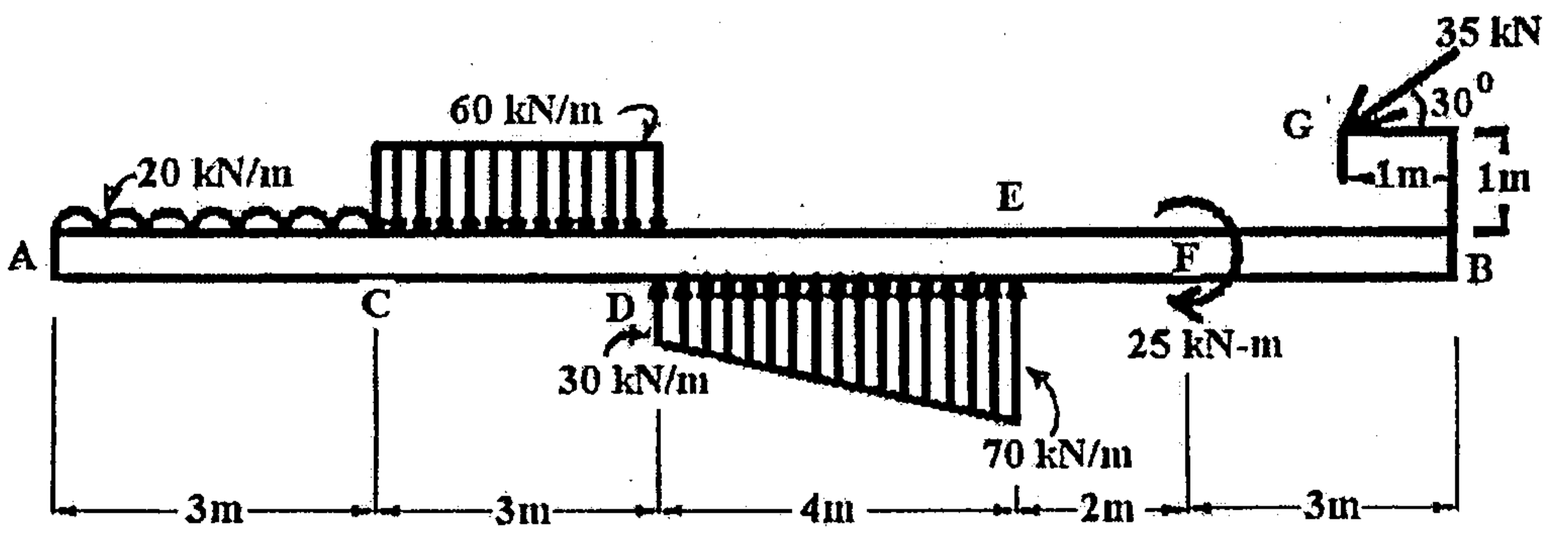


Figure2

(b) A ladder, weight 200 N and length 3 m, is used to support a man of 1000N at its top. If the coefficient of friction between the wall and the ladder is 0.25 and that between the ladder and the floor is 0.35, what minimum angle of inclination with the horizontal will keep ladder in equilibrium? **[06]**

(c) A plane flying horizontally dropped a supply of food packets for people caught in flood. The packets landed 4 s after the drop with a speed of 50 m/s. **[06]**

(i) Find the horizontal and vertical components of the velocity at the instant when the packets landed.

(ii) At velocity was the plane moving?

(iii) How high was the plane flying?

(iv) How far did the packets move in the horizontal direction?

Q.3.

(a) The three cylinders, A(radius 40 mm, weight 30N), B(radius 60 mm, weight 50N) and C(radius 50 mm, weight 40N), are stacked in a cylindrical cavity as shown in Figure3. Find the support reactions at all the contact points (1 to 6). Assume that all the contacts are frictionless. **[08]**

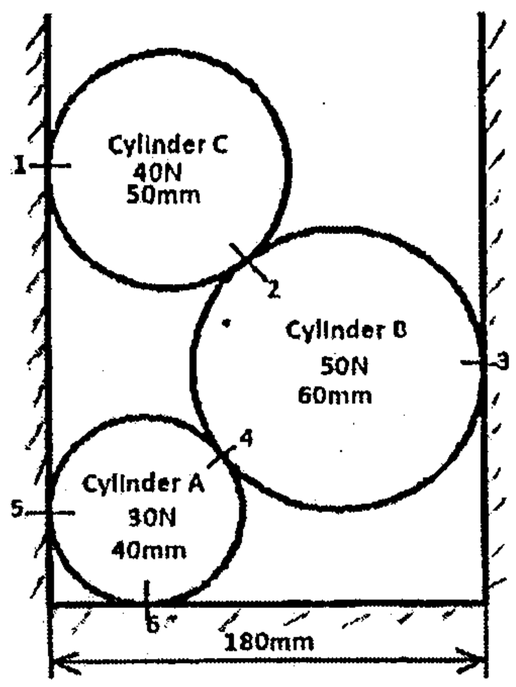


Figure3

(b) The position of a particle moving in X-Y plane is given by: **[06]**

$r = [\frac{3}{2}t^2]i + [\frac{2}{3}t^3]j$ m. Find total velocity, total acceleration, radius of curvature, tangential acceleration and normal acceleration at t = 2 sec.

(c) The link AB of the mechanism shown in Figure4 rotates at 11 rad/s in counter-clockwise direction. Locate the instantaneous centre for the mechanism and find out the angular velocity of link CD. **[06]**

