FE (All Branches) CBSGS 07/12/16

Applied Maths-I

T0121

QP CODE : 529302

(3 hours) **[Total Marks : 80]**

Note: i) Q.No 1 is compulsory

ii) Attempt any three from remaining.

ii) All questions carry equal marks.

Q.No.1)a)If tanhx = $\frac{1}{2}$, find sinh2x, cosh2x. (3)

b) If $z = xyf(\frac{y}{x})$, prove that $x\frac{\partial z}{\partial x} + y\frac{\partial y}{\partial y} = 2z$ (3)

c) If x = u(1-v), y = uv – uvw, z = uvw find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$ (3)

d) Using Maclaurins expansion , Prove that (3)

$$e^x secx = 1 + x + \frac{2x^2}{2!} + \frac{4x^3}{3!} + \cdots$$

e) Show that every square matrix A can be uniquely expressed as P+iQ, where P & Q are Hermitian Matrices. (4)

f) Find nth derivative of $e^x cosxcos2x$ (4)

Q.No.2)a) If x =cos θ+isin θ, y = cosØ + i sinØ, show that

$$\frac{x-y}{x+y} = itan\frac{\theta-\emptyset}{2}$$ (6)

b) For the following matrix A , find non singular matrices P and Q such that PAQ is in normal form and hence find the rank of A, $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$ (6)

c) If $u = cosec^{-1}\sqrt{(\frac{x^{1/2}+y^{1/2}}{x^{1/3}+y^{1/3}})}$, show that (8)

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial xy} + y^2\frac{\partial^2 u}{\partial x^2} = \frac{tanu}{12}(\frac{13}{12} + \frac{tan^2 u}{12})$$

Q.No 3)a) For what values of λ, the system of equations 3x-y+4z=3,x+2y-3z=-2, 6x+5y+λz=-3 has a unique solution. Determine the solution in each case. (6)

b) Find the maxima and minima of the function (6)
$f(x,y) = x^3 + y^3 - 3x - 12y + 20$

c) Show that $tan^{-1} i\left(\frac{x-a}{x+a}\right) = \frac{i}{2}\log(\frac{x}{a})$ (8)

Q.No.4)a) Find $\frac{\partial z}{\partial x}, \frac{\partial z}{\partial y}$, using partial derivatives for (6)

$$xe^y + ye^z + logx - 2 - 3log2 = 0 \text{ at P(1,log2,log3)}$$

[TURN OVER

b) Find the principal value of $(1+i)^{1-i}$. (6)

c) Solve the following system of equation by crouts method (8)

$x + y + z = 3,\ 2x - y + 3z = 16,\ 3x + y - z = -3$

Q.No.5)a) Show that $\frac{sin6\theta}{sin2\theta} = 16cos^4\theta - 16cos^2\theta + 3$ (6)

b) Find a and b such that $\lim_{x\to 0} \frac{x(1-acosx)+bsinx}{x^4} = \frac{1}{3}$ (6)

c) If $y = (1-x)^{-\alpha}e^{-\alpha x}$, show that (8)

(i) $(1-x)\,y_1 = \alpha xy$

(ii) $(1-x)y_{n+1} - (n+\alpha x)y_n - n\alpha y_{n-1} = 0$

Q.No.6) a) Show that the rows of the following matrix are linearly dependent and find the relationship between them $\begin{bmatrix} 1 & 0 & 2 & 1 \\ 3 & 1 & 2 & 1 \\ 4 & 6 & 2 & -4 \\ -6 & 0 & -3 & -4 \end{bmatrix}$ (6)

b) If $\emptyset\left(\frac{z}{x^3}, \frac{y}{x}\right) = 0$, prove that $px + qy = 3z$ (6)

c) Fit a second degree parabola to the following data (8)

x:	-2	-1	0	1	2
y:	-3.150	-1.390	.620	2.880	5.378

Course: F.E.(ALL BRANCHES) (CBSGS) (SEMESTER - I)(Prog T0121)

QP Code: 529302(2nd Query)

Correction:

Q. 6 c

Read As: **.620**

Query Update time: 07/12/2016 11:50 AM

Course: F.E.(ALL BRANCHES) (CBSGS) (SEMESTER - I)(Prog T0121)

QP Code: 529302

Correction:

Q.1 B)

$x\frac{\partial z}{\partial x}+y\frac{\partial y}{\partial y}=2z$ read as $x\frac{\partial z}{\partial x}+y\frac{\partial z}{\partial y}=2z$

Q.2 C)

$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial xy}+y^2\frac{\partial^2 u}{\partial x^2}$ read this as $x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}$

Q.6 B) add the sentence

Where $p=\frac{\partial z}{\partial x},\ q=\frac{\partial z}{\partial y}$

Query Update time: 07/12/2016 11:50 AM

F.E. All Branches Choice based
Basic Electrical Engineering 20/12/2016

Q.P. Code :803301

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.1 is compulsory.
(2) Answer any **THREE** questions from remaining five questions.
(3) **Figures** to right indicate **full** marks.
(4) Assume suitable data if required.

1. A) State Maximum Power Transfer Theorem **2**
B) Derive the formula to convert a delta circuit into an equivalent star **4**
C) Define Average value and RMS value of an alternating quantity **4**
D) Prove that power in a 3-phase delta connected system is 3 times that of a star connected system. **4**
E) Explain the working principle of a single phase transformer. **4**
F) What is the use of commutator in a DC machine. **2**

2. A) Obtain current through 1 Ω resistance by using Super position theorem, in fig 2.A. **10**

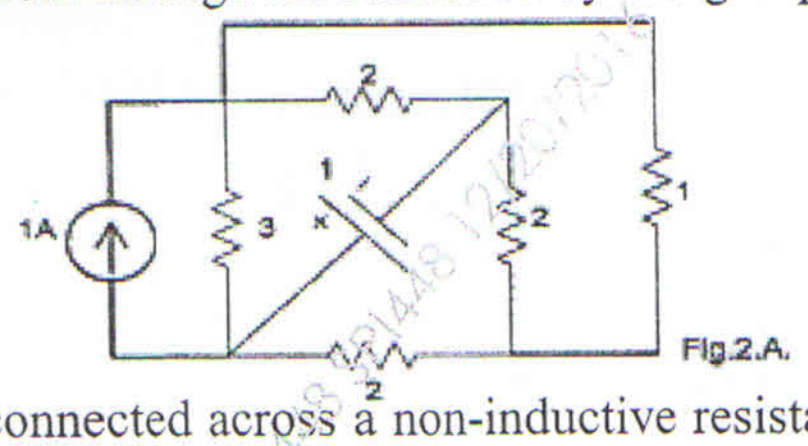


Fig.2.A.

B) A coil is connected across a non-inductive resistance of 120 Ω. When a 240 V, 50 Hz supply is applied to this circuit the coil draws a current 5 A and total current is 6 A. Determine the power and power factor of **10**
i) the coil
ii) the whole circuit

3. A) Obtain Norton's equivalent circuit of the network shown in fig. 3.A, across the terminals A and B **10**

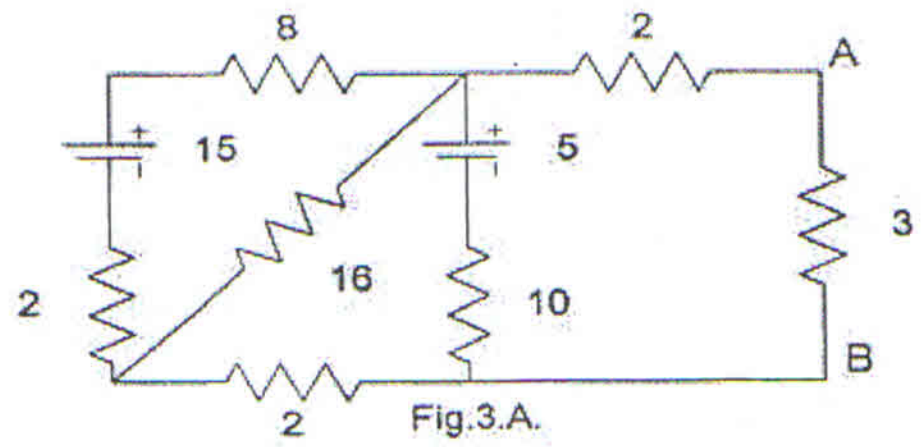


Fig.3.A.

