Dec 2014

FE. SEM-I (old) Applied Physics-I

(OLD COURSE) QP Code : **11923**

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

N. B. : (1) Question No.1 is **compulsory.**
(2) Answer **any four** from **Q No. 2 to 7.**
(3) Assume **suitable** data if required and justify the same.
(4) **Figures** to the right indicate **full** marks.

1. Solve any **five** from the following:– 15
   (a) Write steps to Find miller indices of an atomic plane of a cubic unit cell.
   (b) Calculate the atomic radius of the diamond structure, if the lattice constant of structure is 5 A° .
   (c) Define the terms : valence band, conduction band and forbidden energy band.
   (d) Define mobility of charge carrier, what is its S.I. unit?
   (e) What is vortex state of a superconductor
   (f) Explain reverberation time.
   (g) How to measure depth of sea water using echo sound technique.

2. (a) Describe a unit cell of NaCl. Calculate the number of molecules per unit cell and packing factor. Take radius of Na^+ 0.98A° and radius of Cl^- 1.81A° **8**
   (b) A sample of n-type silicon has a donor density of $10^{20}/m^3$ .It is used in the Hall effect experiment. The sample of width 4.5 mm is kept in a magnetic field of 0.55 T with current density of 500 A/m^2 **7**

   Calculate :–
   (i) Hall voltage developed in it.
   (ii) Hall coefficient
   (iii) Hall angle if mobility of electron is 0.17 m^2 / volt sec.

3. (a) What do you understand by the term critical temperature and critical magnetic field? How does the critical magnetic field vary with the temperature? Explain 'A superconductor is perfectly diamagnetic'. **8**
   (b) An electron travel with a velocity of $2.5x10^6$ m/s in vacuum in a uniform magnetic field strength of $0.94x10^{-4}$ wb/m^2 such that the velocity vector makes an angle of 30° with the field direction. Determine the distance covered along the magnetic induction lines in five such revolutions. **7**

4. (a) What is the lattice constant? Derive the relation between lattice constant with atomic weight and density in a single crystal. **5**
   (b) Explain drift and diffusion currents **5**
   (c) A hall of length 20 m breadth 15 m and height 5 m has a reverberation time of 2.5 seconds. Calculate the average coefficient of absorption. **5**

5. (a) Silicon has the same crystal structure as of diamond. Its density is 2.33×10^3 kg/m^3 and atomic weight is 28.9. Calculate the lattice constant and atomic radius. **5**

   (b) Explain the formation of potential barrier in an unbiased p-n junction. **5**

   (c) What is magnetorstiction effect. Draw the diagram of magnetostriction oscillator and explain its working as an ultrasound generator. **5**

6. (a) Explain the powder method of determination of crystal structure. **5**

   (b) Write short note on 'Magnetic levitation'. **5**

   (c) What will be the Young's modulus of quartz plate, if 5.5 mm thick quartz plate is used to produce an ultrasonic waves of frequency 0.4999 MHz. The density of quartz is 2.65×10^3 kg/m^3. **5**

7. (a) What are crystal defects. Explain point defects in crystal. **5**

   (b) Explain in brief the conditions necessary for good a acoustical design of an auditorium. **5**

   (c) Explain functions of various important parts of a CRT with diagram. **5**

FE (SEM-I) (OLD) - 26/12/14
Computer Prog - I

(OLD COURSE) **Q.P. Code : 11927**

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

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

1. (a) Explain data hiding and data abstraction. 5
(b) Explain default constructor with example. 5
(c) Compare: local v/s global variable. 5
(d) Find the output of the following. 5

(i)
```
void main()
{ int x=4,y=3;
x=++x +y++;
y=-- y + y- -;
cout<<x<<" "<<y;
}
```

ii)
```
#define cube(x) (x * x* x)
void main()
{ int k=4,R;
R=cube(k);
cout<<R;
}
```

2. (a) WAP in c++ to display the factors of the no. between 1 to 30. 10
(b) Explain array of object with example. 5
(c) Explain parameterized constructor with example. 5

3. (a) WAP inc++ to display the max and min element in a given list. 10
(b) Explain static storage class. 5
(c) Explain strcmp( ) with example. 5

4. (a) What is recursion? Write a recursive program to find factorial of a no. 10
(b) Explain multilevel inheritance. Give example. 5
(c) What is the difference between declaration and definition? 5

5. (a) What is function overloading? Write a program using concept of function overloading to find square of int, float, double . 10
(b) Write a program to check if the string is palindrome. 5
(c) Explain function overriding 5

6. (a) Define a structure employee consisting of following members: 10
Employee Name, code, salary.
Write a program inc++ to read 5 records and display them in ascending order comparing with the salary of employee.
(b) Explain call by address and call by reference with example. 10

7. d) Write a note on.(Any Two) :- 20
(i) Run time polymorphism
(ii) Pure virtual function
(iii) friend function
(iv) Constructor and Destructor.

ME / EXTC / I old
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BEE

17/11/2014

(OLD COURSE)

QP Code : **11908**

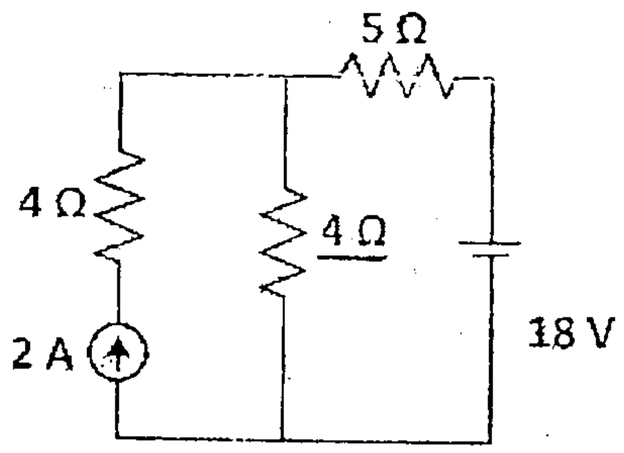
(3 Hours)

[Total Marks : 100

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

1. (a) The resistance of a 50Ω resistor is increased by 10% when its operating temperature increased from 20°C to 50°C. Calculate resistance temperature coefficient at 0°C. **3**

(b) Find current through 4Ω resistance by superposition theorem. **3**



(c) An instantaneous current i= 10Sin(314t + 20°) A flows through a circuit containing pure resistor of 5Ω. Write an instantaneous wave equation of voltage across resistor. **2**

(d) In inductive coil containing resistance 10Ω and inductance of 0.1H is connected in parallel with a capacitor of 150μF. Find resonant frequency of the circuit & dynamic impedance of the circuit. **3**