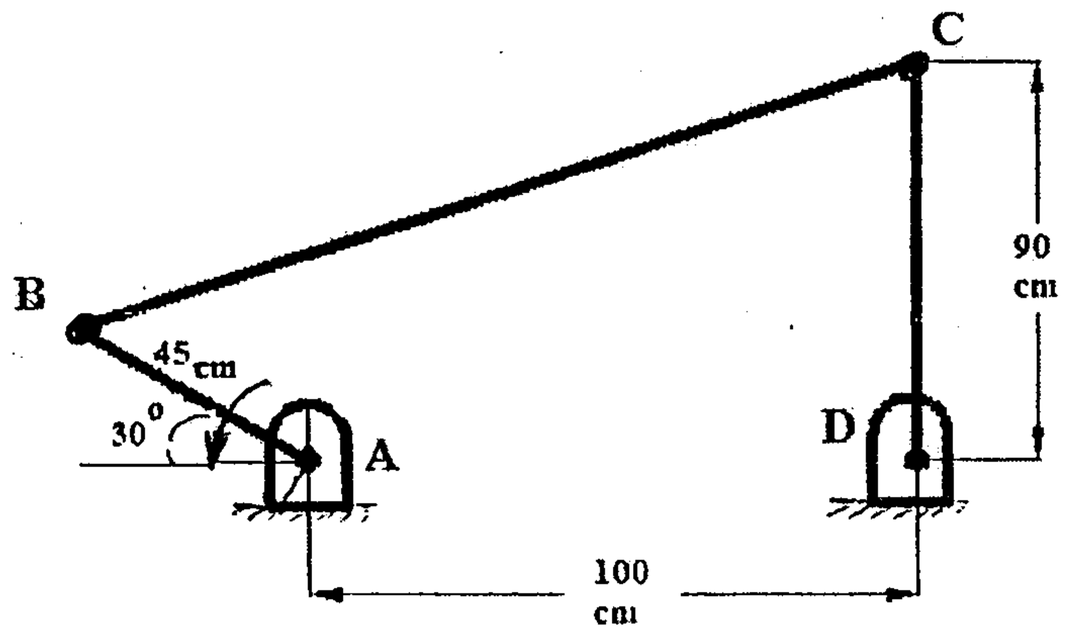


Figure4

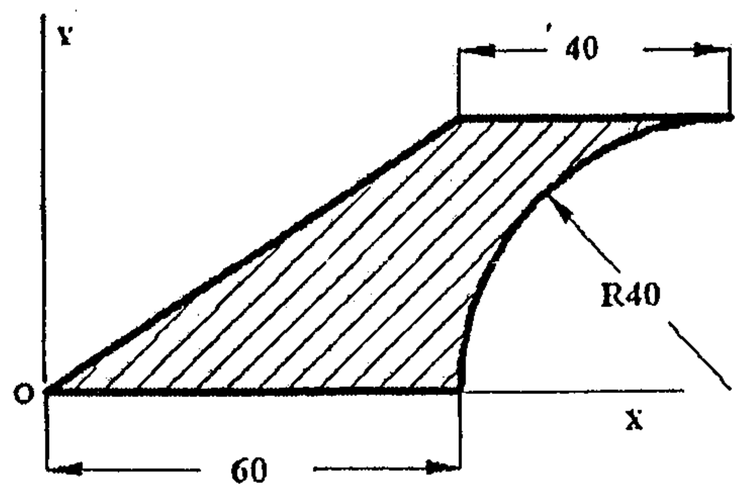


Figure5

Q.4.

(a) Locate the coordinates of the centroid for the shaded lamina shown in Figure5. The dimensions are in mm. **[04]**

(b) For the system shown in Figure6, find all the support reactions. **[08]**

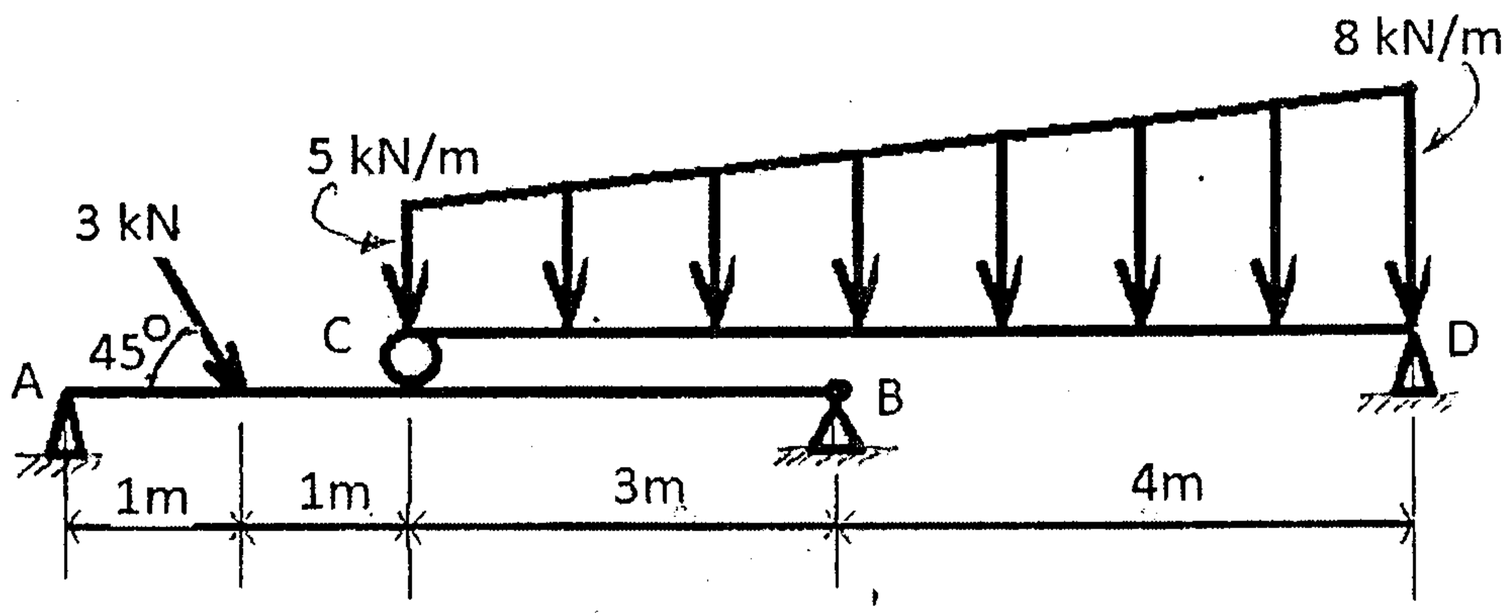


Figure6

(c) Figure7 shows velocity-time graph for a particle travelling along a straight line. Find the acceleration and displacement at 5 sec, 20 sec and 30 sec. Also draw the acceleration-time and displacement-time diagrams.