[TURN OVER]

B) A series RLC circuit, if ω_0 is the resonant frequency, ω_1 and ω_2 are the half power frequencies, prove that $\omega_0 = \sqrt{(\omega_1\ \omega_2)}$ **5**

C) Derive the equivalent circuit of a 1-phase transformer. **5**

4. A) Obtain current through 15 Ω resistance by nodal analysis in fig.4.A. Take reference node as marked. **10**

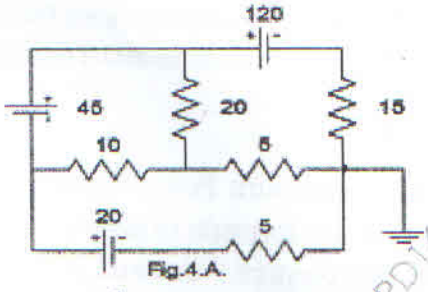


Fig.4.A.

B) In a balanced 3 phase, star connected system, a wattmeter is connected with its current coil in series with Y line and pressure coil between Y and R lines. Draw a neat circuit digram showing the above watmeter connection. Assuming a lagging power factor, draw the corresponding phasor diagram and derive the watmeter reading in terms of line voltage, line current and phase angle. **10**

5. A) Obtain current through 60 Ω resistance by Mesh analysis in fig.5.A. **6**

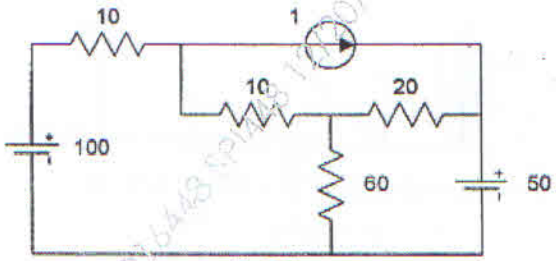


Fig.5.A.

B) Develope the phasor diagram of a single transformer supplying to a resistive load. **8**

C) Derive the emf equation of a DC generator. **6**

6. A) A resistor and a pure reactance are connected in series across a 150 V ac supply. When the frequency is 40 Hz, the circuit draws 5 A. When the frequency is increased to 50 Hz, the circuit draws 6 A. Find the value of resistance and the element value of the reactance. Also find the power drawn in the second case. **10**

B) A single phase 10 KV A, 500 V/250 V, 50 Hz transformer has the following constants. **10**

Resistance : primary = 0.2 ohms, secondary = 0.5 ohms
Reactance : primary = 0.4 ohms, secondary = 0.1 ohms
Resistance of equivalent exciting circuit w.r.t. primary = 1500 ohms
Reactance of equivalent exciting circuit w.r.t. primary = 750 ohms
What will be the reading of the instruments placed in primary side when the transformer is connected for OC and SC tests ?

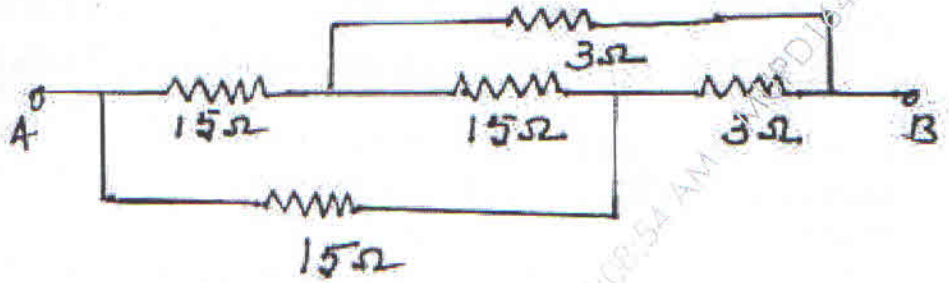
F.E. All branches CBSGS Sem. - I
Basic Electrical Engineering 20/12/2016

Q.P. Code : 529500

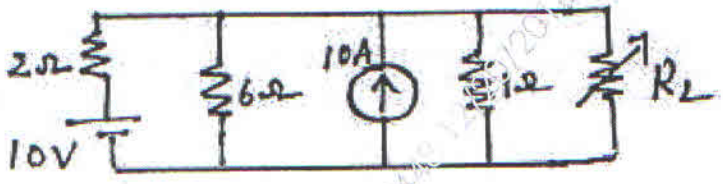
(3 Hours) **[Total Marks : 80**

N.B. : (1) Question No.1 is compulsory.
(2) **Answer** any **three** from the remaining **five** questions.
(3) Assumption made should be clearly stated.
(4) Answer to questions should be grouped together and written together.

1. a) Find equivalent resistance across the terminal AB. 3

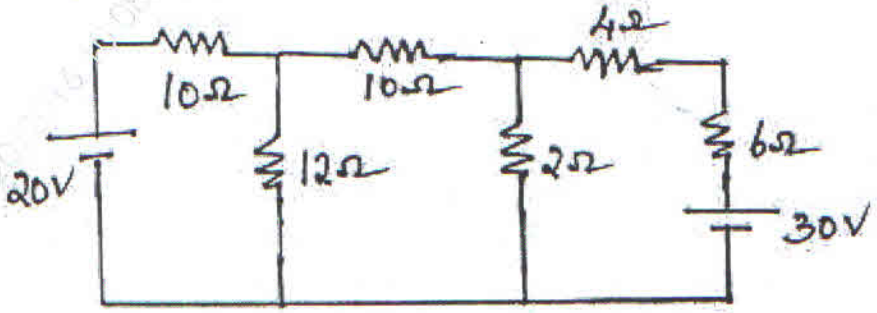


b) Find load resistance which dissipate maximum power. 3



c) Find the rms value of a sinusoidal waveform. 3
d) Draw resonance graph and write any four conditions of series resonance. 3
e) Write equations for three phase active power and reactive power along with its units. 2
f) Derive the conditions for maximum efficiency of a single phase transformer. 4
g) Draw the input and output voltage waveform of a half wave rectifier. 2

2. a) Using Mesh analysis find current through 2 Ω resistor. 6



[TURN OVER]

b) The impedances (12) Ω and (10 -j20)Ω are connected in parallel and current through 12 Ω is 10<0. Determine current through other branch, total current and kVA, kVAR, kW and power factor of the whole circuit. 8

c) Draw phasor diagram of a single phase transformer connected to a inductive load. 6

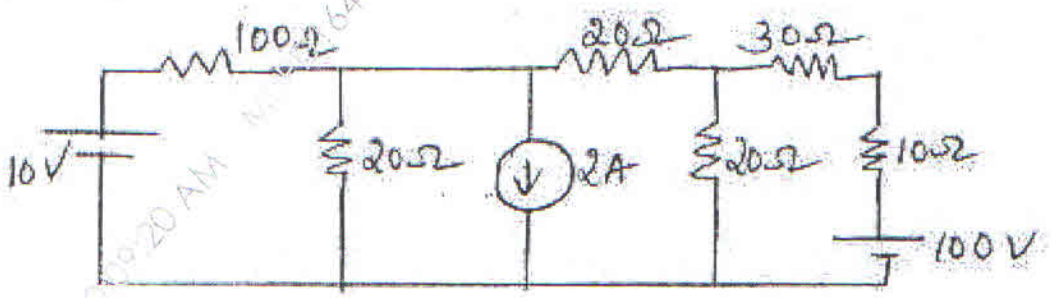
3. a) In a delta connected load each phase consists of a resistance of 100 Ω in series with a capacitor of capacitance 31.8 μF. When it is connected to a 400 V , three phase 50 Hz supply calculate 8
i) the line current ii) Power factor iii) The power absorbed and iv) total kVA

b) A 50 kVA, 2200/220 V, 50 Hz single phase transformer gave the following test results. 6
Open circuit test(H.V side): 2200 V, 0.5 A, 1000 W
Short circuit test(H.V side): 100 V, 20 A, 500 W
Determine i) Half load efficiency at 0.8 pf lagging and
ii) KV A at which maximum efficiency occurs and maximum efficiency at unity power factor.