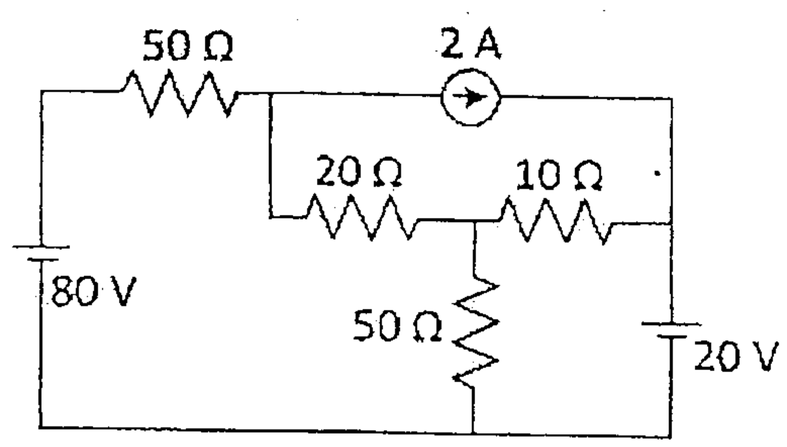
(e) The readings of the two wattmeters connected to measure three phase power input are 1000W and 500W. Find total reactive power in the circuit. **2**

(f) Draw the circuit diagram to carry out short circuit test on single phase transformer. **3**

(g) Explain working principle of a three phase induction motor. **2**

(h) Define rectification efficiency of a full wave rectifier. **2**

2. (a) Find current in 10Ω by mesh analysis. **6**



(b) A coil having resistance of 10Ω and an inductor of 50mH is connected to a 230V, 50Hz supply. Find impedance of a coil, current, power factor of a coil and power factor of complete circuit. 6

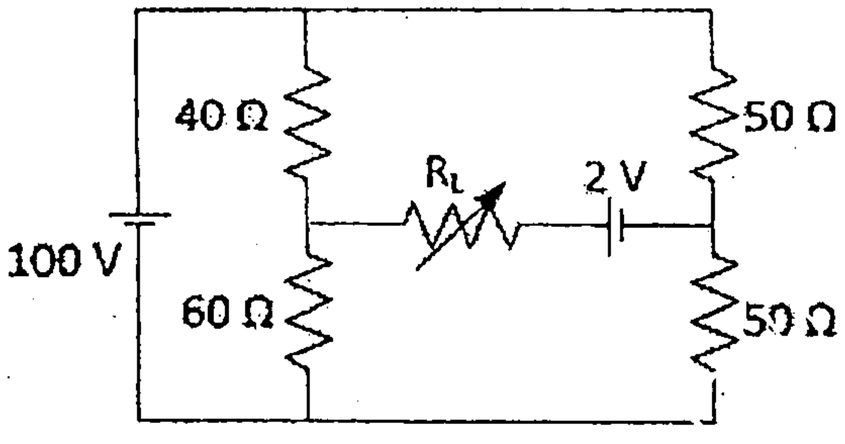
(c) Draw the phasor diagram of a transformer on lagging pf load & write meaning of all the terms used. 8

3. (a) Derive the relation between line and phase quantities in three phase star connected load. 8

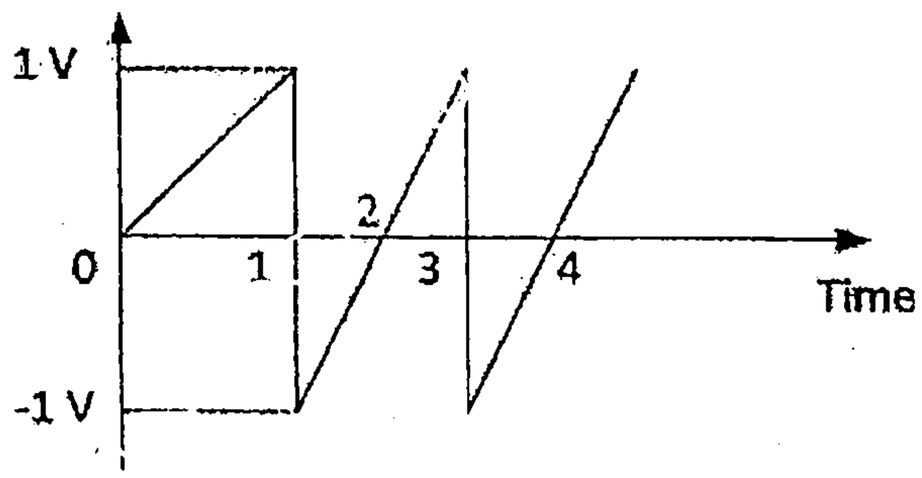
(b) Explain open circuit test to calculate R_0 & X_0 of a single phase transformer. 4

(c) Explain double field revolving theory in single phase induction motors. 8

4. (a) Find maximum power in R_L. 7



(b) Find rms value of waveform shown. 4



(c) A three phase star connected load has a pf 0.4 lag. Two wattmeters are connected to measure power input. Total power in the circuit is 30KW. Find readings of each wattmeter. 4

(d) Explain full wave bridge rectifier with neat waveforms. 5

5. (a) Derive the formula for delta to star conversion of resistances. 7

(b) A coil of 0.6 pf is in series with a 100 μF capacitor and is connected to a 50Hz supply. The potential difference across the coil equal to the potential difference across capacitor. Find resistance and inductance coil. 5

(c) The OC & SC on a 5 KV A, 200V /400V, 50Hz, single phase transformer gave following test results 8
OC Test (meters on LV) 200V, 1A, 100W
SC Test (meters on HV) 15V, 10A, 85W.

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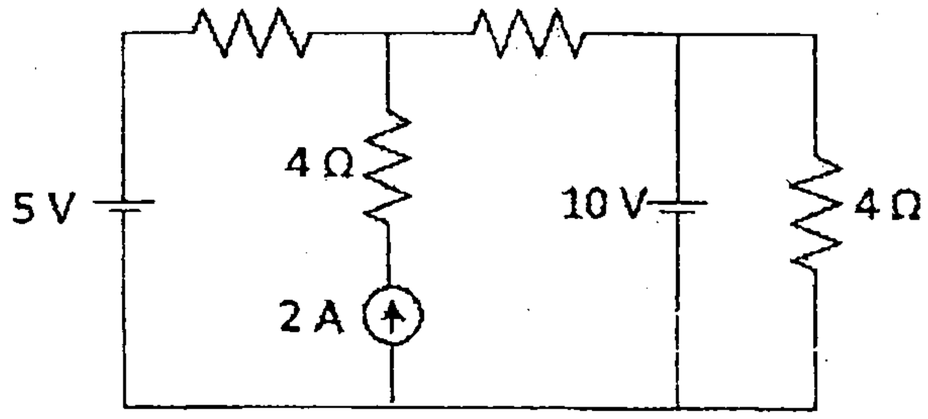
Calculate equivalent circuit parameters referred to primary, Calculate efficiency of transformer at full load, 0.8 pf Lag.

