F.E. Sem-I - (CBSGS) - Applied Mathematics - I - Nov-16

QP CODE : 529302

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

Note: i) Q.No 1 is compulsory

ii) Attempt any three from remaining.

iii) 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 = cos$\emptyset$ + i sin$\emptyset$, 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

Sem-I (CBSGS)/ Applied Physics-I/ Nov-16

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 (CBSGS) NOV / DEC '16

APPLIED CHEMISTRY

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. **4**
Calculate the hardness of water sample.

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**

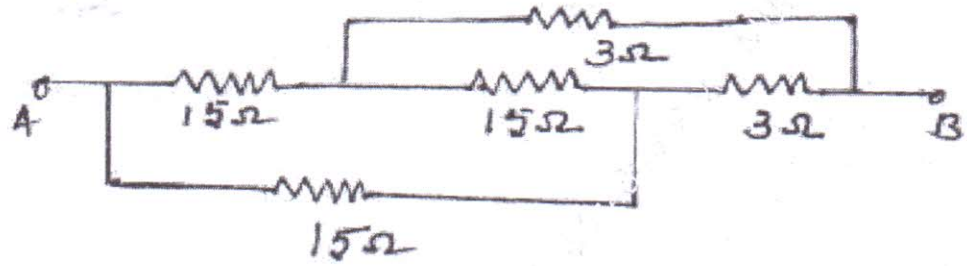
Sem-I- (CBSGS)- Basic Electrical & Electronics Engg. Nov-16.

Q.P. Code : 529500

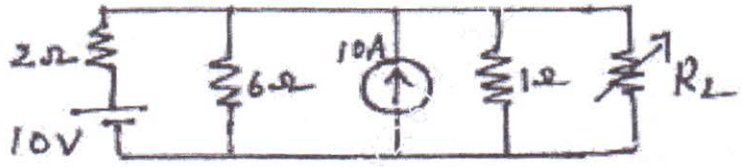
(3 Hours) **[Total Marks : 80**

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

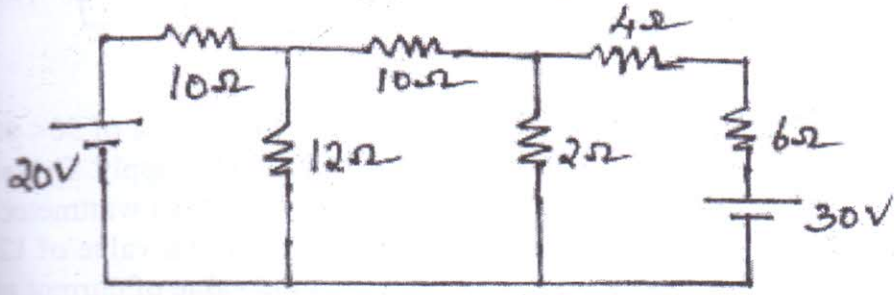
d) Draw resonance graph and write any four conditions of series resonance. 3

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



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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

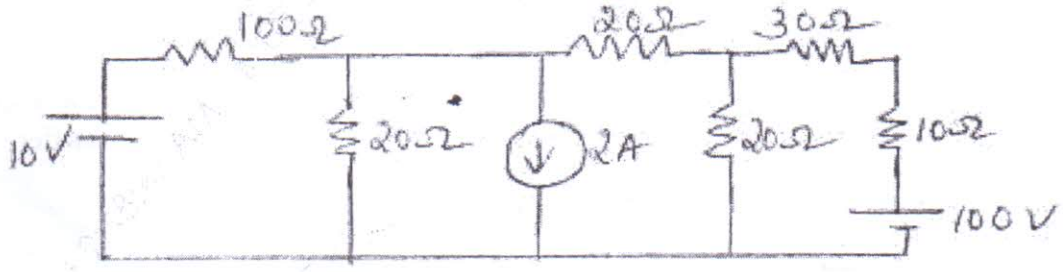
3. a) In a delta connected load each phase consists of a resistance of 100 Ω in series with a capacitor of capacitance 31.8 μF. When it is connected to a 400 V , three phase 50 Hz supply calculate 8
i) the line current ii) Power factor iii) The power absorbed and iv) total kVA

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

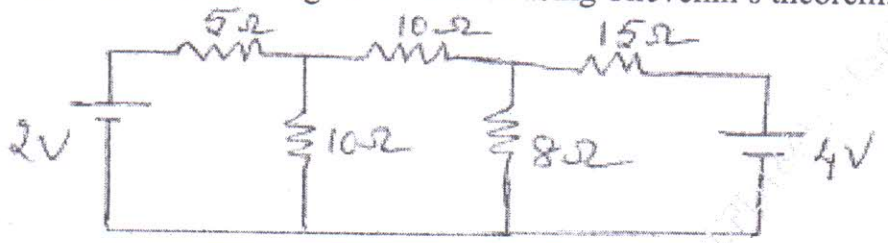


b) A balanced three phase star connected load has an impedance of 50< 60 Ω each phase connected across a three phase 1100 V, 50 Hz supply. Two watt meters are used to measure power. Find the reading of each wattmeter. 4