c) With neat circuit diagram and characteristics explain the input and output characteristics of a CE transistor configuration. 4

d) Draw the circuit diagram and output voltage waveform of a full wave bridge rectifier with capacitor filter. 2

4. a) Find current through 10 Ω using source transformation. 7

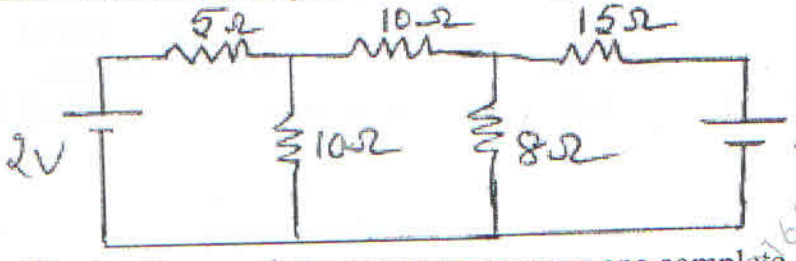


b) A balanced three phase star connected load has an impedance of 50< 60 Ω each phase connected across a three phase 1100 V, 50 Hz supply. Two watt meters are used to measure power. Find the reading of each wattmeter. 4

c) An alternating current of frequency 50 Hz has a maximum value of 12 A. Write down instantaneous current eauation. Find the value of current after 2.77 ms. Also find time taken to reach 9.6 A for the first time. 5

d) Derive rectification efficiency and ripple factor of a full wave centre tapped rectifier. 4

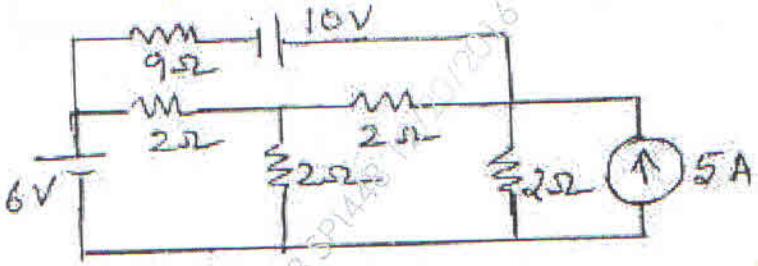
5. a) Calculate the current through 5 Ω resistor using Thevenin's theorem. 8



b) For an RL circuit prove that average power over one complete cycle is $V_{rms}\ I_{rms}\ \cos\emptyset$. 4

c) A 12 kVA, 400/200 V single phase 50 Hz transformer has maximum efficiency of 95 % at 85 % of full load at unity power factor. Determine the efficiency at full load at 0.8 power factor lagging. 8

6. a) Find current through 9Ω resistor using superposition theorem. 7



b) A series RLC circuit has the following parameter values R=10 Ω, L=0.01H, C=100 μH. Compute the resonant frequency, Q factor of the circuit, band width, lower and upper cut off frequency. 7

c) Prove that the power and power factor in a balanced three phase circuit can be calculated from the reading of two watt meters. Draw relevant connections and phasor diagram. 6

F.E. /Sem-I CBGS
Engg. Mechanics

14/12/16

QP Code : 529403

(3 Hours)

[Total Marks: 80

N. B.
1. Question No. 1 is Compulsory.
2. Answer any three questions out of remaining questions.
3. Assume any suitable data wherever required but justify the same.
4. Figures to the right indicate full marks.
5. Take $g = 9.81\ m/s^2$

Q1. (a) If resultant of two forces is 200 N vertical, determine magnitude and direction of F2 (refer fig No. 1). [4]

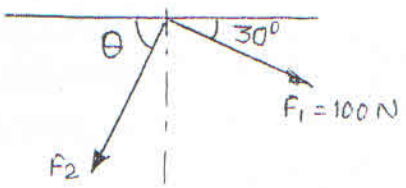


Fig No. 1

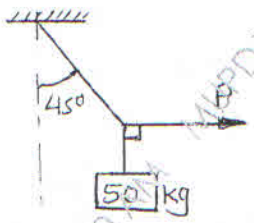


Fig No. 2

(b) Determine value of P to maintain equilibrium by using Lami's theorem (refer fig No. 2). [4]

(c) Explain with neat sketch, angle of repose and find relationship between angle of repose and angle of friction. [4]

(d) For the particle a-t diagram is shown in fig No. 3. Construct s-t and v-t diagrams. [4]

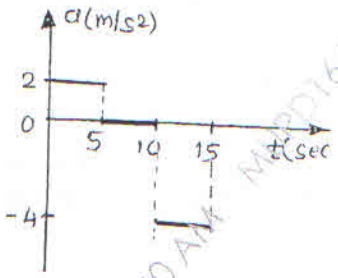


Fig No. 3

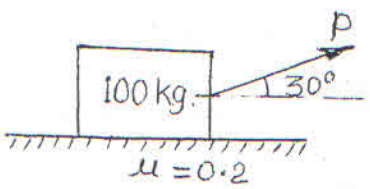


Fig No. 4

(e) A 100 kg block resting on horizontal plane is pulled by force P to accelerate the block at 3 m/s2 to right hand side as shown in fig No. 4. Determine P. [4]

[TURN OVER

Q2. (a) Determine magnitude, direction and position of resultant from O for the force system as shown in fig No. 5 [6]

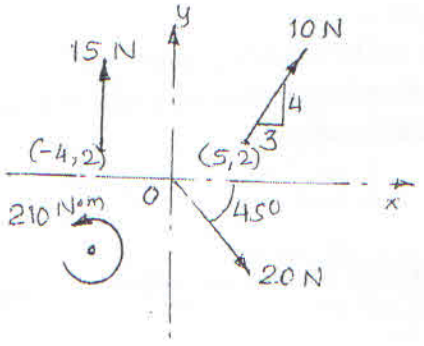


Fig No. 5

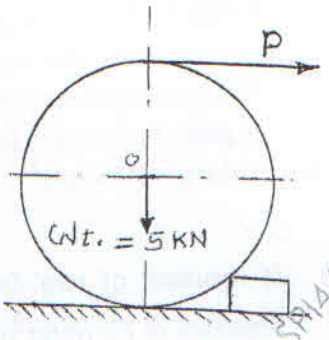


Fig No. 6

(b) An inextensible string is wound around the cylinder of diameter 1 m and the cylinder is just pulled over an obstacle of height 20 cm by pulling the string as shown in fig No.6. Determine pull P required. [8]

(c) A marble of mass m is dropped from certain height H on the horizontal floor. It rises to half the height H after second bounce. Determine coefficient of restitution between marble and the floor. [6]

Q3. (a) Determine the centroid of shaded area as shown in fig No. 7. [8]

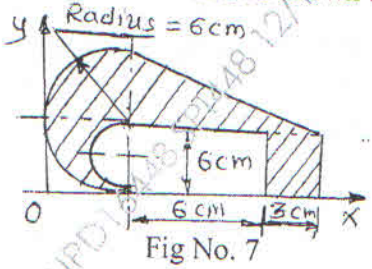


Fig No. 7

(b) Determine magnitude and direction of resultant. Tensions in wires AB, AD and AC are 100 N, 150 N and 200 N respectively. (refer fig No. 8) [6]

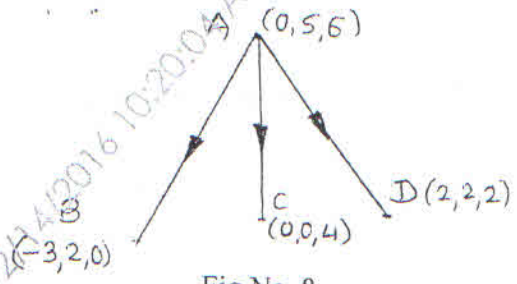


Fig No. 8

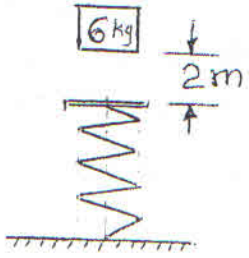


Fig No. 9

(c) A block of mass 6 kg falls from height 2 m onto a spring whose stiffness is 12 N/mm. Find velocity of block when spring gets compressed by 0.1 m. (refer fig No. 9) [6]