6. (a) Find the current in 2Ω by superposition theorem. 7

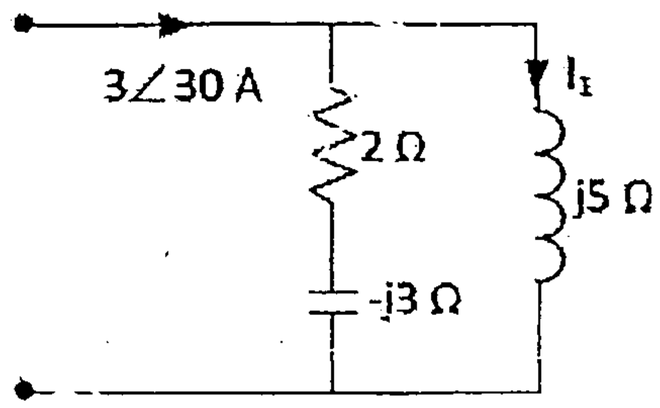


(b) A resistor and a capacitor are in series with a variable inductor. When the circuit is connected to a 220V, 50Hz supply, the maximum current obtainable by varying the inductance is 0.314A. The voltage across capacitor is then 800V, find R, L and C. 7

(c) Prove that the two wattmeter method can measure power input taken by a three phase star connected circuit. 6

7. (a) An alternating current of 50Hz frequency has a maximum value of 100A. Calculate its value 1/600 sec after the instant of current zero and increasing positively thereafter. 2

(b) Find the current in inductor for the circuit shown. 3



(c) A 15KVA single phase transformer was loaded as follows 5
2KW at 0.5 pf for 12 hours
12KW at 0.8 pf for 6 hours
18KW at 0.9 pf for 6 Hours.
If iron loss and full load copper loss both are equal to 153W, Find all day efficiency.

(d) Derive an expression for emf induced in DC motor. 5

(e) Describe experimental setup to obtain the input output characteristics of CE configuration of BJT. 5

FE (old) Sem-I 1/12/014
Engg. Mechanics.

(OLD COURSE) **QP Code : 11902**

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

N.B. (1) Question **No. 1** is **Compulsory**.

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

(3) Figure to the right indicates full marks.

(4) Assume suitable additional data necessary and state the same clearly in your answer.

(5) Take $g=9.81 m/s^2$.

Q1 a) Determine the magnitude and direction of the resultant of coplanar concurrent forces acting at O as shown in fig.1.a.

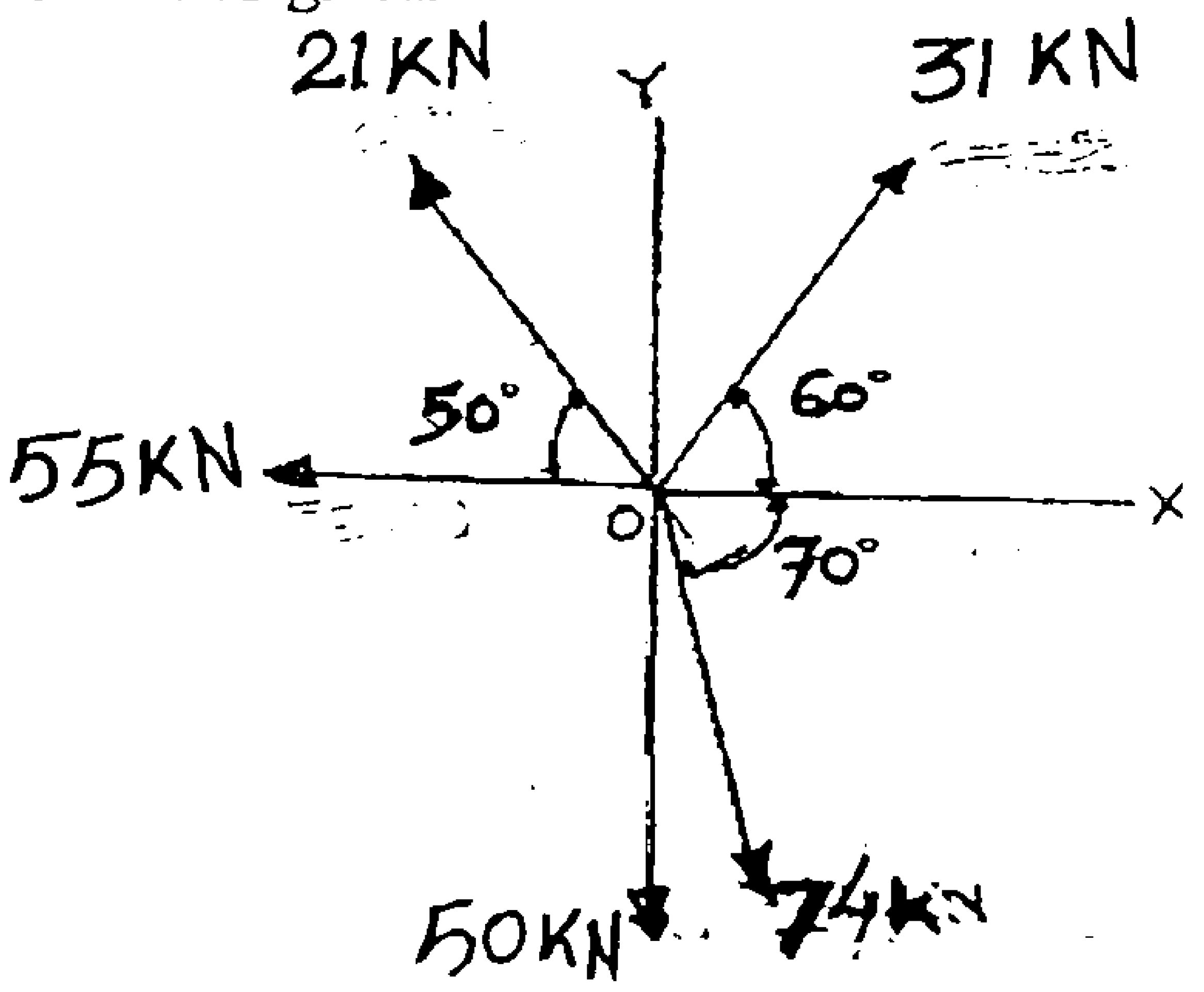


Fig 1.a

b) Explain the terms i) Perfect truss ii) Redundant truss iii) Deficient truss

c) A flat belt is passing over two fixed pulleys as shown in fig 1.c. Determine the minimum force P is required to just lift the 30 kN load. Take μ = 0.3 between belt and all pulleys.

