

DECEMBER-2019
EXAMINATION TIME TABLE
PROGRAMME - F.E.(Sem I)
(ALL BRANCHES) (CBSGS)

| Days and Dates | Time | Paper Code | Paper |
|------------------------------|--------------------------|------------|---|
| Friday, November 15, 2019 | 10:30 a.m. to 01.30 p.m. | 58501 | Applied Mathematics – I. |
| Tuesday, November 19, 2019 | 10:30 a.m. to 01.30 p.m. | 58502 | Engineering Mechanics. |
| Thursday, November 21, 2019 | 10:30 a.m. to 01.30 p.m. | 58503 | Basic Electrical & Electronics Engineering. |
| Monday, November 25, 2019 | 10:30 a.m. to 12.30 p.m. | 58504 | Applied Chemistry – I. |
| Wednesday, November 27, 2019 | 10:30 a.m. to 12.30 p.m. | 58505 | Applied Physics – I. |
| Friday, November 29, 2019 | 10:30 a.m. to 12.30 p.m. | 58506 | Environmental Studies (EVS). |

[Time: 3 Hours]

[Marks:80]

Please check whether you have got the right question paper.

- N.B: 1. Question 1 is compulsory.
2. Attempt any three questions from Q.2 to Q.6.

Q1 (a) Prove $\cosh^5 x = \cosh 5x + 5 \cosh 3x + 10 \cosh x$ (3)

(b) If $u = \log(\tan x + \tanh y)$
Prove $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} = 2$ (3)

(c) If $u = \frac{yz}{x}$, $v = \frac{zx}{y}$, $w = \frac{xy}{z}$ Show that $\frac{\partial(u,v,w)}{\partial(x,y,z)} = 4$ (3)

(d) Express the following matrix as sum of symmetric and skew symmetric matrix. (3)

$$A = \begin{pmatrix} 2 & 2+i & 3 \\ -2+i & 0 & 4i \\ -i & 3-i & 1-i \end{pmatrix}$$

(e) Show that $\log(1 + \sin x) = x - \frac{x^2}{2} + \frac{x^3}{6}$ (4)

(f) If $y = \frac{x^2}{(x-1)(x-2)}$ Find y_n (4)

Q2 (a) Solve the Equation $x^4 - x^3 + x^2 - x + 1 = 0$ (6)

(b) Reduce the following Matrix to the Normal form and hence find the rank of the matrix (6)

$$A = \begin{pmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{pmatrix}$$

(c) If $u = \frac{x^2 y^2 z^2}{x^2 + y^2 + z^2} + \cos^{-1} \left(\frac{xy + yz}{\sqrt{x^2 + y^2 + z^2}} \right)$ (8)

Find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$

Q3 (a) (a) Investigate for what values of λ and μ the system of equations $x+2y+3z= 4$, $x+3y+4z = 5$, $x+3y+\lambda z = \mu$. (6)
 have 1) unique solution, 2) Infinite solutions, 3) No solution

(b) Find the Extreme values of $f(x,y)= xy+ a^3(\frac{1}{x} + \frac{1}{y})$ (6)

(c) Separate into real and imaginary parts of $\tan^{-1}(e^{i\theta})$ (8)

Q4 (a) If $u^2 + xv^2 = x + y$, $v^2 + yu^2 = x - y$ Find $\frac{\partial u}{\partial x} \frac{\partial v}{\partial y}$ (6)

(b) If $\log \cos(x+iy)= a+ib$ Prove $2e^{2a} = \cosh 2y + \cos 2x$ (6)

(c) Solve the following Equations by Gauss Seidel method Up to four iterations. (8)

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

Q5 (a) Using De Moivre's theorem Prove (6)
 $\cos^7 \theta = \frac{1}{2^6} (\cos 7\theta + 7 \cos 5\theta + 21 \cos 3\theta + 35 \cos \theta)$

(b) Evaluate $\lim_{x \rightarrow 0} (\frac{1}{x^2} - \cot^2 x)$ (6)

(c) If $y = \sin(m \sin^{-1} x)$ Prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$ (8)
 And hence find $y_3(0)$.