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

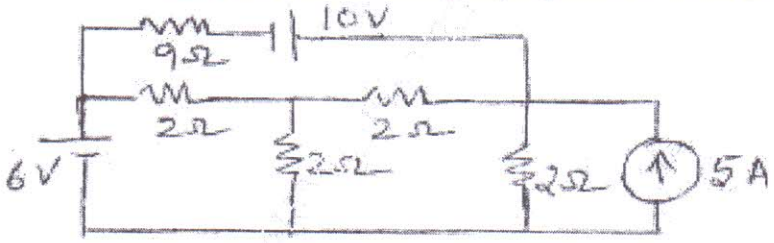
5. a) Calculate the current through 5 Ω resistor using Thevenin's theorem. 8



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

E. Sem - I - (CBSGS) - Engineering Mechanics - Dec. 2016.

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]

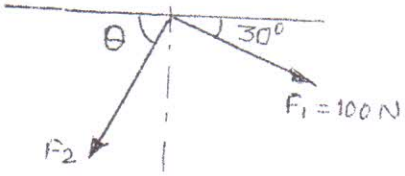


Fig No. 1

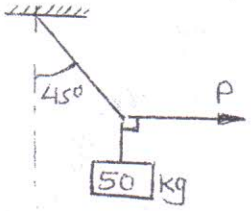


Fig No. 2

(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]

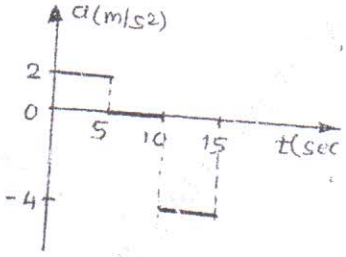


Fig No. 3

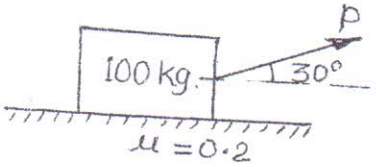


Fig No. 4

(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]

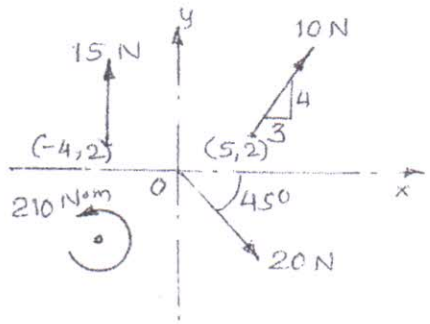


Fig No. 5

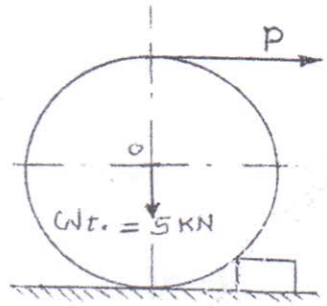


Fig No. 6

(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]

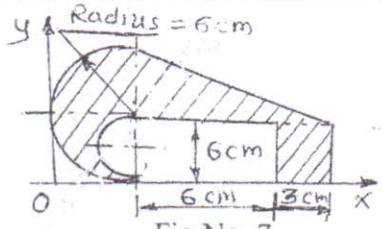


Fig No. 7

(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]

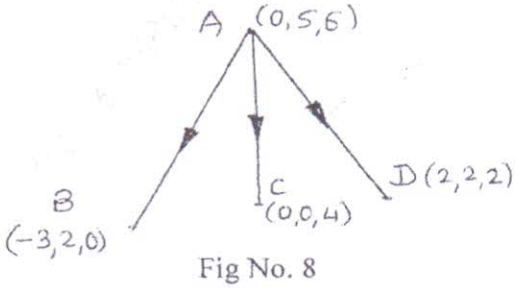


Fig No. 8

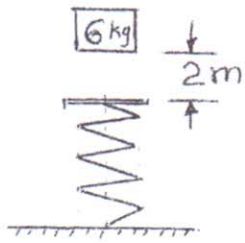


Fig No. 9

(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]

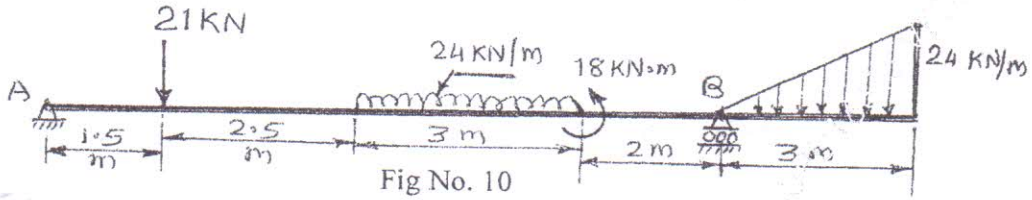


Fig No. 10

(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]