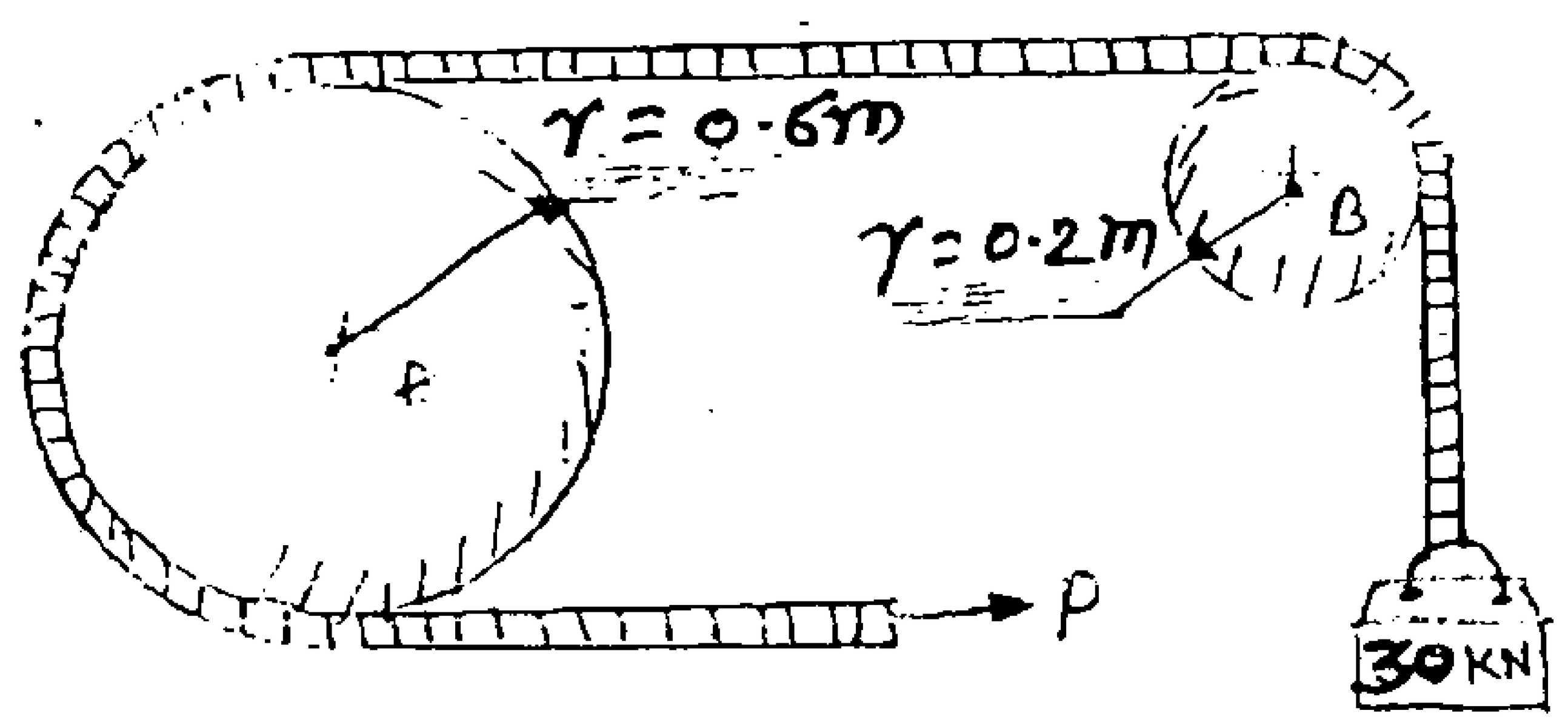


Fig 1.c

d) During a test, the car moves in a straight line such that its velocity is defined by $v= 0.3(9t^2 + 2t)$ m/s, where t is in seconds. Determine the position and acceleration when t=3 seconds. Given at t =0, s=0.

[TURN OVER

e) The 150 kg car A is coasting at freely at 1.5 m/s on the horizontal track when it encounters a car B having a mass of 120 kg and coasting at 0.75 m/s towards it as shown in fig.1.e. If the cars meet and couple together, determine the speed of both the cars just after the coupling. [5x4=20]

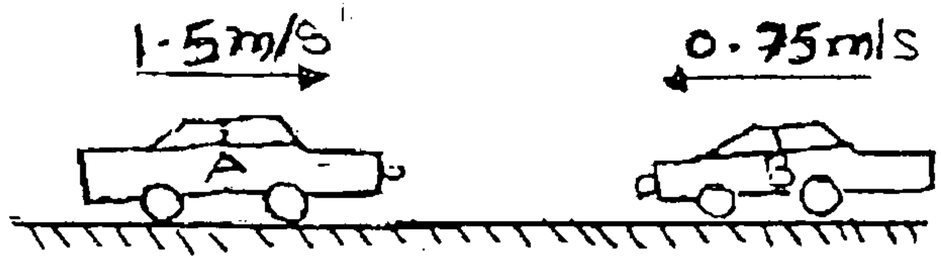


Fig 1.e

Q2 a) The four tangent forces are acting on the circle of radius 2.4 m. Find the resultant in magnitude and direction and also find the point of application of the resultant. Refer fig.2.a [8]

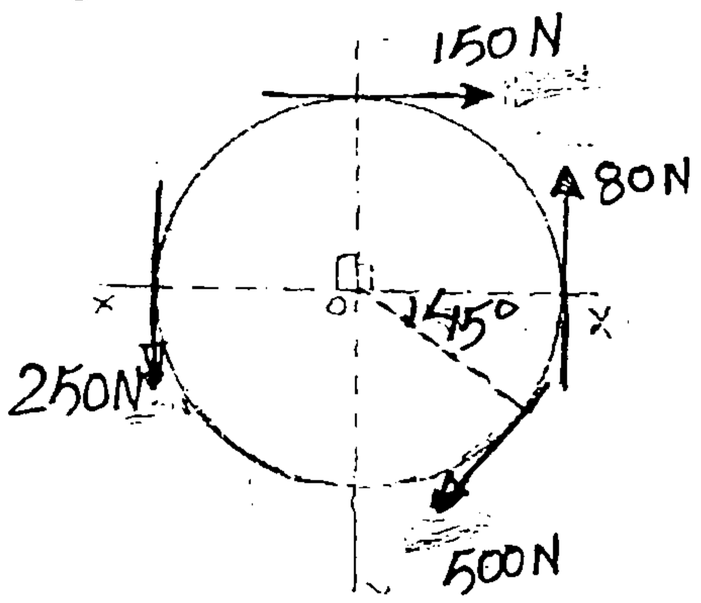


Fig 2.a

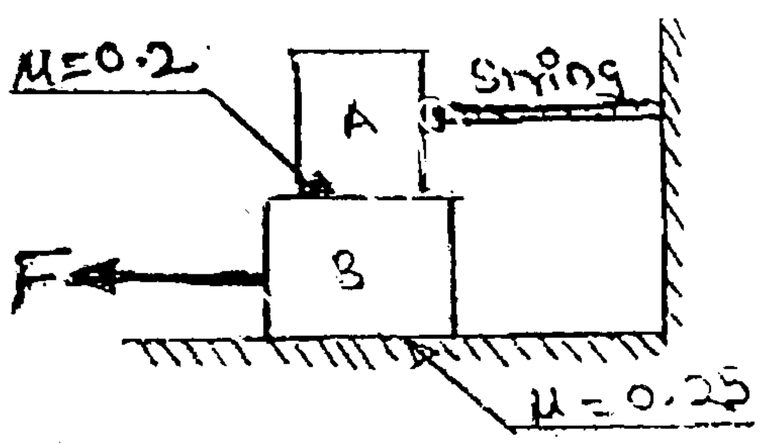


Fig 2.b

b) In fig.2.b weight of two blocks A and B are 100 N and 150 N respectively. Find the smallest value of the horizontal force F to just move the lower block B if

i) The block is restrained by a string. ii) When string is removed. [6]

c) Track repairs are being carried out over 2 km length of a railway line. The maximum speed of the train is 90 kmph and the repair track should not exceed 36 kmph. The train approaching the repair track decelerates uniformly from 90 kmph to 36 kmph in 200 m. after traveling on the repair track it accelerates to its full speed in 1600 m. Determine the time lost due to track repair. [6]