Q6 (a) (a) Show the following vectors are linearly dependent and find the relation between them. (6)
 $[2, -1, 3, 2], [1, 3, 4, 2], [3, -5, 2, 2]$.

(b) If $z=f(x,y)$ where $x = u \cosh v$, $y = u \sinh v$ Prove (6)
 $(\frac{\partial z}{\partial x})^2 - (\frac{\partial z}{\partial y})^2 = (\frac{\partial z}{\partial u})^2 - \frac{1}{u^2} (\frac{\partial z}{\partial v})^2$

(c) Fit the curve of the form $y= ab^x$ to the following data. (8)

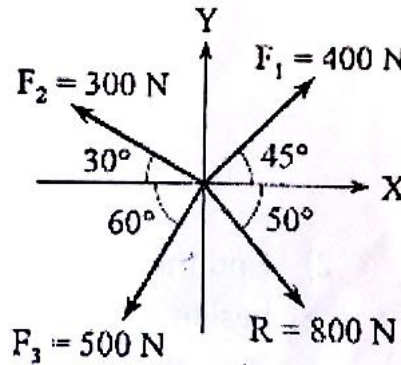
| | | | | | |
|---|-----|-------|-------|-------|-------|
| x | 2 | 3 | 4 | 5 | 6 |
| y | 144 | 172.8 | 207.4 | 248.8 | 298.5 |

(3 Hours)

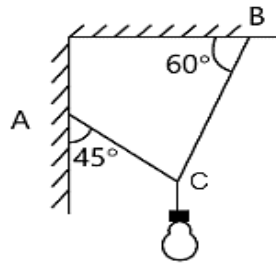
(Total Marks : 80)

- N.B.:**
1. Question No. 1 is compulsory.
 2. Attempt any 3 more questions from remaining five.
 3. Assume suitable data if necessary, and mention the same clearly.
 4. Figures to the right indicate full mark.
 5. Take $g = 9.81 \text{ m/s}^2$.

1. a) Forces F_1, F_2, F_3 and F_4 are acting on a particles. Find the force F_4 so as to give the resultant of system of concurrent forces $R = 800 \text{ N}$ as shown in figure. [4]

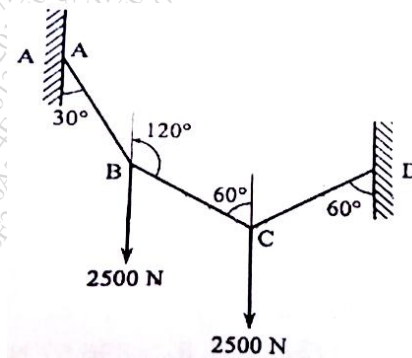


- b) A light fixture weighing 24 N is hung by a string as shown in figure. Determine the tensions in AC and BC of the string. [4]



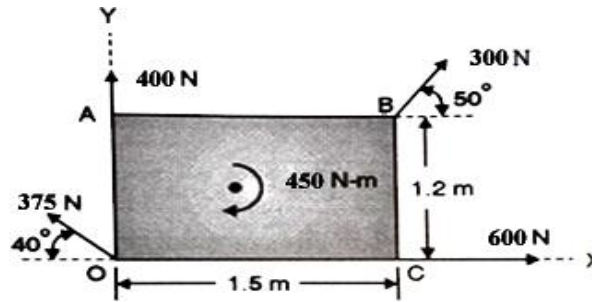
- c) State various laws of friction. [4]
- d) The motion of a particle is defined by the relation $v = 4t^2 - 3t - 1$ where v is in m/s and t is in sec . If the displacement $x = -4 \text{ m}$ at $t = 0$, determine the displacement and acceleration at $t = 3 \text{ sec}$. [4]
- e) A car travelling at a speed of 60 m/s is braked and comes to rest in 10 seconds after the brakes are applied. Find the minimum coefficient of friction between the wheels and the road. [4]

2. a) Two equal loads of 2500 N are supported by the flexible string ABCD at point B and C. Find the tension in the portion AB, BC and CD of the string. [8]