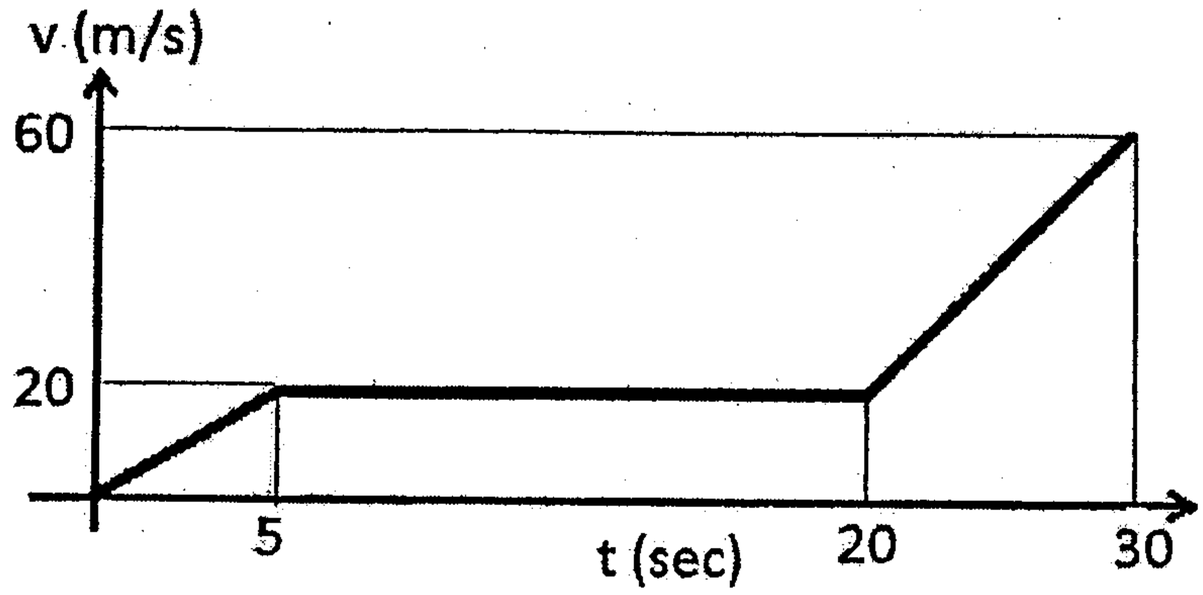


Figure7

Q.5.

(a) For the truss shown in Figure8, find the forces in members ED, CD and CE using method of sections. Also find the forces in all other members. **[06]**

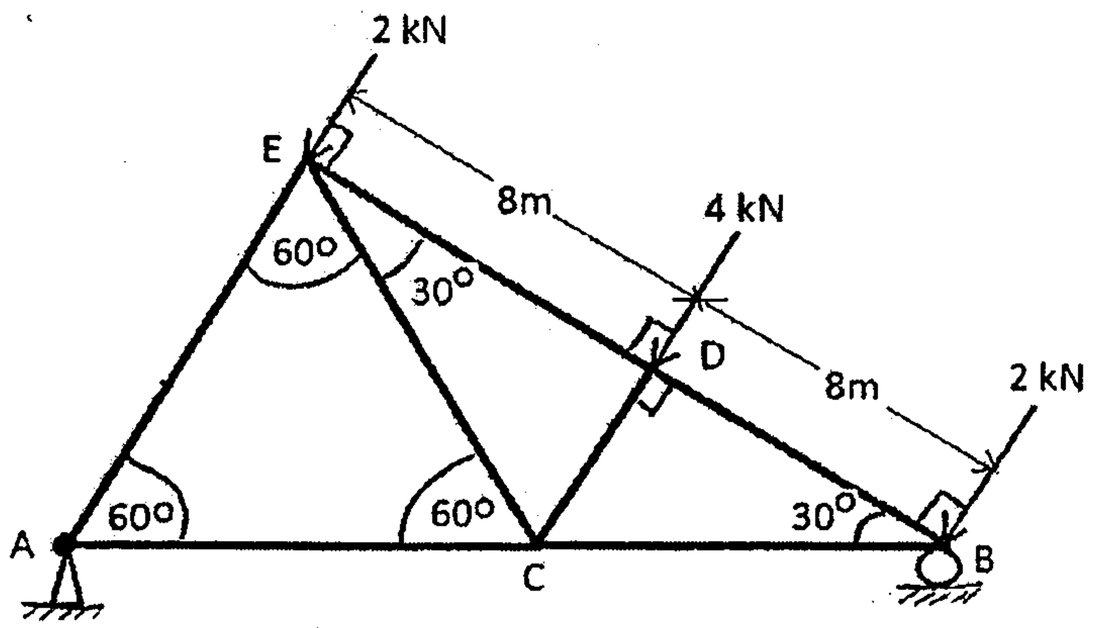


Figure8

(b) For a flat belt system prove that: $\frac{T_1}{T_2} = e^{\mu\beta}$, **[08]**

where T_1, T_2 are the tensions on the tight and slack sides respectively, μ is the coefficient of friction between the belt material and the pulley and β is the angle of wrap between the pulley and the belt.

(c) The system shown in Figure9 is resting initially. Neglecting the friction, determine the velocity of block A after it has moved 2.7 m when pulled by the 90 N force. **[06]**

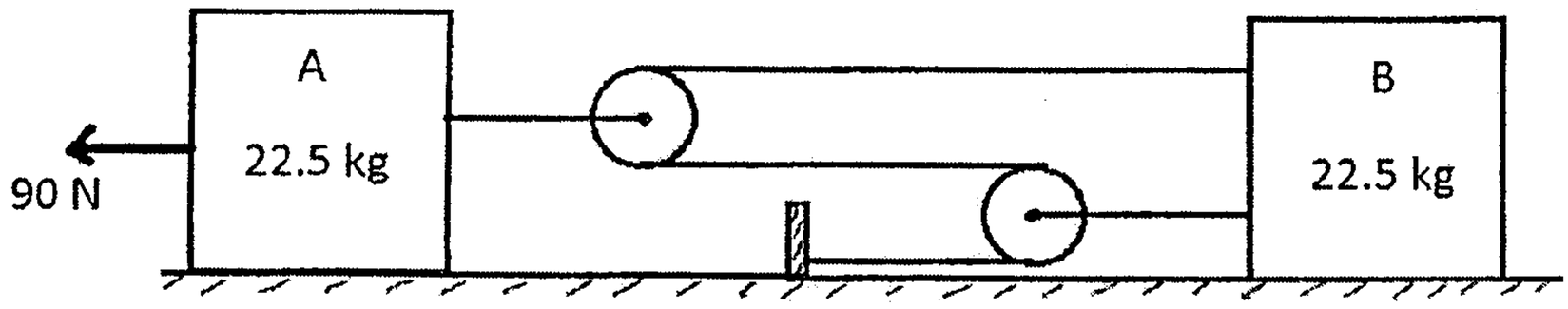


Figure9

Q.6.