Q3 a) Two spheres A and B are resting in a smooth trough as shown in fig.3.a. Find reactions at point 1, 2, 3 and 4. [8]

b) The motion of the particle is described by x-t and y-t relations as $x = 2(t+2)^2$ and $y = 2/(t+2)^2$. Show that path travelled by the particle is a rectangular hyperbola. Determine velocity and acceleration of the particle at t = 2 sec. [6]

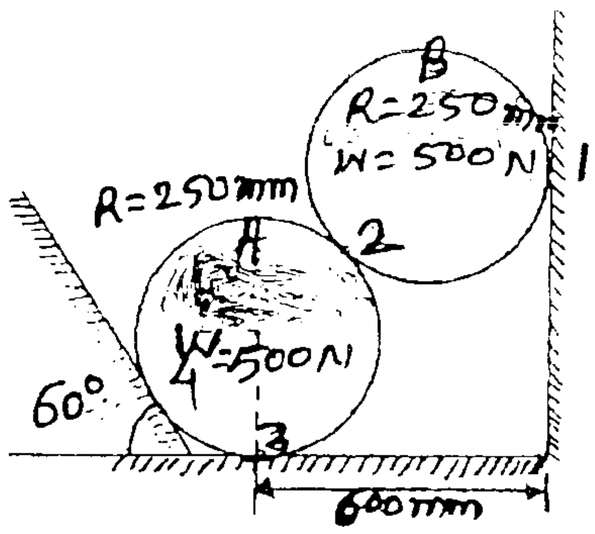


Fig 3 a

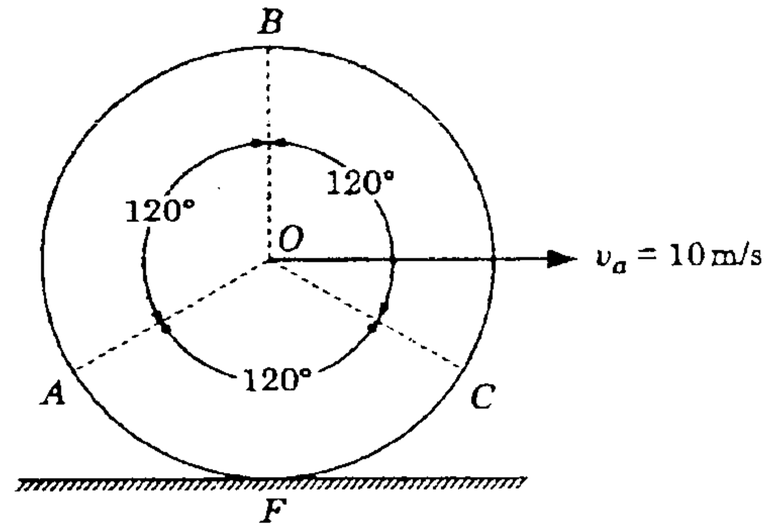


Fig 3.c

c) A wheel of diameter 1 m rolls without slipping on a flat surface as shown in fig.3.c. The centre of the wheel is moving with a velocity of 10 m/s. Find the velocity of the point A, B and C. [6]

Q4 a) A square of side 5cm is cut from the composite area as shown in fig 4.a. Locate the centroid of the remaining area. [4]

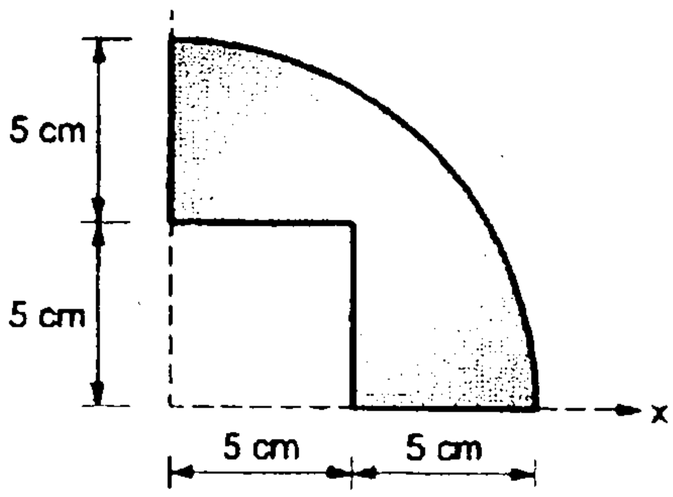


Fig 4.a

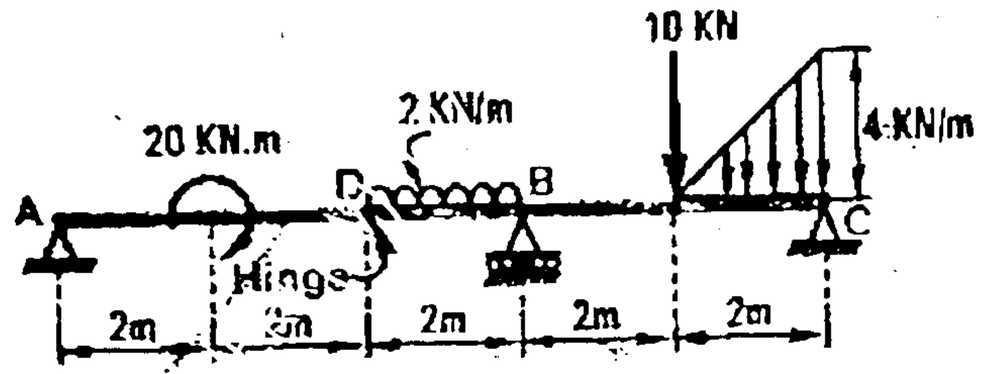


Fig 4.b

b) Determine the reactions at supports A, B and C for the beam loaded as shown in fig 4.b. D is an internal hinge 4m from A. [8]

c) The drinking fountain n is designed such that the nozzle is located from the edge of the basin shown in fig.4.c. Determine the maximum and minimum speed at which water can be ejected from the nozzle so that it does not splash over the sides of the basin at B and C which are at the same level. [8]

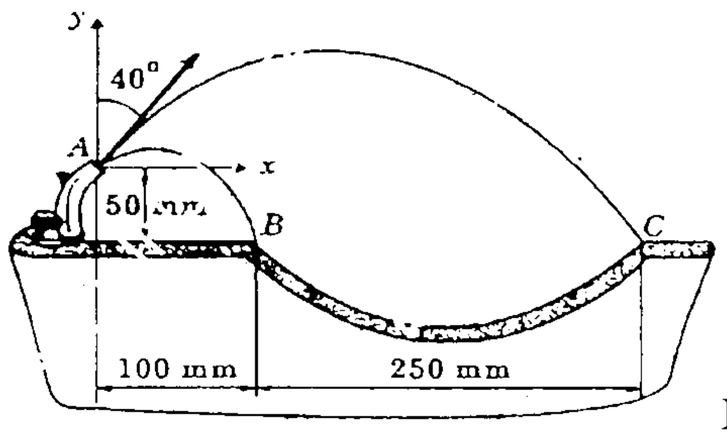


Fig. 4.c

Q5 a) Referring to the truss shown in fig. 5a find

i) Reactions ii) Zero force members iii) Forces in members BF and EF by method of sections. iv) Forces in other members by method of joints. [6]