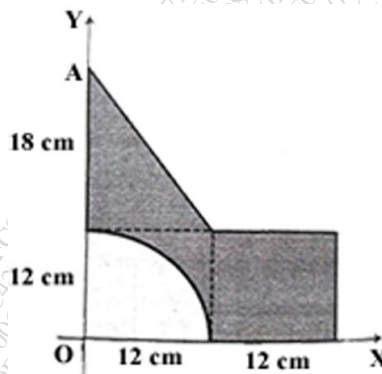
- b) Find the resultant of the force system on a body OABC as shown in figure. Also find the

points where the resultant will cut the X and Y axis. [6]

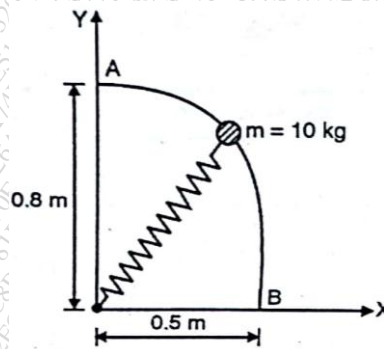


c) If a ball is thrown vertically down with a velocity of 10m/s from a height of 3m. Find the maximum height it can reach after hitting the floor, if the coefficient of restitution is 0.7. [6]

3. a) Determine the Centroid of the shaded area. [8]

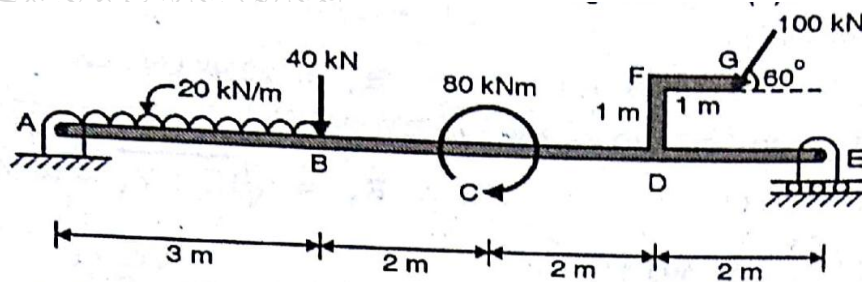


b) The 10kg mass slides from rest at A along the frictionless rod. Determine the speed at B. Stiffness of the spring $K = 80 \text{ N/m}$. Unstretched length of spring is 0.3 m. [6]



c) A force $\mathbf{F} = 80\mathbf{i} + 50\mathbf{j} - 60\mathbf{k}$ passes through a point A (6,2,6). Compute its moment about origin. [6]

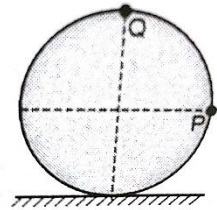
4. a) Find support reactions at A and E for the beam loaded as shown in fig. [8]



b) An aero plane flying horizontally with a velocity of 100m/s releases a packet which lands to the ground after 8 seconds. Find the velocity with which the packet lands. [6]

Also find the height from which it was released.

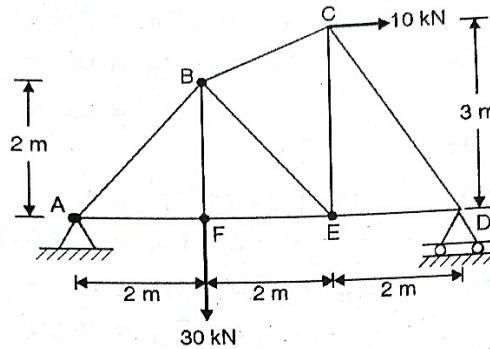
- c) A wheel of radius 0.75m rolls without slipping on a horizontal stationary surface to the right. Determine the velocities of the points P and Q when the velocity of centre of the wheel is 25 m/s to the right.



[6]

5. a) For the truss shown in Fig, determine :

- Forces in members AB, BF and EF by method of sections only.
- Forces in all other members by method of joints.



[3]

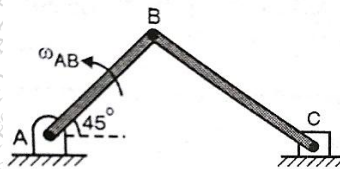
[5]

- b) A motorcycle starts from rest and accelerates at 2m/s^2 till velocity reaches 10m/s . Then it accelerates at 1m/s^2 till velocity reaches 15m/s and continues at uniform velocity of 15m/s till it covers a total distance of 300m . Find the total time taken to cover this distance. Draw the v-t and x-t graph for this motion.