(a) A 12m long bar of negligible mass is acted upon by forces as shown in Figure10. Find the angle for the bar to remain in equilibrium. **[06]**

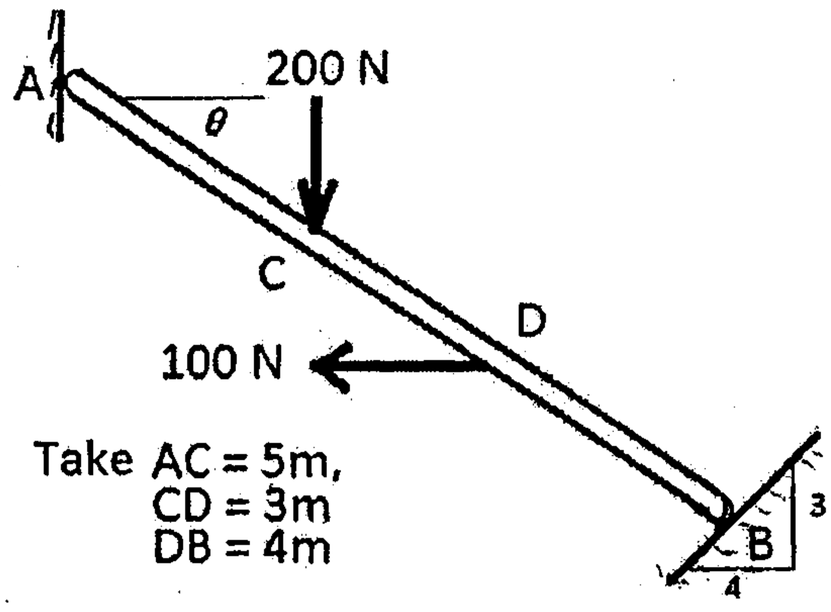


Figure10

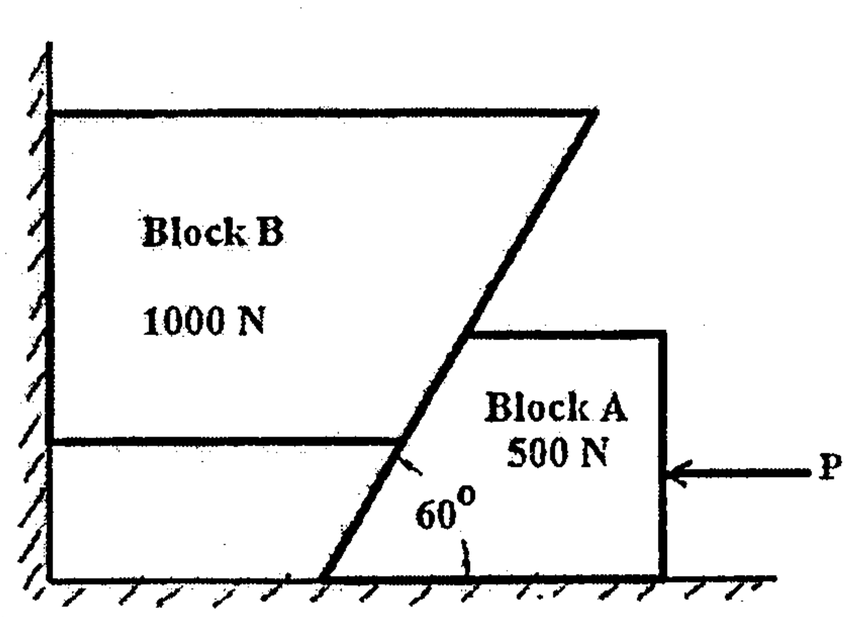


Figure11

(b) Two blocks A and B are kept against the floor and the wall as shown in Figure11. Find the magnitude of horizontal force P applied to block A that will hold the system in equilibrium. Take coefficient of friction between block A and B as 0.25 and as 0.2 for all other surfaces.

(c) A rod ABC is guided by two rollers at A and B. At the instant shown in Figure12, the downward velocity of the roller at B is 0.8 m/s. Find angular velocity of the rod ABC and the velocity of point C.

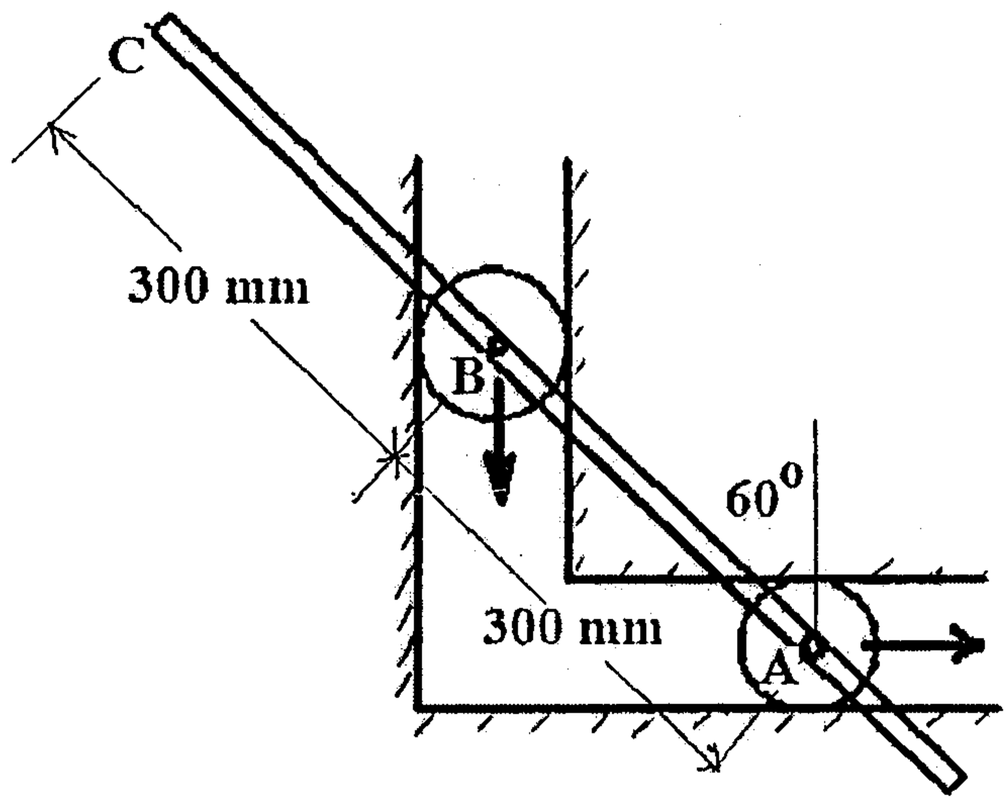


Figure12

Q.7.