Q4. (a) Determine support reactions of the beam loaded as shown in fig No. 10. [8]

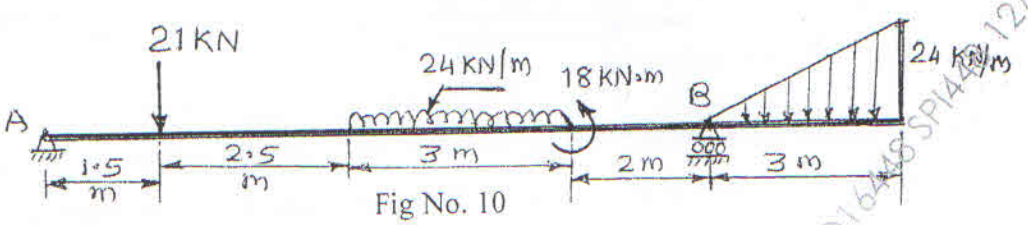


Fig No. 10

(b) A particle is projected with velocity u at an angle of elevation 600 with horizontal. It reaches to the height of 5 m in 2 sec. determine velocity u and the range. [6]

(c) Two wheels are attached to ends of rod AB as shown in figure No.11. Determine angular velocity of rod AB and velocity of end B. [6]

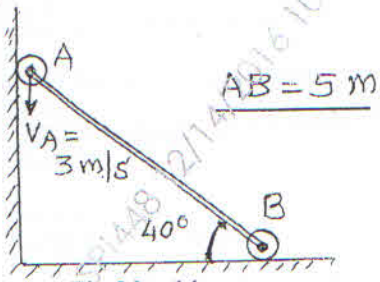


Fig No. 11

Q5. (a) A truss is loaded as shown in the figure No.12. Determine support reactions. State zero force members with reasons and determine forces in members DE, DH and IH by method of section. [8]

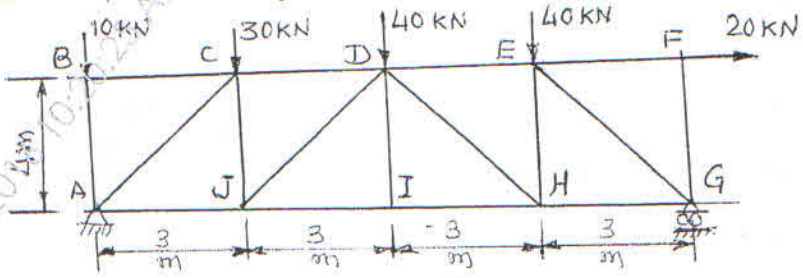


Fig No. 12

[TURN OVER

(b) A roller of diameter 0.8 m rolls without slipping between two parallel plates as shown in figure No.13. Locate ICR and find angular velocity of the wheel. [6]

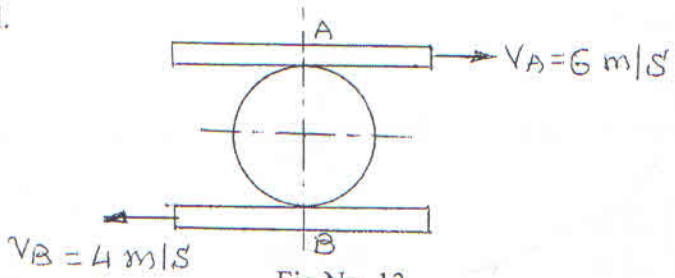


Fig No. 13

(c) Two trains starts from Vadala station at the same time. Train A moves with acceleration 5 m/s2 towards Vashi and train B with acceleration 3 m/s2 towards Bandra. Tracks from Vadala to Vashi and Vadala to Bandra makes 30^0 with each other. Determine velocity of train A with respect to train B after 10 seconds. [6]

Q6 (a) A force of 100 N acts along AB. Coordinates of A and B are (-1, 1, 1) m and (-2, 3 4) m. find moment of force about origin O. [4]

(b) Determine how much weight can be lifted by applying P= 500 N. Weight of block B is 200 N. and that of wedge A is 100 N. (refer fig No. 14). [8]

(c) A particle travels on a circular path whose arc distance travelled is defined by $S = (0.5t^3 + 3t^2)$ m. If total acceleration is 10 m/s^2 at t = 2 sec, find radius of curvature. [4]

(d) Two masses are positioned as shown in fig No. 15. If 5 kg mass is released from rest, find the speed at which 5 kg mass will hit the ground. [4]

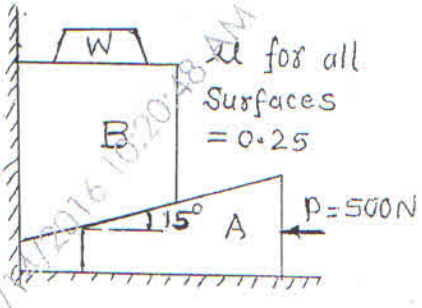


Fig No. 14

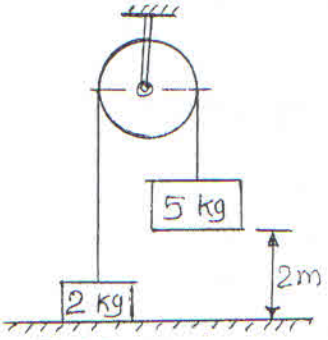


Fig No. 15

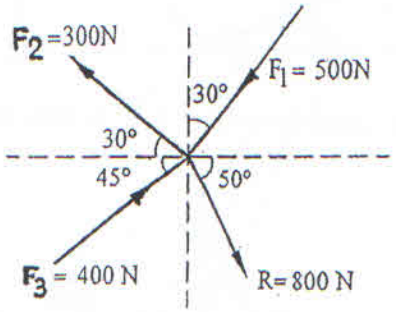
FE Isem - I Choice Based 14/12/16
Engg. mechanics.

Q.P. Code : 803200

(3 Hours) [Total Marks 80]

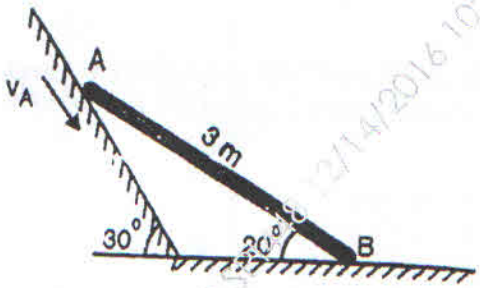
N.B:- (1) Question No.1 is compulsory.
(2) Attempt any 3 questions from remaining five questions.
(3) Assume suitable data if necessary, and mention the same clearly.
(4) Take g = 9.81m/s², unless otherwise specified.

Q-1 a. Find the force F4, so as to give the resultant of the force system shown below. [4]



b. A particle starts from rest from origin and its acceleration is given by, $a = \frac{k}{(x+4)^2}$ m/s². Knowing that V = 4 m/s when x = 8m, find (i) value of k and (ii) Position when V = 4.5m/s. [4]

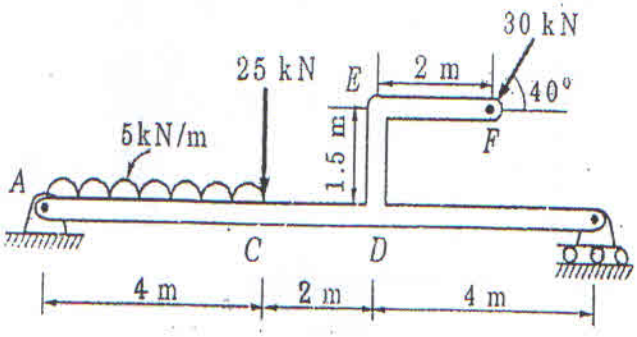
c. Rod AB of length 3m is kept on smooth planes as shown in fig. The velocity of end A is 5m/s along the inclined plane. Locate the ICR and find the velocity of end B. [4]



d. What is Zero force member in a Truss. With examples state the conditions for a zero force member. [4]