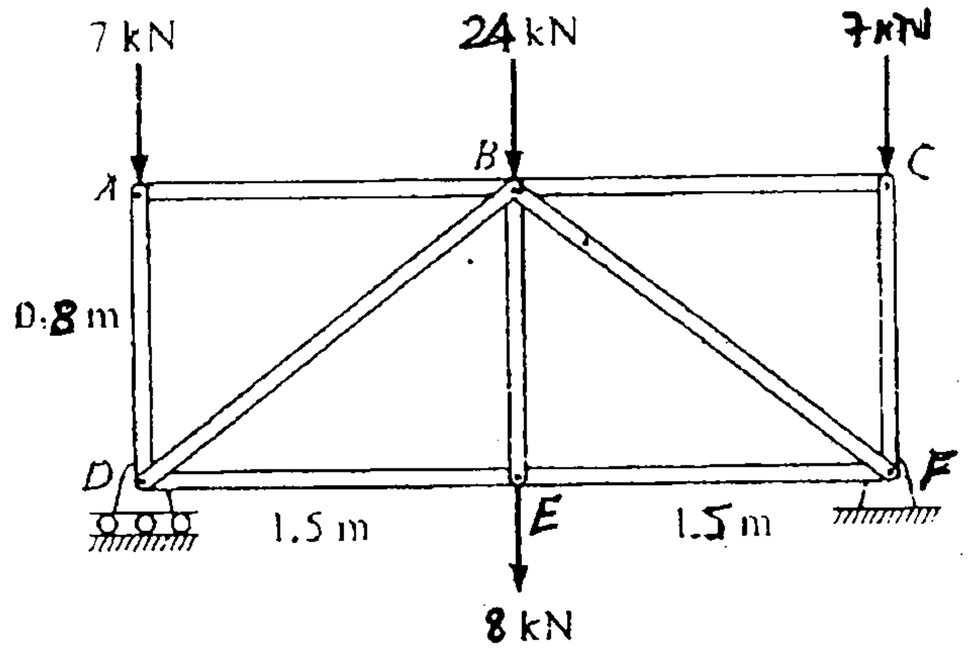


Fig 5.a

b) What maximum power is transmitted if the cross section of the belt is 10 cm^2 and maximum stress is limited to 2400N/cm^2. Density of belt material =5 gm/cm^3. The ratio of effective tension =2. [6]

c) Two blocks P and Q of mass 8kg and 24kg respectively are connected by a weightless rope passing over a frictionless pulley as shown in fig 5.c. Determine the velocity of the system 3 seconds after starting from rest. Take the coefficient of friction for all surface μ=0.3. [6]

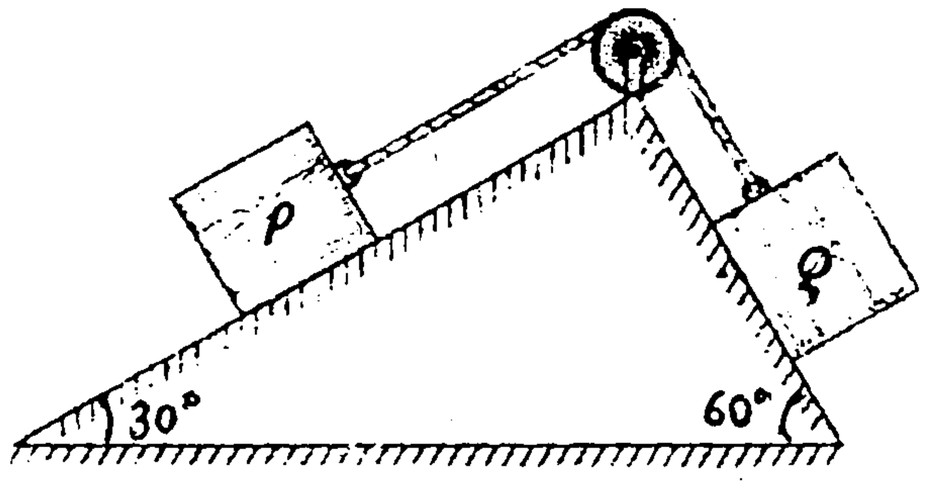


Fig 5.c

Q6 a) Rod AB is supported by a pin and bracket at A and rests against a frictionless peg at C. Determine the reaction at A and C When a 170 N force is applied at B as shown in fig 6.a. [6]

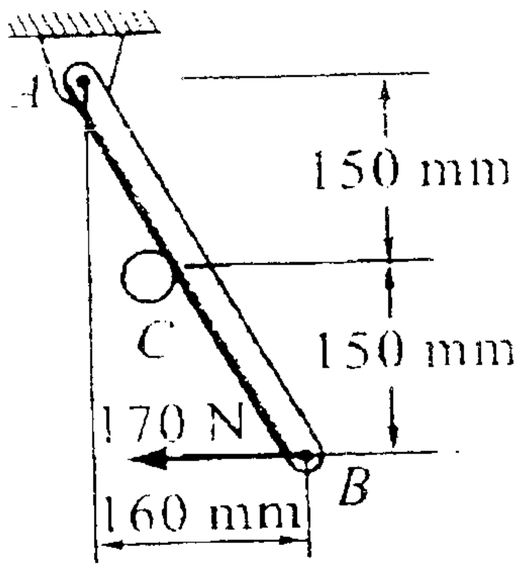


Fig. 6.a

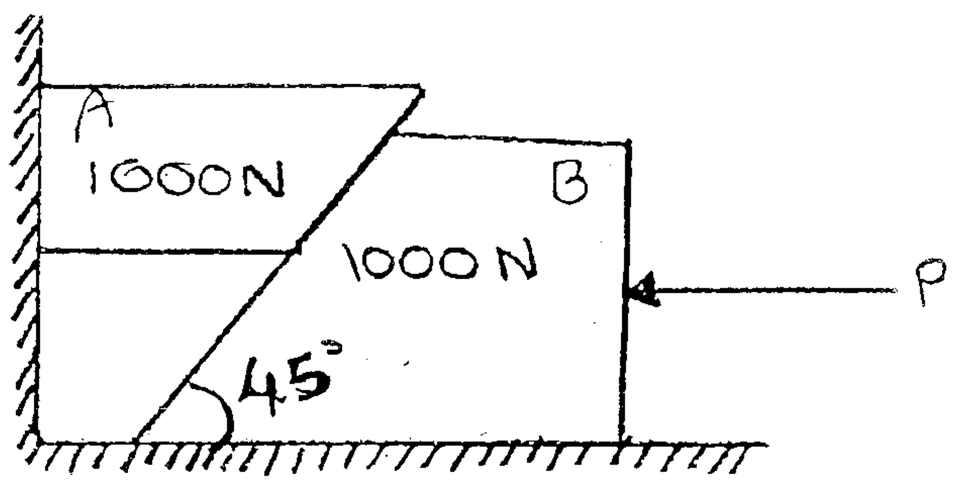


Fig. 6.b

b) A block weighing 1000N is to raised by applying a horizontal force P on another block B of 1000N as shown in fig. 6.b. Calculate the minimum force P to push the block A up. Take μ=0.25 at all faces. [6]

c) In the mechanism shown in fig.6.c angular velocity of rod DC is $\pi/6$ rad/second. Determine angular velocity of CB and AB. [8]