(a) For the lamina shown in Figure13, find the moment of inertia about X and Y axes. The dimensions are in mm. **[06]**

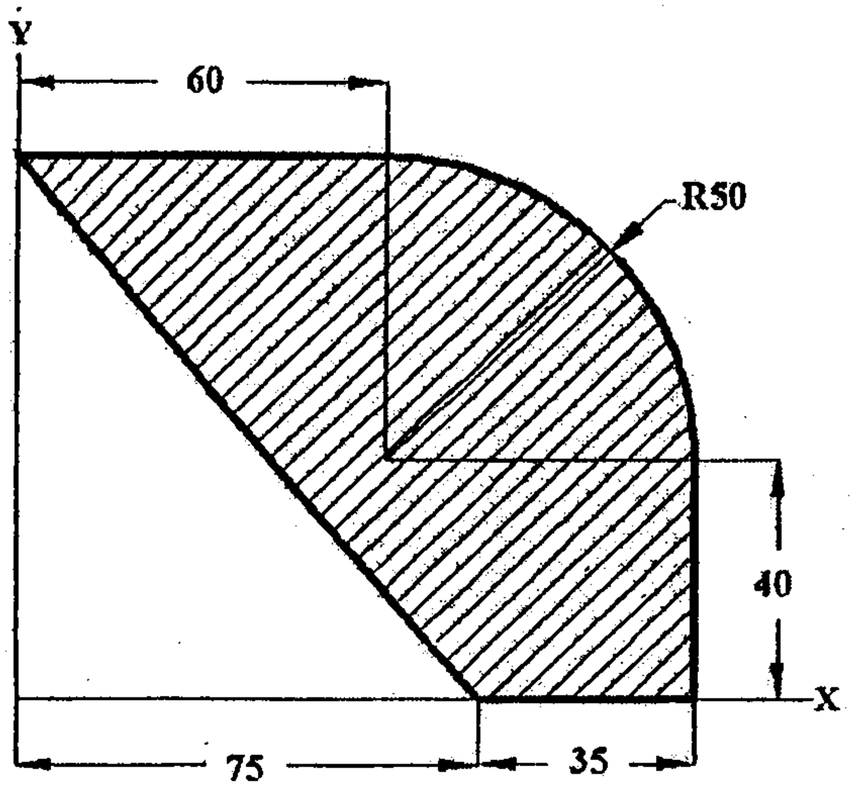


Figure13

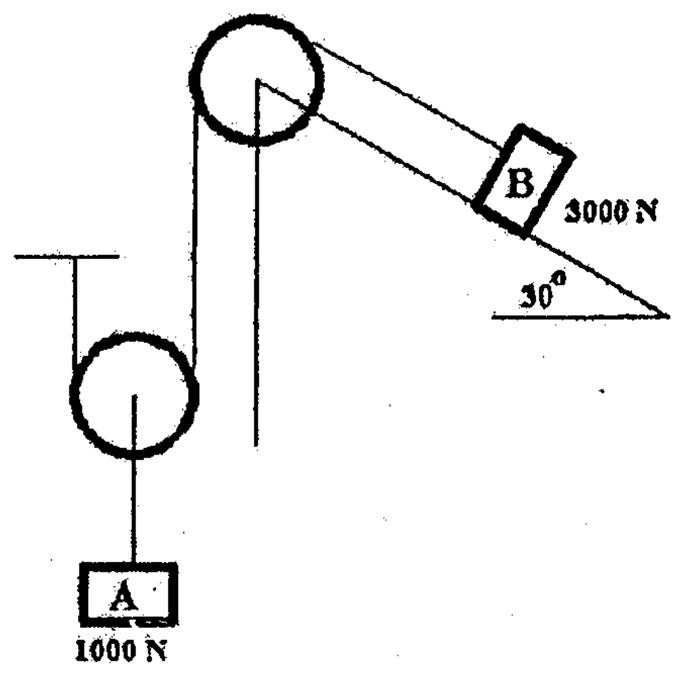


Figure14

(b) The block B of weight 3000 N having a speed of 2 m/s, as shown in Figure 14 travels a distance of 10 m down the plane. Block A of weight 1000 N is connected to it by an inextensible thread. Find the final velocities of both the blocks. Take the coefficient of kinetic friction between the block B and the slope as 0.3. **[08]**

(c) Sphere A and B are colliding as shown in Figure15. If the coefficient of restitution between the spheres is 0.9, find the velocities of the spheres after the collision. **[06]**

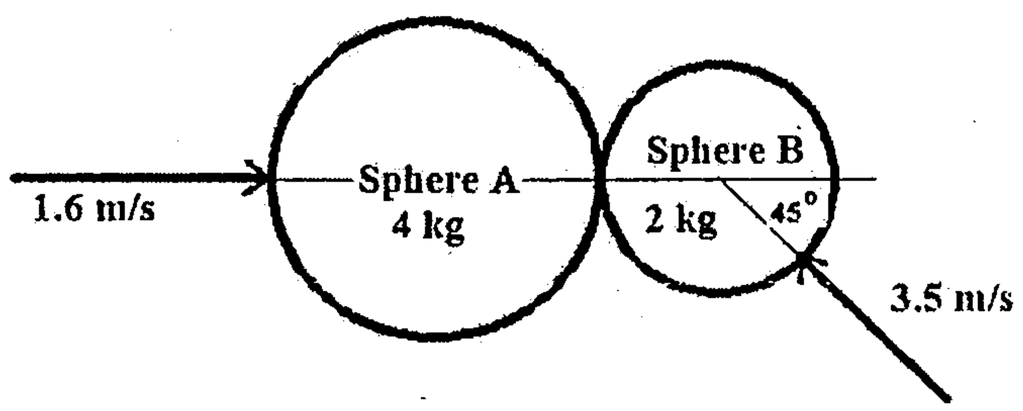


Figure15

FE/sem-I (OLD) 18/5/13
BEE

Con. 6892–13. (OLD COURSE) GS–4977
(3 Hours) [Total Marks : ~~80~~ 100

NB 1) First question is compulsory.
2) Answer any four questions out of remaining six questions.
3) Assumption made should be clearly stated.
4) Figures to the right indicate marks.