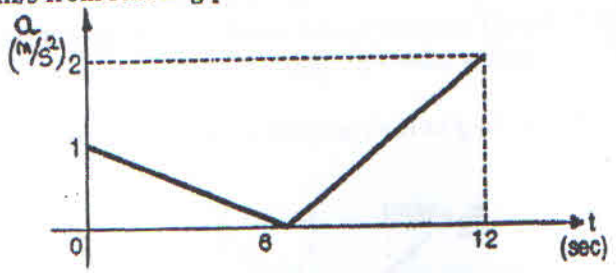
e. A glass ball is dropped onto a smooth horizontal floor from which it bounces to a height of 9m. On the second bounce it rises to a height of 6m. From what height the ball was dropped and what is the coefficient of restitution between the glass and the floor. [4]

Q-2 a. Figure shows a beam AB hinged at A and roller supported at B. The L shaped portion is welded at D to the beam AB. For the loading shown, find the support reactions. [8]

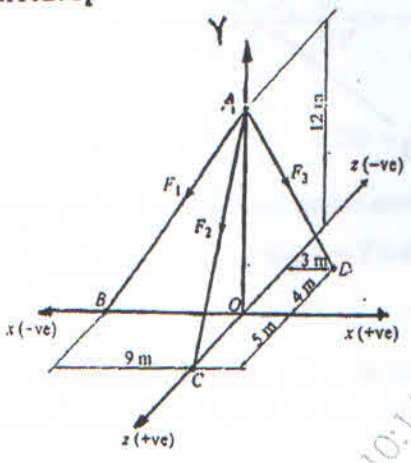


(TURN OVER)

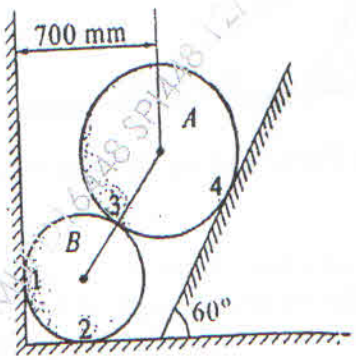
b. The acceleration-time diagram for linear motion is shown. Construct velocity-time diagram and displacement-time diagram for the motion assuming that the motion starts with initial velocity of 5m/s from starting point. [6]



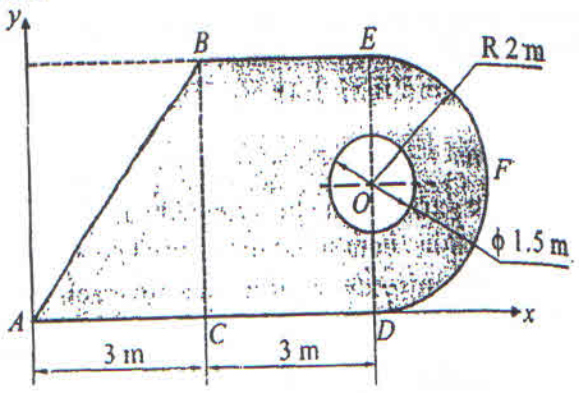
c. The resultant of three concurrent space forces at A is $\overline{R} = (-788j)N$. Find the magnitude of F1, F2 and F3 forces. [6]



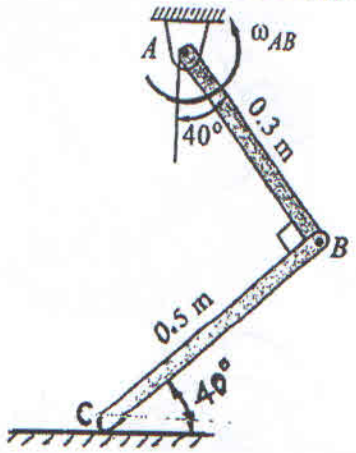
Q-3 a. Two spheres A and B of weight 1000N and 750N respectively are kept as shown in fig. Determine the reactions at all contact points 1, 2, 3 and 4. Radius of A is 400mm and Radius of B is 300mm. [8]



b. A circle of diameter 1.5m is cut from a composite plate. Determine the centroid of the remaining area of the plate. [6]

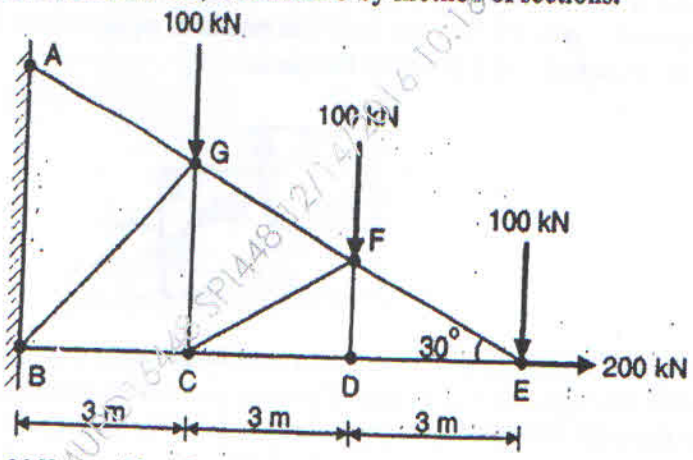


c. A rod AB has an angular velocity of 2 rad/sec, counter clockwise as shown. End C of rod BC is free to move on a horizontal surface. Determine (i) Angular velocity of BC and (ii) Velocity of C [6]

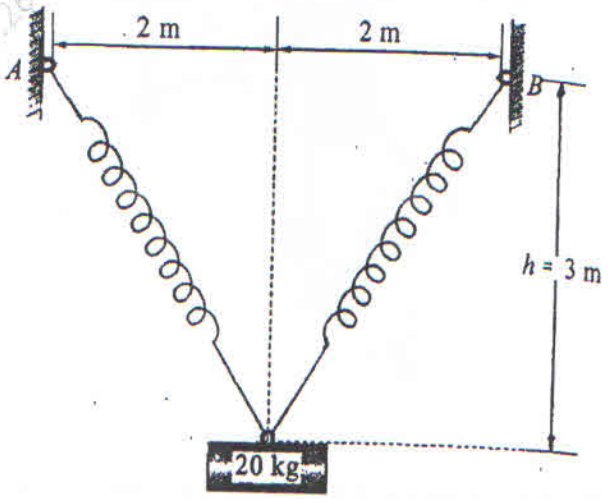


Q-4 a. A truss is loaded and supported as shown. Determine the following: [8]

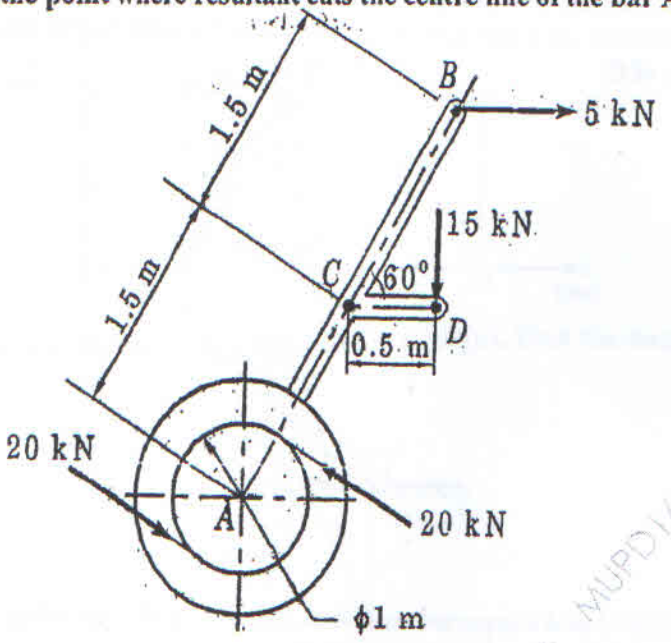
(i) Identify the zero force members if any.
(ii) Find the forces in members EF, ED and FC by method of joints.
(iii) Find the forces in members GF, GC and BC by method of sections.