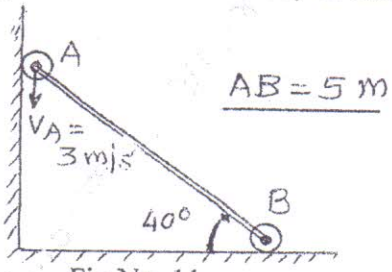


Fig No. 11

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]

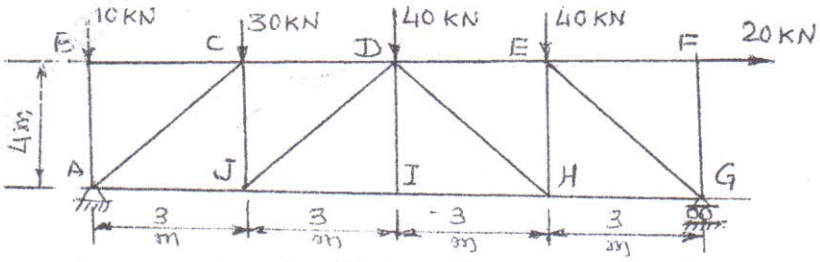


Fig No. 12

(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]

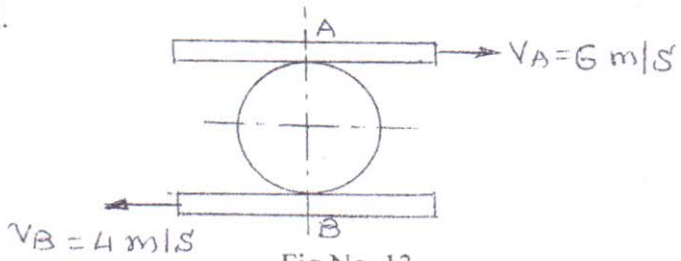


Fig No. 13

(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]

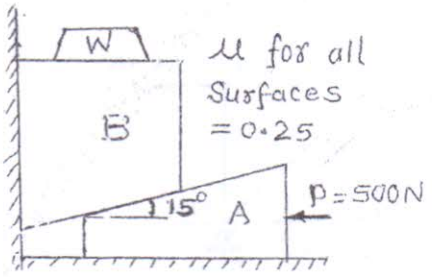


Fig No. 14

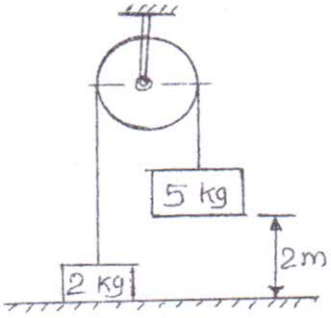


Fig No. 15

F.E. / Sem I (CBSGS) / E.V.S. Nov/Dec '16

QP Code : 529803

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

N.B. : (1) Question no. **1** is **compulsory**
(2) Attempt **any three** questions from the **Q. 2 to Q. 6.**
(3) Draw **neat diagrams wherever necessary.**
(4) **Figures** to the **right indicate** full **marks.**

1. Attempt **any five** questions from following :- **15**
   (a) Explain the role of Ministry of Environment and Forest' (MoE & F) towards conservation of environment.
   (b) What are the causes and effects of photochemical smog?
   (c) Which are the renewable sources of energy? Why there is growing emphasis given on renewable energy sources?
   (d) Explain briefly the concept of Green Buildings.
   (e) What are the environmental aspects of sustainable development?
   (f) What is Food Web? Explain giving suitable example.
   (g) Explain the causes and effects of E-pollution.

2. (a) Explain the importance of 3R -principle as a control measure for sustainable development. **5**
   (b) What is solid waste? Explain solid waste management by composting. **5**
   (c) Draw a suitable diagram and explain how solar energy can be harnessed using photovoltaic cells. **5**

3. (a) What causes Global Warming? What are its adverse effects? **5**
   (b) Explain important powers and functions of Central Pollution Control Board (CPCB). **5**
   (c) Which are the Indoor Air Pollutants? What effects are produced on account of them? **5**

4. (a) Why there is global environmental crisis pertaining to water? **5**
   (b) Explain important features of environmental clearance and authorization mechanism. **5**
   (c) Draw a suitable diagram of flat plate collector and explain its working. **5**

5. (a) Explain how environmental education is an important measure for sustainable development. **5**

[TURN OVER]

(b) What are the causes and effects of Noise Pollution? 5

(c) Draw a neat sketch of a wind -mill and explain its role in generation of energy. 5

6. (a) What are Carbon Credits? Explain with suitable example. 5

(b) What are the reasons and effects of depletion of natural forest resources. 5

(c) Draw a neat diagram of Bag House Filter and explain its working. 5