[6]

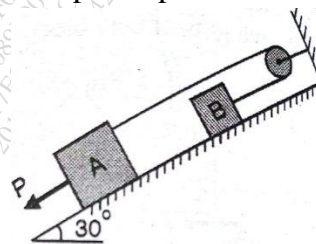
- c) In the slider crank mechanism shown in fig, the crank AB of length 10 cm rotates anti-clockwise with an angular velocity of 6 rad/sec . The connecting rod BC is 45 cm in length and the slider at C is constrained to move along a horizontal line. At the instant shown, find the angular velocity of rod BC and velocity of slider at C.

[6]



6. a) Determine the force P to cause motion to impend. Take masses of blocks A and B as 8kg and 4kg respectively. Coefficient of static friction between sliding surfaces is 0.2 . Assume smooth pulley. The force P and the rope are parallel to the inclined plane.

[8]

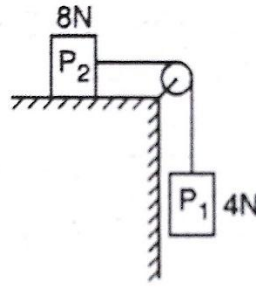


- Explain conditions for equilibrium for different system of forces in space.
- A car starts from rest and moves along a circular path having a radius of 25m . Its speed increases at a uniform rate of 0.5 m/s^2 . Find the time from the start and distance travelled

[4]

when its resultant acceleration becomes 1.5 m/s^2 . [4]

d) Blocks $P_1 = 4\text{N}$ and $P_2 = 8\text{N}$ are connected by inextensible string. Find acceleration of the blocks. The coefficient of kinetic friction is 0.15 , pulley is frictionless. [4]



TOTAL MARKS: 80

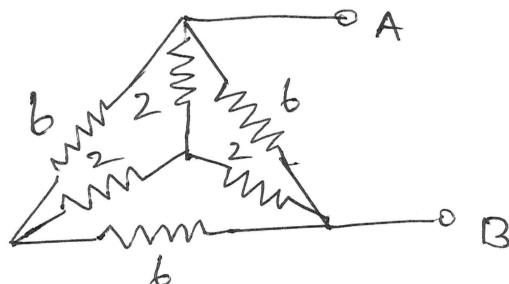
TIME: 3hrs

NB

- 1) Question No. 1 is compulsory.
- 2) Answer any three questions out of remaining five questions.
- 3) Assumption made should be clearly stated.
- 4) Answer to questions should be grouped together and written together.

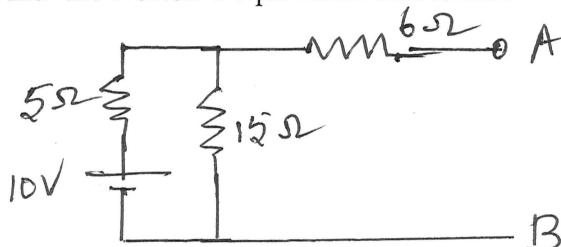
Q1 a. Find R_{AB}

3



b. Find the Norton's equivalent across AB.

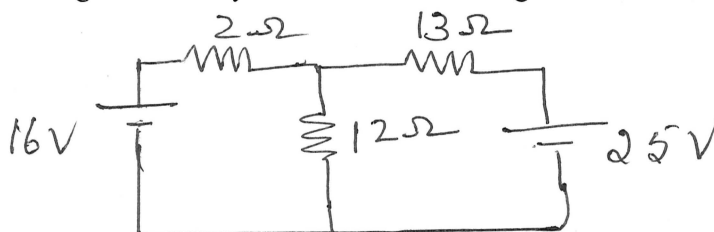
3



- c. A pure inductor of 0.2 H is connected across single phase 200 V , 50 Hz supply. Write the instantaneous equation of voltage and current. 3
- d. Write any four conditions of series resonance. 3
- e. What is the phase line relation in star connected system? 2
- f. Explain the working of a single phase transformer under load 4
- g. Illustrate the working of half wave rectifier. 2

Q2 a. Using Mesh analysis find current through 2Ω resistor.