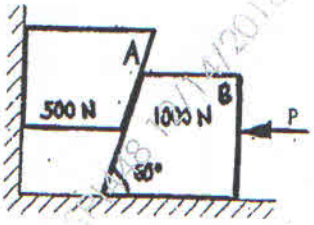
b. A cylinder has a mass of 20kg and is released from rest when h=0 as shown in the figure. Determine its speed when h=3m. The springs each have an unstretched length of 2m. Take k=40N/m. [6]



c. A machine part is subjected to forces as shown. Find the resultant of force in magnitude and direction. Also locate the point where resultant cuts the centre line of the bar AB. [6]

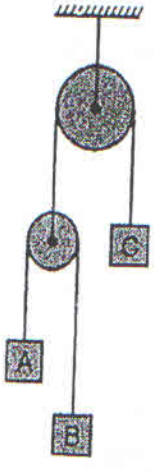


Q-5 a. Two blocks A and B are resting against the wall and floor as shown in the figure. Find minimum value of P that will hold the system in equilibrium. Take μ=0.25 at the floor, μ=0.3 at the wall and μ=0.2 between the blocks. [8]

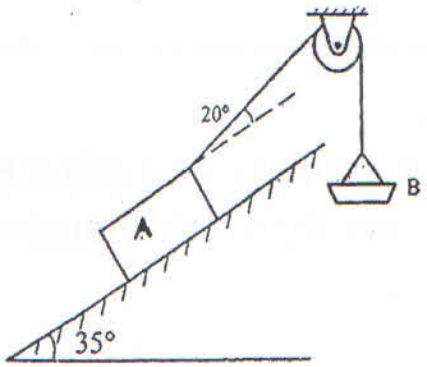


b. A shot is fired with a bullet with an initial velocity of 20m/s from a point 10m infront of a vertical wall 5m high. Find the angle of projection with the horizontal to enable the shot to just clear the wall. Also find the range of shot where the bullet falls on the ground. [6]

c. Three blocks A, B and C of masses 3kg, 2kg and 7kg respectively are connected as shown. Determine the acceleration of A, B and C. Also find the tension in the strings [6]

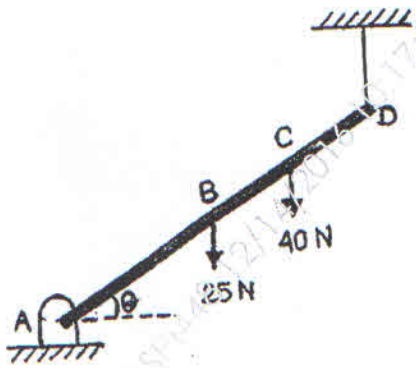


Q-6 a. Block A of weight 2000N is kept on an inclined plane at 35°. It is connected to weight B by an inextensible string passing over smooth pulley. Determine the weight of pan B so that B just moves down. Assume μ=0.2. [5]

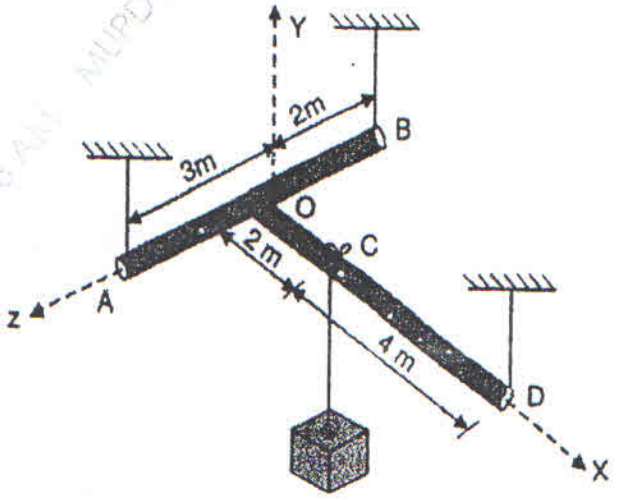


b. A particle falling under gravity travels 25m in a particuiar second. Find the distance travelled by it in next three seconds. [5]

c. A rod AD of length 40cm is suspended from point D as shown in fig. If it has a weight of 25N and also supports a 40N load, find the tension in the cable using the method of virtual work. Take AC=30cm. [5]



d. A T-shaped rod is suspended using three cables as shown. Neglecting the weight of the rods, find the tension in each cable. [5]



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Course: F.E ALL BRANCH

QP Code: 803200

In the diagram of Q 2 (a), the right end of the beam must be labeled as " B " (besides the right side triangle)

Query Update time: 14/12/2016 11:15 AM

Course: F.E ALL BRANCH

QP Code: 803200 (2nd query)

Q 6 (d) In the diagram the weight of the suspended block can be taken as 100N

Query Update time: 14/12/2016 11:30 AM

F.E. (All Branches) CBCGS 07/12/16

Applied Maths-I

TO131

Q.P. Code : 803104

(3 Hours) **[Total Marks : 80**

N.B : (1) Question No.1 is compulsory.
(2) Answer any three questions from remaining.
(3) Assume suitable data if necessary.

1. (a) If $\cos\alpha\cosh\beta = \frac{x}{2}, \sin\alpha\sinh\beta = \frac{y}{2}$, Prove that 03

$$\sec(\alpha - i\beta) + \sec(\alpha + i\beta) = \frac{4x}{x^2 + y^2}$$

(b) If $z = \log(e^x + e^y)$, show that $rt - s^2 = 0$, where 03

$$r = \frac{\partial^2 z}{\partial x^2}, t = \frac{\partial^2 z}{\partial y^2}, s = \frac{\partial^2 z}{\partial x \partial y}$$

(c) If $x = uv, y = \frac{u+v}{u-v}$. Find $\frac{\partial(u,v)}{\partial(x,y)}$. 03

(d) If $y = 2^x \sin^2 x \cos x$ find y_n 03

(e) Express the matrix 04

$$A = \begin{bmatrix} 1 & 0 & 5 & 3 \\ -2 & 1 & 6 & 1 \\ 3 & 2 & 7 & 1 \\ 4 & -4 & 2 & 0 \end{bmatrix}$$

as the sum of symmetric and skew-symmetric matrices.

(f) Evaluate $\lim_{x \to 0} \frac{e^{2x} - (1+x)^2}{x\log(1+x)}$ 04

2. (a) Show that the roots of $x^5 = 1$ can be written as $1, \alpha, \alpha^2, \alpha^3, \alpha^4$. Hence show that $(1-\alpha)(1-\alpha^2)(1-\alpha^3)(1-\alpha^4) = 5$ 06

(b) Reduce the following matrix to its normal form and hence find its rank. 06

$$A = \begin{bmatrix} 3 & -2 & 0 & 1 \\ 0 & 2 & 2 & 7 \\ 1 & -2 & -3 & 2 \\ 0 & 1 & 2 & 1 \end{bmatrix}$$

(c) Solve the following system of equations by Gauss-Seidel Iterative Method upto four iterations. 08

$$4x - 2y - z = 40$$
$$x - 6y + 2z = -28$$
$$x - 2y + 12z = -86$$

TURN OVER

3. (a) Investigate for what values of 'λ' and 'μ' the system of equations 06

$$x + y + z = 6$$
$$x + 2y + 3z = 10$$
$$x + 2y + \lambda z = \mu$$

has (i) no solution
(ii) a unique solution
(iii) an infinite no. of solutions.