1 (a) The resistance of a wire increases from 50Ω at 15°C to 58Ω at 55°C. Calculate the temperature coefficient of resistance at 0°C of the conductor material. [04]

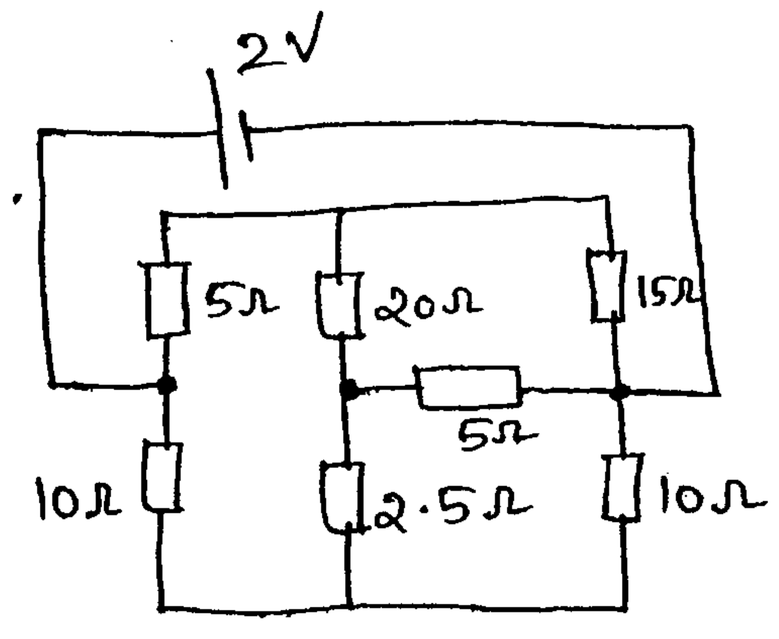
(b) Explain any one starting method for single phase induction motor. [04]

(c) Two circuits have the same value of numerical impedance. The p.f. of one is 0.8 and the other is 0.6. What is the p.f. of combination if they are connected in parallel? [04]

(d) Derive the condition for maximum efficiency for a transformer. [04]

(e) Draw the V-I characteristics and working of the zener diode. [04]

2 (a) Find the current through 20Ω using Thevenin's theorem. [08]



(b) A 1Φ transformer has 1000 turns on the primary and 200 turns on the secondary. The no load current is 3A at a p.f. of 0.2 lagging when the secondary current is 280A at a p.f. of 0.8 lagging. Calculate the primary current and p.f. Assume the voltage drop in the windings to be negligible. [08]

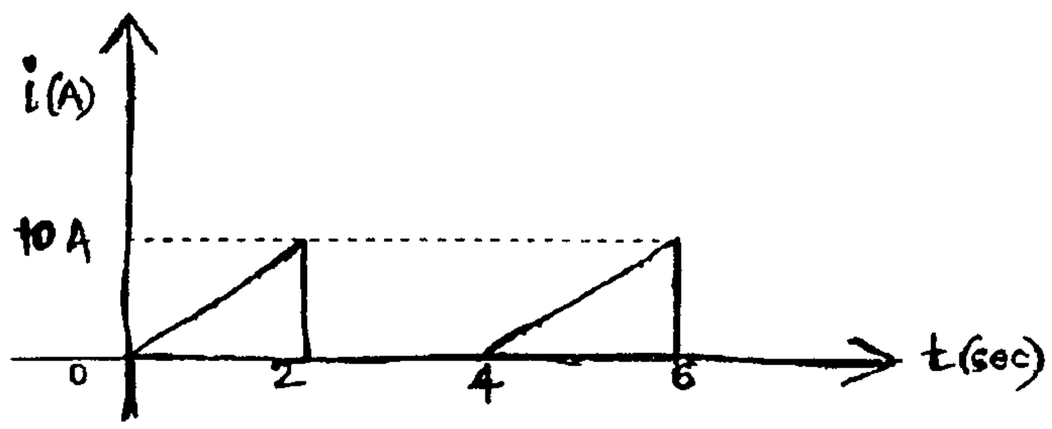
(c) What are the losses in the transformer? Explain why the rating of the transformer in KVA not in KW. [04]

| TURN OVER

3 (a) A current of 5A flows through a pure resistance in series with a coil when supplied at 250V 50Hz. If the voltage across the resistance is 125V and across the coil is 200V calculate (i) impedance, resistance and reactance of the coil (ii) Power absorbed by the coil (iii) Draw phasor diagram. [10]

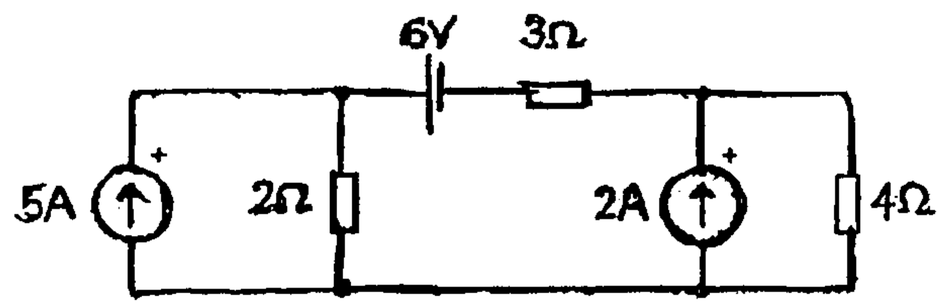
(b) Using neat circuit diagram and phasor diagram show that two watt meters are sufficient to measure 3Φ power of a star connected balanced load. [10]

4 (a) Find the form factor of the waveform shown below. [08]



(b) Derive the e.m.f. equation for a D.C. Motor. [05]

(c) Find the current passing through 3Ω resistor by source transformation. [07]



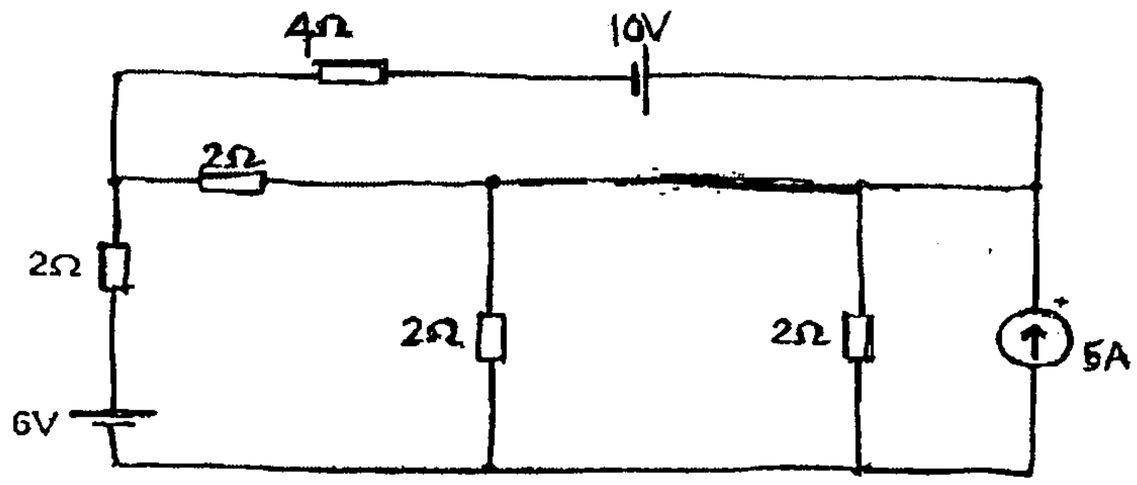
5 (a) O.C. and S.C. test reading of a 4KVA, 200V/400V 50Hz. 1Φ transformer are, [10]