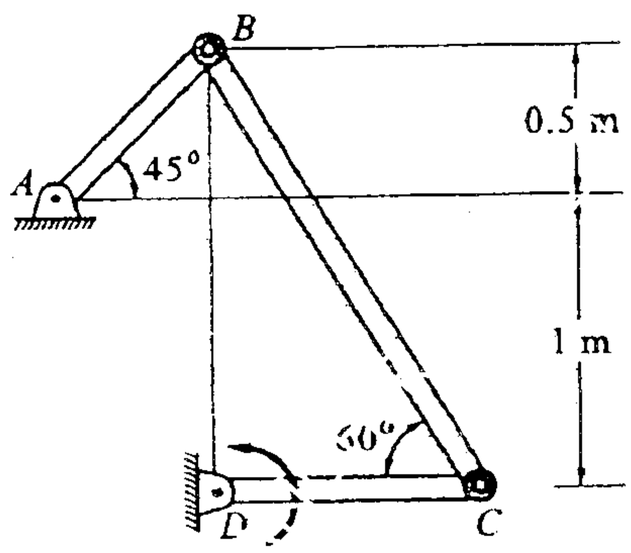


Fig. 6. c

Q7 a) Find the moment of inertia of shaded area shown in fig 7.a about x- axis and y-axis [6]

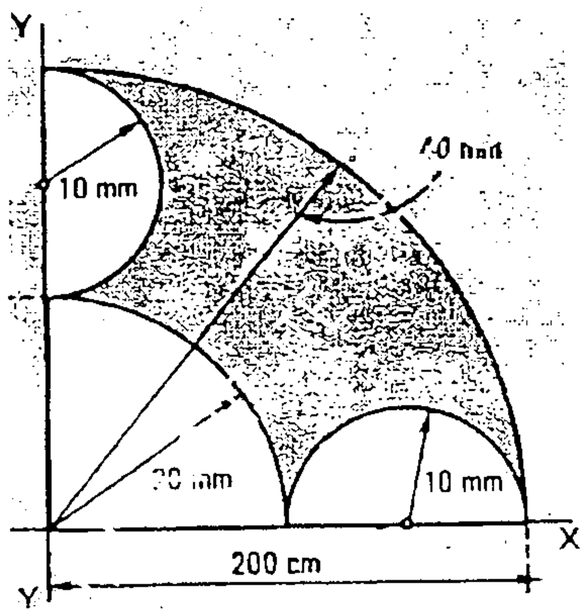


Fig. 7.a

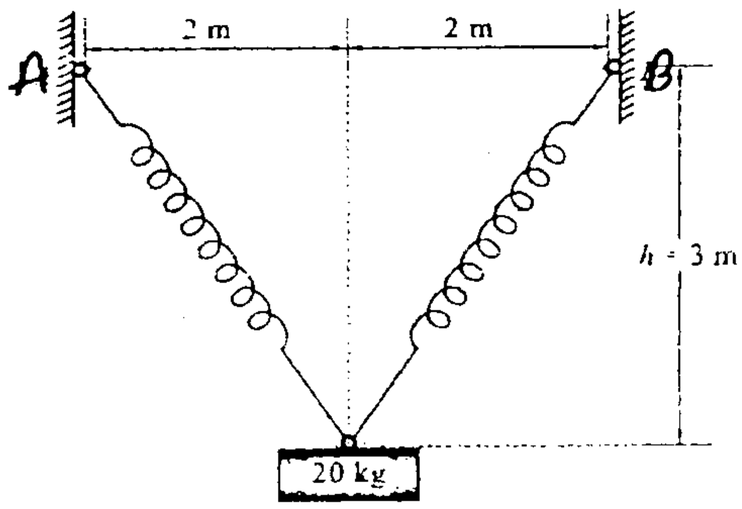


Fig. 7.b

b) The cylinder has a mass of 20 kg and is released from rest when h=0.fig 7.b. Determine its speed when h=3m. The springs each have an unstretched length of 2m. (k=40N/m) [8]

c) A ball of mass 0.15 kg is approaching with a velocity of 30 m/s on to a stationary block of mass 0.2 kg centrally as shown in fig 7.c. If coefficient of restitution between the ball and block is e=0.7, find the distance travelled by the block on a flat horizontal rough surface with dynamic friction μ_k=0.3. [6]

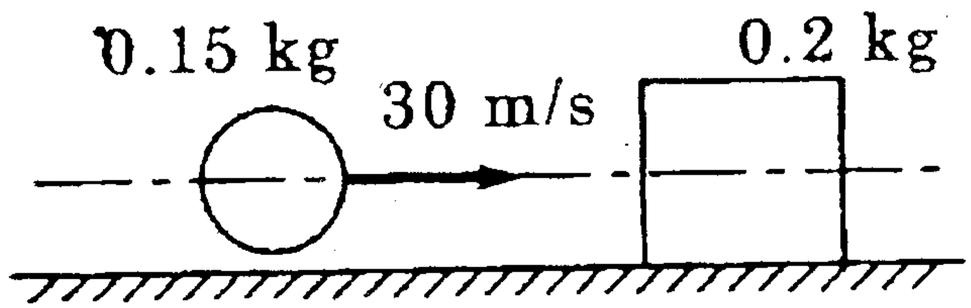


Fig 7.c

F.E. Sem I (old) 5/12/14

App. Maths-I

(OLD COURSE) Q.P. NO : **11895**

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

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

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

(3) Answer to **subquestions** should be written **together.**

1. (a) P. T. $\frac{1+\cos\alpha+i\sin\alpha}{1-\cos\alpha+i\sin\alpha}=\cot\left(\frac{\alpha}{2}\right)e^{i\left(\alpha-\pi/2\right)}$ 3

(b) If $y=x^2e^x\cos x$: find y_n 3

(c) P. T. $\tanh^{-1}x=x+\frac{x^3}{3}+\frac{x^5}{5}+\frac{x^7}{7}+\ldots\ldots$ 3

(d) If $u=\frac{e^{x+y+z}}{e^x+e^y+e^z}$ S.T. $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=2u$ 3