(b) If $u = x^2 + y^2 + z^2$, where $x = e^t, y = e^t \sin t, z = e^t \cos t$ 06

Prove that $\frac{du}{dt} = 4e^{2t}$

(c) i) Show that $\sin(e^x - 1) = x + \frac{x^2}{2} - \frac{5x^4}{24} + \ldots\ldots$ 04

ii) Expand $2x^3 + 7x^2 + x - 6$ in powers of $x - 2$ 04

4. (a) If $x = u + v + w, y = uv + vw + uw, z = uvw$ and ϕ is a function of x, y and z. 06

Prove that

$$x\frac{\partial \phi}{\partial x} + 2y\frac{\partial \phi}{\partial y} + 3z\frac{\partial \phi}{\partial z} = u\frac{\partial \phi}{\partial u} + v\frac{\partial \phi}{\partial v} + w\frac{\partial \phi}{\partial w}$$

(b) If $\tan(\theta + i\phi) = \tan\alpha + i\sec\alpha$, 06

Prove that i) $e^{2\phi} = \cot\frac{\alpha}{2}$ ii) $2\theta = n\pi + \frac{\pi}{2} + \alpha$

(c) Find the root of the equation $x^4 + x^3 - 7x^2 - x + 5 = 0$ which lies between 2 and 2.1 correct to three places of decimals using Regula Falsi Method. 08

5. (a) If $y = \left(x + \sqrt{x^2 - 1}\right)^m$, Prove That 06

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

(b) Using the encoding matrix $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$, encode and decode the message 06

I*LOVE*MUMBAI*

(c) i) Considering only principal values separate into real and imaginary parts 04

$i^{\log(1+i)}$

ii) Show that $i\log\left(\frac{x-i}{x+i}\right) = \pi - 2\tan^{-1}x$ 04

F.E. (All Branches) CBCGS 07/12/16

T0131 Applied Maths - I

Q.P. Code : 803104

6. (a) Using De Moivre's theorem prove that 06

$$\cos^6\theta - \sin^6\theta = \frac{1}{16}(\cos 6\theta + 15\cos 2\theta)$$

(b) If $u = \sin^{-1}\left(\dfrac{x^{\frac{1}{3}} + y^{\frac{1}{3}}}{x^{\frac{1}{2}} - y^{\frac{1}{2}}}\right)^{\frac{1}{2}}$, Prove that 06

$$x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = \frac{\tan u}{144}\left(\tan^2 u + 13\right)$$

(c) Discuss the maxima and minima of $f(x,y) = x^3y^2(1-x-y)$ 08

F.E Sem I. App. chem (CBGS). 27/12/2016.

QP Code:529604

(2 Hours) [Total Marks :60

N.B. : (1) Question No.**1** is **compulsory**.
(2) Answer any **three** questions from the remaining five.
(3) All questions carry equal marks.
(4) Atomic Weights: Ca=40, Mg=24, Cl=35.5, S =32, H=1, C=12, O=16, K=39

1. Attempt any **five** from the following:- **15**
   (a) define BOD and COD.
   (b) What are the drawbacks of natural rubber?
   (c) Distinguish between thermoplastic and thermosetting resins.
   (d) Define cloud point and pour point. Discuss its significance.
   (e) What is a condensed system? State the condensed phase equation.
   (f) List the applicaitons of CNT's
   (g) 25 ml of a sewage water sample was refluxed with 10 ml of 0.25 N k_2Cr_2ON solution in presence of dill H_2SO_4, Ag_2SO_4 and $HgSO_4$. The unrea cted dichromate required 5.5 ml of solution, under the same conditions. Calculate the COD of sewage water sample.

2. (a) Calulate the amount of lime (85% pure) and soda (95% pure) required to soften one millon litres of water which contains $MgCO_3$=8.4 ppm, $CaCl_2$ = 22.2 ppm $MgCl_2$ = 9.5 ppm, CO_2 =33 ppm HCl=7.3 ppm, kCl -16.8 ppm. **6**
   (b) State Gibb's phase rule. Give its applicaitons to one component system. **5**
   (c) What are CNTs? Describe the laser method of preparation of CNT. **4**

3. (a) Define lubricant. Discuss the boundary film lubrication mechanism. **6**
   (b) Explain compounding of plastics. (any **five**) **5**
   (c) State the limitations of phase rule. **4**

4. (a) Give the preparation, properties and uses of (any **two**) **6**
      (i) PMMA (b) Buna-s (iii) Kevlar
   (b) With the help of neat and labelled diagram explain zeolite process for softening of water. **5**
   (c) Find the acid value of oil whose 5 ml required 2 ml. of 0.01 N KOH during titration. (density of the oil = 0.92) **4**

5. (a) Explain manufacturing of portland cement (wet process) with a labelled diagram of rotary kiln. **6**
   (b) Explain the injection moulding method with the help of a neat diagram. **5**

[Turn Over

(c) The hardness of 50,000 litres of water sample was removed by passing it through a zeolite softner. Then it required 200 litres of NaCl solution containing 125 g/l of NaCl of regeneration. Calculate the hardness of water sample. **4**

6. (a) Discuss the following treatment methods for municipal water.(any **two**) **6**
   (i) Bleaching powder
   (ii) Ozone
   (iii) Chlorine

(b) Discuss any two of the following:- **5**
   (i) Glass transition temperature
   (ii) Polymers in medicine and surgery
   (iii) Conducting polumers

(c) Write a note on blended oil. **4**

F.E Sem-I (All Bs.). Choice Based.
Applied Chemistry-I
27/12/16.

Q.P. Code : 803400

(2 Hours) **[Total Marks : 60**

N.B. : (1) Question **No.1** is **Compulsory.**
(2) Attempt any **3** questions from remaining.
(3) Figures to the right indicate full marks.
(4) Atomic weight H=1 , C=12, N=14, O=16, Na=23, Mg=24, S=32, Cl=35.5,Ca =40

1. Answer **any five** from the following : **15**
   (a) What is the role of polymers in medicine and surgery ? Explain with the help of any three examples.
   (b) Distinguish between alkaline and non alkaline hardness.
   (c) State the limitations of phase rule.
   (d) What are carbon nanotubes ? Explain different types of carbon nanotubes.
   (e) When would solid lubricants are used ?
   (f) 6 ml of waste water was refluxed with 25 ml of $K_2Cr_2O_7$ solution and after refluxing the excess unreacted dichromate required 20ml of 0.1 N FAS solution . A blank of distilled water on refluxing with 25 ml of $K_2Cr_2O_7$ solution required 35 ml of 0.1N FAS solution. Calculate the COD of waste water sample.

2. (a) Calculate the quantity of pure lime and soda required for softening of 40000 liters of water containing the following impurities **6**
   $Ca(HCO_3)_2$ = 16 ppm , $Mg(HCO_3)_2$ = 7 ppm , $CaSO_4$ =13 ppm , $MgCl_2$= 10 ppm , NaCl = 2 ppm.

   (b) (i) Distinguish between thermoplastics and thermosettings. **3**
   (ii) Define flash and fire points. **2**

   (c) Write the CVD method for preparation of carbon nanotubes. **4**

3. (a) What is meant by fabrication of plastics ? Explain injection moulding with the help of a neat diagram. **6**

   (b) (i) State the condensed phase rule. **3**
   (ii) How is gypsum useful in setting and hardening of cement ? **2**

TURN OVER

(c) The hardness of 85000 liters of water sample was removed by passing it through a zeolite softener. The zeolite required 2000 liters of NaCl solution containing 190 mg/lit of NaCl for regeneration. Calculate the hardness of water sample. 4

4. (a) How is activated sludge process carried out for the treatment of waste water ? Explain with flow sheet diagram. 6

(b) (i) 1.4 gm of oil required 1.8 ml of 0.01 N KOH for neutralization. Calculate the acid value and mention whether the oil is suitable to be used or not. 3

(ii) Write the applications of fullerenes. 2

(c) What are the functions of fillers and plastisizers in the compounding of plastics ? 4

5. (a) Write the preparation, properties and uses of PMMA and Buna-S. 6

(b) (i) What are the advantages of ion exchange process ? 3

(ii) What is oilness ? What is its importance in lubrications ? 2

(c) What is the application of phase rule to one component water system ? Explain with the help of phase diagram. 4

6. (a) Define lubricants and lubrication. Discuss the hydrodynamic lubrication in detail. 6

(b) (i) Define phase, component and degree of freedom. 3

(ii) What are the industrial applications of ultrafiltration ? 2

(c) What is RCC ? Write the advantages of it. 4

F.E. (All Branches) – Sem – I
Choice Based Applied Physics-

30/12/16

QP Code:803504

(2 Hours) [Total Marks : 60

N.B. : (1) Question. **1** is **compulsory.**
(2) Attempt any **three** questions from the remaining questions No. **2** to **6.**
(3) **Assume** suitable **data** wherever required.
(4) **Figures** to the **right** indicate **marks.**

1. Attempt any **five** questions from the following- **15**

(a) What are crystal imperfections? Mention any two significance of it.

(b) Write schrodinger's time dependent and time independent wave equations of matter waves in one dimension and state physical significance of these equations.