O.C. test – 200V, 0.7A, 70W on L.V. side

S.C. test – 15V, 10A, 85W on H.V. side

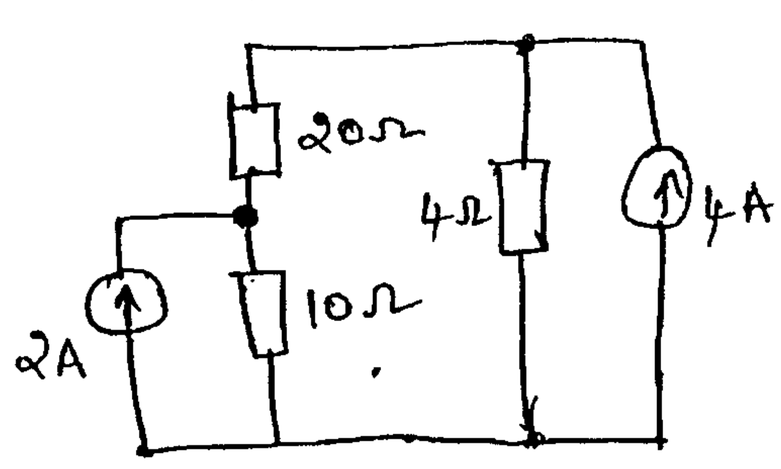
Find the (i) equivalent circuit constants (ii) full load efficiency (iii) efficiency at half full load. Assume 0.8 p.f lag.

(b) For the given circuit find the current through 4Ω resistor by using superposition theorem. [10]



6 (a) Three identical coils each having a resistance of 15Ω and inductance of 0.03H are connected in delta across a 3Φ, 50 Hz, 230V supply. Calculate the phase current, line current and total power absorbed. [10]

(b) Use nodal analysis to find the voltage across 10Ω resistance. [04]



(c) Explain Double field revolving theory. [06]

7 (a) A resistor and a capacitor are in series with a variable inductor. When the circuit is connected to a 200V, 50Hz supply, the maximum current obtainable by varying the inductance is 0.314A. The voltage across the capacitor is then 300V. Find the circuit constants. [10]

(b) Explain full wave rectifier with a center tapped transformer. Find the expression for r.m.s and average value of load current and ripple factor. [06]

(c) Explain All day efficiency of a transformer. [02]

(d) Draw full wave rectifier circuit with capacitor filter and its output voltage waveform. [02]

FE/Sem-I (O) 29/5/2013.

A. P. I

P3–upq–Feb.–13KL–240 A4 E

Con. 6901–13. **(OLD COURSE)** **GS–5022**

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

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Q. **2** to Q. **7**.
(3) Figures to the **right** indicates **full** marks.
(4) Use **suitable** data wherever **necessary**.

1. Attempt any **five** questions from the following :— **15**

(a) Draw the following planes in cubic unit cell – $(1\,2\,3)\,(\bar{1}\ \bar{1}\ 0), (\bar{2}\,1\,0)$

(b) State Bragg's law of X-ray diffraction and explain terms used in it.

(c) Show how Fermi level changes with increasing temperature in n–type superconductor.

(d) Define mobility of charge carriers and state its SI unit.

(e) State DC Josephson effect.

(f) State Sabine's formula explaining the terms involved in it.

(g) Find the natural frequency of a quartz plate of thickness 1·5 mm.
Given : Young's modulus for quartz = 8×10^{10} N/m^2
Density of quartz = 2650 kg / m^3.

2. (a) Derive an expression for inter planar spacing for the planes having (hkl) as their miller indices. **8**
Silver has FCC structure and its atomic radius is 1·44 A°. Find the inter planar spacing for (220), (200) and (111) planes.

(b) State and explain Hall effect. A copper strip 2 cm wide and 1 mm thick is placed in a magnetic field with B = 1·5 Wb/m^2. If current of 200A is set up in the strip, Calculate Hall voltage that appears across the strip. Given $R_H = 6 \times 10^{-7}$ m^3/c. **7**

3. (a) What is superconductivity ? Define critical temperature and critical field. Differentiate between type–I and tyep–II superconductors. **8**

(b) Explain with a neat diagram, construction of Cathode Ray Tube and discuss how frequency of AC signal is measured using CRO. **7**

4. (a) Describe NaCl structure with a neat diagram. **5**

(b) Show that for an intrinsic semiconductor, Fermi level lies at the middle of the forbideen gap. **5**

(c) A loudspeaker emits energy in all directions at the rate of 1·5 J/s. What is the intensity level in dB at a distance of 20m. Standard intensity level of sound is 10^{-12} W/m^2. **5**

[TURN OVER

5. (a) What are liquid crystals ? Explain various phases of liquid crystals. **5**
   (b) The n-side of a p-n junction for Ge contains 10^{16} donor atoms/cm^3 and p-side has 10^{18} acceptor atoms/cm^3. Calculate barrier potential at room temperature if the intrinsic concentration is $2{\cdot}5 \times 10^{13}$ / cm^3. **5**
   (c) Explain construction and working of magnetostriction oscillator. **5**

6. (a) A 10 keV electron beam is made incident on atomic planes having interplanar spacing $5{\cdot}5 \times 10^{-11}$ m. What will be the angle of deviation for the first order maximum ? **5**
   (b) What is the use of superconductors in MAGLEV ? **5**
   (c) Write a short note on Applications of ultrasonic waves. **5**

7. (a) Calculate the ratio of number of vacancies to the number of atoms when the average enegry required to create a vacancy is 1·95 eV at 500°K. **5**
   (b) Explain various methods for design of good acoustics. **5**
   (c) Write a short note on – Electrostatic focussing. **5**

11/5/13

F.E. Sem I (old)

Applied maths - I

218 : Con. No.-JP

Con. 6859–13. **(OLD COURSE)** **GS–4950**

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

N.B. 1. Question No. 1 is compulsory.