(e) Find $\left[\left(\bar{a}\times\bar{b}\right)\times\left(\bar{c}\times\bar{d}\right)\right]+\left[\left(\bar{b}\times\bar{c}\right)\times\left(\bar{a}\times\bar{d}\right)\right]+\left[\left(\bar{c}\times\bar{a}\right)\times\left(\bar{b}\times\bar{d}\right)\right]$ 4

(f) If the temp T at any print (x, y, z) on the surface of the sphere $x^2+y^2+z^2=1$ is $T=400\,xyz^2$. Find heighest tempreture. 4

2. (a) Find z if $\arg(z+1)=\frac{\pi}{6}$ & $\arg(z-1)=\frac{2\pi}{3}$ 6

(b) If $\sin(\theta+i\phi)=\tan\alpha+i\sec\alpha$ then S.T. $\cos 2\theta\cosh 2\phi=3$. 6

(c) If $u=\frac{x^3y^3z^3}{x^3+y^3+z^3}+\cos\left[\frac{x^2+y^2+z^2}{xy+yz+zx}\right]$ 8

find $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}$

3. (a) If $f(x)=x(x+1)(x+2)(x+3)$; S.T. $f'(x)=0$ has at least three real roots in $[-3, 0]$. 6

(b) Verify the formula that $\frac{d}{dt}\left(\bar{A}+\bar{B}\right)=\bar{A}\times\frac{d\bar{B}}{dt}+\frac{d\bar{A}}{dt}\times\bar{B}$ for 6

$\bar{A}=5t^2i+tj-t^3k$ & $\bar{B}=\sin t\,i-\cos t\,j$ 8

(c) Expand $\sin^{-1}x$ in assending powers of x upto the term x^7.

4. (a) Express $\frac{\sin 7\theta}{\sin \theta}$ in powers of $\sin \theta$ only. 6

(b) Test the convergence of $\Sigma \frac{3^n + 4^n}{4^n + 5^n}$ 6

(c) If $y = \sin\left(m \sin^{-1} x\right)$ S.T. 8

$$\left(1-x^2\right) y_{n+2} - (2n+1) x y_{n+1} - \left(n^2 - m^2\right) y_n = 0$$

5. (a) S.T. $\frac{d^n}{dx^n}\left(\tan^{-1} x\right) = \frac{(-1)^{n-1}(n-1)! \sin\left(n \tan^{-1} 1/x\right)}{\left(x^2+1\right)^{n/2}}$ 6

(b) find a, b if $\lim_{x \to 0} \frac{a \sin x - \sin 2x}{\tan^3 x} = b$ 6

(c) If $\overline{A} = \nabla(xy + yz + zx)$ find $\nabla \cdot \overline{A}$ & $\nabla \times \overline{A}$ 8

6. (a) If $u = x^2 - y^2$, $v = 2xy$ & $z = f(u, v)$ P.T. 6

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 4\sqrt{u^2+v^2}\left[\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2\right]$$

(b) Find directional derivative of $\phi = e^{2x-y-z}$ at (1,1,1) in the direction of tangent to the curve $x = e^{-t}$, $y = 2 \sin t + 1$ $z = t - \cos t$, at $t = 0$. 6

(c) Find the prinicipal value of $(x+iy)^i$ and show that it is enrirely real if $\frac{1}{2}\log\left(x^2 + y^2\right)$ is multiple of π. 8

7. (a) If $u(x+y) = x^2+y^2$ then S.T. $\left(\frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right)^2 = 4\left[1 - \frac{\partial u}{\partial x} - \frac{\partial u}{\partial y}\right]$ 6

(b) Find the maximum and minimum values of $x^3+3xy^2-3x^2-3y^2+4$ 6

(c) Separate into real and imaginary parts of $\left(\sqrt{i}\right)^{\sqrt{i}}$ 8

Dec 2014

(OLD COURSE) **Q.P. Code : 11915**

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

N.B. : (1) Question No.**1** is **compulsory**.
(2) Answer any **four** questions from the remaining **six**
(3) **All** questions carry **equal** marks
(4) **Figures** to the **right** indicate marks.

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

1. Attempt any **five** from the following :– **15**
   (a) Explain the terms : (i) BOD (ii) COD What is their significance.
   (b) Distinguish between thermoplastics and thermosetting plastics.
   (c) What are lubricants ? List any four functions of lubricants.
   (d) Write any three merits and three demerits of phase rule.
   (e) What are carbon nanotubes ? Briefly explain the different types of carbon nanotubes.
   (f) Write any three advantages and disadvantages of hydropower.
   (g) 5ml of oil requires 2.5ml of 0.05N KOH for titration. Find the acid value of the lubricant and state if it is fit for use (Density of oil = 0.91 g/ml)

2. (a) A water sample contains :– **6**
   $Ca(HCO_3)_2$ = 65ppm, $CaSO_4$ = 40ppm, $Mg(HCO_3)_2$ = 25ppm $MgSO_4$ = 35ppm, $CaCl_2$ = 20ppm, $Mg(NO_3)_2$ = 15ppm.
   Calculate the amount of soda (95% pure) and lime (90% pure) for softening 50,000 litres of water.
   (b) Write a note on conducting polymers **5**
   (c) With the help of a neat diagram, explain the principle and working of a Hydrogen fuel cell. **4**

3. (a) Write the preparation, properties and uses of :– **6**
   (i) BuNa - S (ii) Polyethylene
   (b) With the help of a neat diagram, explain the mechanism of boundary lubrication. **5**
   (c) Explain the synthesis of carbon nanotubes using Laser Ablation method. **4**

4. (a) Under what conditions are solid lubricants used ? Explain the structure, properties and uses of any one solid lubricant. **6**
   (b) Explain the application of Gibbs phase rule to lead-silver system. **5**
   (c) The hardness of 60,000 litres of a water sample was removed by a zeolite softener. The zeolite required 100 litres of NaCl solution containing 1000 mg/litre of NaCl for regeneration. Calculate the hardness of the water sample. **4**

5. (a) Using Gibbs phase rule, calculate the number of phases, components and degrees of freedom for the following equilibria. **6**

(i) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

(ii) Ice(s) $\rightleftharpoons$ Water (l)

(b) Explain the activated sludge method for treatment of waste water with the help of a neat flow chart. **5**

(c) Outline the role of the following additivies in plastic compounding.:– **4**

(i) Fillers

(ii) Lubricants

6. (a) Outline the applications of nanomaterials in the field of : **6**

(i) Medicine

(ii) Catalysis

(iii) Electronics

(b) 25ml of standard hard water containing 1g/litre of $CaCO_3$ required 30ml of EDTA. 50ml of hard water sample required 40 ml of this EDTA. 40 ml of hard water sample after boiling required 20ml of the same EDTA. Calculate the temporary, permanent and total hardness of the water sample. **5**

(c) With the help of a neat diagram explain the principle and working of a biogas plant. **4**

7. (a) What is meant by fabrication of plastics ? What are the different fabrication methods for plastics ? Explain the method of compression moulding with the help of a neat diagram. **6**

(b) Explain the zeolite method of softening of water. **5**

(c) State Gibbs phase rule and define :– **4**

(i) Phase

(ii) Component

(iii) Degrees of freedom.