6



- b. The impedances $(8+6)\Omega$ and $(10-j10)\Omega$ are connected in parallel across voltage of $230\angle 0$. Determine current in each branch and kVA, kVAR, kW and power factor of the whole circuit. 8

[TURN OVER

c. Derive emf equation of a single phase transformer 6

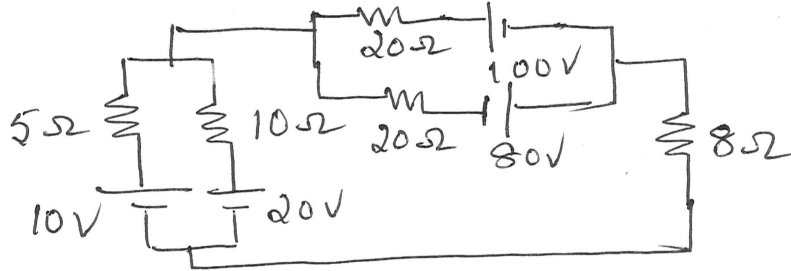
Q3 a. Calculate the phase and line currents in a balanced delta connected load taking 75 kW at a power factor of 0.8 lag from a three phase 440 V supply. Also calculate the per phase impedance. 8

b. Illustrate with neat circuit diagram the procedure for conducting open circuit test and short circuit test. 6

c. Illustrate with neat diagram and explain the input characteristics of an NPN transistor in CE configuration. 4

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

Q4 a. Find current through 8 Ω resistor using source transformation. 7

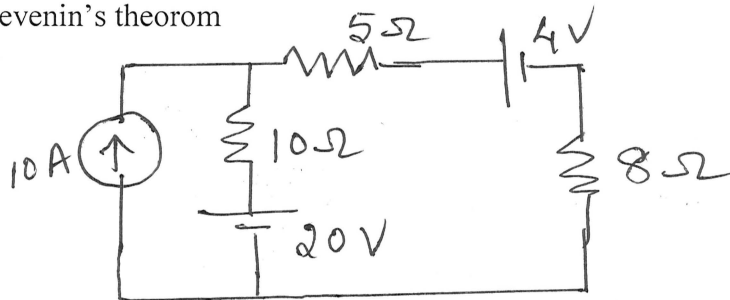


b. Three identical coils each having a resistance of 10 Ω and an inductive reactance of 10 Ω are connected in star across 400 V three phase supply. Find the reading on each of the watt meters connected to measure the power 4

c. Define the rms value of an ac quantity. 5

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

Q5 a. Determine the current through 8 Ω resistor in the network using Thevenin's theorem 8



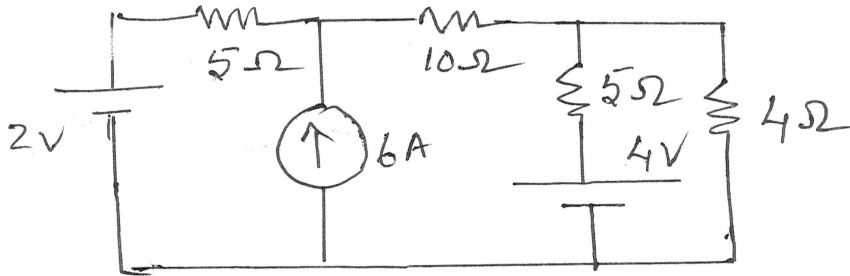
b. An rms voltage of $100\angle 0$ is applied to an impedance $Z = 20\angle 30$. Find the current through the circuit and power factor of the circuit. 4

c. Derive the conditions for maximum efficiency of a single phase transformer. 8

[TURN OVER

Q6 a. Find current through $4\ \Omega$ resistor using superposition theorem.

7



- b. A series R-L-C circuit with $R=10\ \Omega$, $L=0.014\ \text{H}$ and $C=10\ \mu\text{F}$ is connected across 230V variable frequency supply. Calculate a) resonance frequency b) current at resonance c) Q-factor d) voltage across inductor and capacitor and e) power factor at resonance. 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 - CBSGS - 25/11/2019

(2 Hours)

(Total Marks : 60)

Please check whether you have got the right question paper.