2. Attempt any **Four** questions from the remaining.

3. Figures to the **right** indicate full marks.

1. a) Find all fourth roots of unity [03]

b) Find the n^{th} order derivative of $y = Cos^2 x$. [03]

c) If $\bar{a} + \bar{b} + \bar{c} = \bar{0}$ prove that $\bar{a} \times \bar{b} = \bar{b} \times \bar{c} = \bar{c} \times \bar{a}$. [03]

d) Using Maclaurin's series find expansion of $\log \sec x$. [03]

e) If $u = \log(\tan x + \tan y + \tan z)$ show that [04]

$$Sin2x\frac{\partial u}{\partial x} + Sin2y\frac{\partial u}{\partial y} + Sin2z\frac{\partial u}{\partial z} = 2$$

f) Using Lagrange's method find the point on the plane $2x + y - z = 5$ which is nearest to the origin. [04]

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

$$\alpha^n + \beta^n = 2^{n+1} Cos\frac{n\pi}{3}.$$

b) Separate into real and imaginary parts $Cos^{-1}(e^{i\theta})$. [06]

c) State and prove Euler's theorem for a homogeneous function in two variables. Hence find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ if $u = \frac{x^3y + y^3x}{x^2 + y^2}$. [08]

3. a) If $f(x) = x(x+1)(x+2)(x+3)$ then show that $f'(x) = 0$ has at least three real roots. [06]

b) Write down the formula for $\frac{d}{dt}[\bar{a} \times \bar{b}]$ verify the same for [06]

$\bar{a} = 5t^2\hat{i} + t\hat{j} - t^3\hat{k}$ and $\bar{b} = Sint\,\hat{i} - Cost\hat{j}$

c) Prove that $\log(1 + e^x) = \log 2 + \frac{x}{2} + \frac{x^2}{8} - \frac{x^4}{192} + \ldots\ldots$ [08]

[TURN OVER

4. a) If w is a complex cube root of unity prove that $(1-\omega)^6 = -27$. [06]

b) Discuss the convergence of the series $\sum \frac{n!}{n^n}$ [06]

c) Find the n^{th} order derivative of $y = \frac{1}{1+x+x^2+x^3}$. [08]

5. a) If $y = aCos(\log x) + bSin(\log x)$ show that [06]

$$x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$$

b) Evaluate $\lim_{x\to 0}[\frac{1^x + 2^x + 3^x + 4^x}{4}]^{\frac{1}{x}}$. [06]

c) Define solenoidal and irrotational vector field. A vector field is given by [08]

$\overline{F} = (ySinz - Sinx)i + (xSinz + 2yz)j + (xyCosz + y^2)k$ Prove that it is irrotational and find its scalar potential.

6. a) If $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$ prove that [06]

$$\frac{1}{x}\frac{\partial u}{\partial x} + \frac{1}{y}\frac{\partial u}{\partial y} + \frac{1}{z}\frac{\partial u}{\partial z} = 0.$$

b) Define directional derivative of a scalar point function $\phi(x, y, z)$. Find [06]

directional derivative of $\phi = xy^2 + yz^3$ at $(2,-1,1)$ in the direction normal to the surface $x\log z - y^2 = -4$ at $(-1,2,1)$.

c) If $Coshx = Sec\theta$ prove that i) $x = \pm\log(Sec\theta + \tan\theta)$ [08]

$$\text{ii)}\ \theta = \frac{\pi}{2} - 2\tan^{-1}(e^{-x})$$

7. a) If $(Siny)^x = (Cosx)^y$, then prove that $\frac{dy}{dx} = \frac{y\tan x + \log Siny}{\log Cosx - x Coty}$. [06]

b) A rectangular box open at the top has a volume of 32 cubic units. find the dimensions of the box requiring least material for its construction. [06]

c) Write the separation for $\log(x+iy)$. If $i^{a+ib} = a+ib$ prove that [08]

$a^2 + b^2 = e^{-(4k\pi+\pi)b}$, where k is positive integer.

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F.E Sem I (old)
A.C. I

P3–upq–Feb.–13KL–302 A4 E

Con. 6702–13. **(OLD COURSE)** **GS–5049**

(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) **Atomic Weight**

H = 1	**0 = 16**
Ca = 40	**Mg = 24**
C = 12	**Cl = 35·5**

1. (a) Find the acid value of 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 lubricator or not. **15**
(b) What are Carbon nanotubes ? Explain different types of Carbon nanotubes.
(c) Distinguish between Thermoplastic and Thermosetting resins.
(d) State the limitations of phase rule.
(e) What is meant by hardness ? Explain its types.
(f) Explain any three functions of lubricants.
(g) Distinguish between conventional and non-conventional energy sources.

2. (a) Calculate the quantity of lime and soda required to soften one million litre of hard water containing following impurities : **6**

$CaCo_3$ = 10·0 ppm $Mg(HCO_3)_2$ = 36·5

$MgCl_2$ = 19·0 ppm SiO_2 = 2 ppm

(b) What is meant by fabrication of plastic ? Explain Extrusion moulding with the help of diagram. **5**
(c) With the help of neat diagram explain photovoltaic cell. **4**

3. (a) Give the synthesis and uses of (i) polystyrene (ii) Urea formaldehyde. **6**
(b) Write a note on solid lubricant. **5**
(c) Explain applications of nanoma terial in medicine and catalysis. **4**

4. (a) Define lubrication. Explain the mechanism of hydrodynamic lubrication. **6**
(b) Explain the application of phase rule to one component system. **5**
(c) Explain the reverse osmosis and ultrafiltration. **4**

[TURN OVER

5. (a) What are stainless steels ? Explain the specific effects of following elements on the properties of the steel. **6**
   (i) Chromium (ii) Molybdenum.
   (b) The hardness of 3500 litres of water was completely removed by zeolite softner. The zeolite had required 25 litres of 100 gm/lit. of NaCl to regenerate. Calculate the hardness of water. **5**
   (c) Write a note on conducting polymers. **4**

6. (a) What are nanomaterials ? Explain structure of fullerenes. **6**
   (b) Explain with the help of diagram Zeolite process used for softening of water. **5**
   (c) Explain the Nickel–hydrogen batteries with the help of chemical reactions. **4**

7. (a) What are main constituents of plastic ? Write the functions and examples of each. **6**
   (b) Give the definition and significance of BOD and COD. **5**
   (c) Explain shape memory effect. **4**