(c) Draw the I-V characteristics of a photo-diode. What is meant by dark current?

(d) Define super conductivity and critical temperature. Plot the variation of resistance versus temperature in case of superconducting state of the material.

(e) What is reverberation time? Discuss sabine Formula

(f) State 'magnetostriction effect.' Mention any two applications of ultrasonic waves.

(g) Calculate conductivity of a germanium sample if a donar impurity atoms are added to the extent to one part in 10^6 germenium atoms at room temperature.

Assume that only one electron of each atom takes part in conduction process.

Given: Avogadro's number- 6.023×10^{23} atoms/gm – mole

Atomic weight of Ge=72.6

Mobility of electrons = 3800 cm^2/volts sec.

Density of Ge = 5.32 gm/cm^3

2. (a) Describe with necessary theory the Davisson and Germer experiment establishing wave nature of electrons. calculate the de-broglie wavelength of an aplha particle accelerating thorugh a potential difference of 200 volts **8**
Given- Mass of alpha particle = 6.68×10^{-27}kg.

(b) Define the terms drift current and mobility of a charge carriers. Calculate the current product in a germanium sample of area of cross section 1 cm^2 and thickness of 0.01 m, when a potential difference of 2 V is **7**

applied cross it. Given- The concentration of free electrons in germanium is $2 \times 10^{19}/m^3$ and mobilities of electrons and holes are 0.36 m^2/volts sec and 0.17 m^2/volts sec respectively.

3. (a) Draw and explain the unit cell of sodium chloride (NaCl) crystal. Determine effective number of NaCl molecules per unit cell and co-ordination number. **8**

(b) State applications of Hall effect. In a Hall effect experiment a potential difference of 4.5 μV is developed across a foil of zink of thickness 0.02 mm, when a current of 1.5A is carrying in a direction perpendicular to applied magnetic field of 2 tesla. Calculate **7**

(a) Hall coefficient for zinc

(b) Concentration of electrons

4. (a) Discuss formation of cooper pairs and energy gap in superconductor on the basis of BCS theory. **5**

(b) State any five factors affecting the acoustics of the building and give the remedies for each. **5**

(c) An ultrasonic pulse of 0.09 M Hz sends down towards the sea-bed which returns after 0.55 seconds. The velocity of ultrasonic waves in sea water is 1800 m/sec. Calculate the depth of sea and wavelength of ultrasonic pulse. **5**

5. (a) How does the position of Fermi energy level changes with increasing doping concentration in p-type semi-conductors? sketch the diagram. **5**

(b) Explain analysis of crystal structure using Bragg's X ray spectometer. **5**

(c) Find the minimum energy of neutron confined to a nucleus of size of the order of 10^{-14}m. **5**

Given mass of neutron = 1.675×10^{-27} kg.

6. (a) Calculate the critical radius ratio of an ionic crystal in ligancy -6. What is the maximum size of cation in ligancy-6 configuration, when size of anion is 2.02A^0? **5**

(b) What do you mean by group and phase velocity? Show that the de-Broglie group velocity associated with the wave packet is equal to the velocity of the particle. **5**

(c) Explain the formation of potential barrier across the unbaised p-n junction region. **5**

F.E. (All Branches). 30/12/16.

CBGS

Applied Physics.

QP Code : 529704

(2 Hours) **[Total Marks : 60**

N.B. : (1) Question **No. 1** is **compulsory.**
(2) Attempt **any three** from Q.2 to Q.6
(3) Assume any data wherever required.
(4) Figures to the right indicates marks.

1. Solve any five from the following :- **15**
   (a) Why the X-rays are preferred to study crystalline solids?
   (b) Draw the following. (1 2 3), [1 2 3], (012)
   (c) Write APF values for SC, BCC and FCC.
   (d) Write Fermi-Dirac Distribution function and also mention the meaning of all the terms used over there.
   (e) Explain the concept of Holes in semiconductor.
   (f) Describe Inverse Piezo Electric effect.
   (g) Write three important characteristics of soft magnetic material.

2. (a) Show that for intrinsic semiconductor Fermi level is located at the centre of forbidden energy gap. **8**
   What is the probability of an electron being thermally excited at 27°C for a solid with band gap of 5.6 eV. Take $K = 1.38 \times 10^{-23}$ J/K
   (b) Find the following for Diamond cubic crystal stucture (i) Atomic radius (ii) Number of atoms per unit cell (iii) Volume of unit cell. Hence determine its APF. **7**

3. (a) State and derive Bragg's law of X -ray diffraction. Calculate the galncing angle of rock salt having d=1.407 Å. Consider first order diffraction and wavelength of x-ray as 1.541Å. **8**
   (b) A metal ring having cross sectional area $5cm^2$ and diameter 20 cm has a coil of 200 turns wound over it. Determine the curent required to produce flux of 2 milliweber when (i) No airgap (ii) Air gap of 1mm. **7**
   In both the cases consider relative permeability of metal as 380.

4. (a) Draw the diagram representing molecular arrangement of different phases for liquid crystal. State any two aplications of liquid crystal. **5**
   (b) Mention different types of polarizability in dielectric. Explain electronic polarizability. **5**
   (c) The resistivity of intrinsic semiconductor is $2 \times 10^{-4}\ \Omega$.cm. If the mobility of electron is $6m^2$/V-sec, and that of hole is $0.2m^2$/V-sec, Calculate its intrinsic carrier density. **5**

[TURN OVER]

5.	(a)	Explain with neat diagram construction and function of solar cell.	5
	(b)	The volume of a room is $600m^3$. The wall area of the room is $220m^2$. The floor and ceiling area is same and is gien as $120m^2$. The average sound absorption coefficient for wal is 0.03, for Ceiling is 0.8 and for floor is 0.06. Calculate the average sound absorption coefficent and the reverberation time.	5
	(c)	Derive critical radious ration for ligancy 6.	5
6.	(a)	Explain Magnetostriction Oscillator to produce Ultrasonic waves.	5
	(b)	Explain the formation of barrier potential in pn junction.	5
	(c)	Explain Ohm's law for magnetic circuit. Also write two points as its comparision with Ohm's law for electrical circuit.	5

F.E - SEM-I (All Branch) Choice Based 02/01/17

- Environmental Studies (EVS) **Q.P. Code : 803601**

(2 Hours) **[Total Marks : 60**

N.B. : (1) Question No.**1** is **compulsory**.
(2) **Attempt** any **three** question from **Q.2** to **Q.6**.
(3) Draw **neat labelled** diagram wherever **applicable**.
(4) Figure to **right** indicate **full** marks.

1. Attempt **any five** from following :- **15**

a) What is sustainable development? Why there is need for sustainable development?
b) Differentiate between : Renewable and Non-renewable sources of energy.
c) What are the causes and effects of E-pollution ?
d) Write important functions of Central Pollution Control Board (CPCB).
e) Explain concept of Carbon Credit.
f) What is Nuclear pollution? What are its sources and effects?
g) What is Ecological Sucession?

2. a) Explain Social and Economic aspects of sustainable development. **5**
b) Draw a neat labelled diagram of Electrostatic Precipitator and explain how it is useful to control gaseous particulate emissions? **5**
c) What is Hydropower? Draw a suitable diagram and explain how hydropower is generated. **5**

3. a) What is solid waste? Explain solid waste management by incineration. **5**
b) Write important functions and powers of State Pollution Control Board. **5**
c) Write a case study on Cloudburst and Landslides at Kedarnath in June 2013. **5**

4. a) Explain global environmental crisis pertaining to population. **5**
b) Explain environmental consent and authorization mechanism. **5**
c) Draw a neat diagram of wind turbine and explain how it helps in energy production. **5**

[TURN OVER]

5. a) Explain how resource utilization as per carrying capacity is an important control measure for sustainable development. 5
   b) Write a case study on pollution of Ganga River. 5
   c) Draw a schematic and explain principle and working of photovoltaic cells. 5

6. a) Explain the causes and effects of depletion of natural water resources. 5
   b) Write a note on industrial waste water treatment. 5
   c) What is Disaster Management? Explain how techniques of disaster management are implemented in the event of earthquake. 5