- N.B.:**
- 1) Question No. 1 is compulsory.
 - 2) Answer any three questions from remaining five questions.
 - 3) Figures to the right indicate full marks.
 - 4) Atomic weight :

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

1. Attempt any five from the following : (15)

- a) Give the preparation, properties and uses of PMMA.
- b) Why COD is greater than BOD?
- c) Define Viscosity Index and give its significance in lubrication.
- d) Find out degree of freedom for the following equation :
 - i) $\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO}_{(s)} + \text{CO}_{2(g)}$
 - ii) $\text{NH}_4\text{Cl}_{(s)} \rightleftharpoons \text{NH}_{3(g)} + \text{HCl}_{(g)}$
- e) Write a note on concrete.
- f) Define fabrication. Draw labelled diagram for injection moulding.
- g) Calculate temporary and permanent hardness of water sample containing following impurities; $\text{CaSO}_4 = 13.6\text{ppm}$, $\text{MgCl}_2 = 9.5\text{ppm}$, $\text{MgSO}_4 = 6.0\text{ppm}$, $\text{CaCl}_2 = 11.1\text{ppm}$.

2. a) A water sample on analysis gave the following data : (06)

$\text{MgSO}_4 = 8.4\text{ppm}$, $\text{Mg}(\text{HCO}_3)_2 = 173.4$, $\text{CO}_2 = 300\text{ppm}$, $\text{MgCl}_2 = 95\text{ppm}$,
 $\text{Mg}(\text{NO}_3)_2 = 26.9\text{ppm}$. Calculate the lime (80% pure) and soda (85% pure)
requirement in Kg for softening of 30,000 liters of water.

b) What is reduced phase rule? Explain two-component lead- silver system with neat and labeled phase diagram. (05)

c) Write a short note on laser method used in manufacturing of CNT. (04)

3. a) Define Lubricant. Explain thin film lubrication in detail. (06)

b) What is vulcanization? How it help to remove drawback of natural rubber? (05)

c) Define triple point. Explain with example. (04)

4. a) Explain the role of each constituent in compounding of plastics. (06)
b) Explain following : (05)
 i) Chlorine treatment method for municipal water
 ii) Reverse osmosis.
c) 20 ml of lubricating oil required 2.5 ml of 0.1N KOH for titration. Calculate acid value of a lubricating oil. (Density of oil = 0.81 gm/ml). From acid value state whether the oil is useful for lubrication or not. (04)
5. a) Define Portland cement. Name the raw materials and give composition of Portland cement. (06)
b) Write a note on conducting polymer. (05)
c) An zeolite softener was completely exhausted and was regenerated by passing 8 liters of NaCl solution having strength 150g/L. If hardness of water is 170 ppm, then calculate total volume that can be softened by zeolite softener. (04)
6. a) What is Activated sludge process? Explain activated sludge process in detail. (06)
b) Give preparation and uses of Kevlar and Urea formaldehyde resin. (05)
c) Explain following properties of lubricant with their significance (any two) : (04)
 i) Oiliness
 ii) Saponification Value
 iii) Cloud point and Pour point.

Time: 2 Hours

Marks: 60

- N:B**
1. Question No.1 is compulsory.
 2. Attempt any **Three** questions from the remaining questions Nos.2 to 6.
 3. Assume suitable data wherever required.
 4. Figures to the right indicate marks.
- Q.1** Attempt **Any Five**
- a) Define the following terms 1) Space lattice 2) Unit cell 3) lattice point **03**
 - b) Distinguish between insulators, conductors and semi-conductors in terms of their energy bands. **03**
 - c) What are liquid crystals? List the various types of liquid crystals. **03**
 - d) What are polar and non-polar dielectrics? **03**
 - e) Define relative permeability and susceptibility. Write the relation between them. **03**
 - f) A classroom has dimensions $20 \times 15 \times 5 \text{ m}^3$, the reverberation time is 3.5sec. Calculate the total absorption of its surfaces and the average absorption coefficient. **03**
 - g) What are ultrasonic waves? State the direct piezoelectric effect. **03**
- Q.2**
- a) Show that Fermi level in intrinsic semiconductor lies at the centre of the forbidden band. $E_F = E_C + E_V/2$ **08**
 - b) Draw the following: (i) (2 3 1) (ii) [2 0 1] (iii) $(\bar{1} \ 2 \ \bar{1})$ Calculate the packing efficiency for Body centered cubic cell? **07**
- Q.3**
- a) Explain various stages of hysteresis and give the significance of hysteresis **08**
 - b) Deduce the Bragg's law for the diffraction of X- rays in crystals. **07**
- Q.4**
- a) For a cubic structure in a crystal, derive an expression for interplanar spacing between the planes with miller indices (hkl) **05**
 - b) What is potential barrier? How is it formed in a p-n junction? **05**
 - c) Derive Clausius –Masotti relation for non-polar dielectrics. **05**
- Q.5**
- a) Copper has F.C.C. structure and the atomic radius is 1.28 \AA . Calculate its density. (At wt = 63.54, $N_A = 6.023 \times 10^{23}$) **05**
 - b) A copper strip 2cm wide and 1mm thick is placed in a magnetic field with $B=1.5 \text{ Wb/m}^2$. If current of 200 A is set up in the strip, calculate Hall voltage that appears across the trip. Given $R_H = 6 \times 10^{-7} \text{ m}^3/\text{C}$. **05**
 - c) Explain in detail the conditions necessary for good acoustical design of an auditorium **05**
- Q.6**
- a) What are real crystals? Differentiate between Frenkel and Schottky defect **05**
 - b) Define the terms: i) mobility ii) conductivity. Find the resistivity of intrinsic germanium at 300K. Given the density of carriers as $2.5 \times 10^{19} / \text{m}^3$, $\mu_e = 0.39 \text{ m}^2/\text{V-sec}$ and $\mu_h = 0.19 \text{ m}^2 / \text{V-sec}$. **05**
 - c) Find the natural frequency of vibration of quartz plate of thickness 1.8mm. Given Young's modulus for quartz is $8 \times 10^{10} \text{ N/m}^2$, Density of quartz is 2650 kg/m^3 . **05**

[2 Hours]

[Total Marks: 60]

Please check whether you have got the right question paper.

- N.B:**
1. Question no. 1 is compulsory.
 2. Answer any three from remaining Q.2 to Q.6.
 3. Draw neat labelled diagrams where applicable.
 4. Figures to the right indicate full marks.

- Q1.** Attempt any five questions from the following:- [15]
- (a) Explain the concept of 'food web'
 - (b) Briefly explain the importance of environmental education for sustainable development.
 - (c) Explain the role of MoE&F (ministry of environment and forest) towards conservation of environment.
 - (d) Draw a labeled diagram of wind turbine and explain only its working principles.
 - (e) Explain the term 'Carbon credit'
 - (f) What is photochemical smog and what are its effects.
 - (g) What are the causes and effects of noise pollution?
- Q2.**
- (a) What are the economic and environmental aspects of sustainable development? [5]
 - (b) What is global warming? How does it affects us adversely? [5]
 - (c) Draw a rough schematic of photovoltaic cell and explain its role in energy generation. [5]
- Q3.**
- (a) Draw a neat diagram of bag house filter and explain its working. [5]
 - (b) Briefly explain important features of environmental clearance and authorization mechanism. [5]
 - (c) How disaster management is important in the event of earthquake. [5]
- Q4.**
- (a) What are the causes and impact of depletion of natural forest resources? [5]
 - (b) Write a note on environmental protection act. [5]
 - (c) Explain how hydropower is generated with suitable diagram. [5]
- Q5.**
- (a) What is the relevance of appropriate technology for sustainable development? [5]
 - (b) Differentiate between: conventional and non-conventional energy sources. [5]
 - (c) Write a brief note on: E- pollution. [5]
- Q6.**
- (a) What are the global environmental problems due to population? [5]
 - (b) Explain briefly how composting is carried out. [5]
 - (c) Explain how technology is useful for better human health and environment. [5]
