FE/Sem-I (CGS) 29/5/13

A.P. I

P4-RT-Exam.-Feb.-13-3-137

Con. 6874-13. **(REVISED COURSE)** **GS-5193**

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

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

1. Attempt any **five** (Each carry equal weightage) :- **15**

(a) Draw unit cells showing position of the atoms for –
(i) a monoatomic BCC Crystal
(ii) a monoatomic SC Crystal
(iii) CsCl Crystal.

(b) Fermi level in K is 2.1 ev. What are the energies for which the probabilities of occupancy at 300 K are 0·99 and 0·01.

(c) Draw the energy band diagram of an unbiased p-n junction and mark the barrier potential and depletion region.

(d) Write the relation between polarization and dielectric susceptibility and the relation between dielectric susceptibility and dielectric constant.

(e) Why soft magnetic material are used in core of transformers.

(f) Calculate the change in intensity level when the intensity of sound increases 1000 times its original intensity.

(g) Explain cavitation effect.

2. (a) Derive an expression for Fermi level for an intrinsic semiconductor. ~~(1+1+1+1)~~ 04

Draw the energy level diagram only, to show the effect of
(i) temperature (ii) impurity atom concentration in low range and (iii) impurity atom concentration in high range. (1+1+1+1)

(b) An elemental crystal has a density of 8570 kg/m^3 packing fraction is 0·68. Determine **7**

the mass of one atom if the nearest neighbour distance is 2·86 $\mathring{A}$.

3. (a) Prove that in a ferromagnetic material, power loss per unit volume in a hysteresis cycle is equal to the area under hysteresis loop. **(4 + 4)**
An iron ring of mean circumferential length 30 cm and cross sectional area 1 cm^2 is wound uniformly with 300 turns of a wire. When a current of 0·032 Amp flows in it, the flux produced in the ring is 2×10^{-6} wb. Find the flux density, magnetic field intensity and permeability of iron.

(b) Derive Bragg's law. Explain why x rays and not γ-ray are used for crystal structure analysis. What data about the crystal structure can be obtained from the x-ray diffraction pattern of a crystal. **(4 + 2+1)**

[TURN OVER

4. (a) Find out the critical radius ratio of an ionic crystal in ligancy 6 configuration. What is the maximum size of cation in ligancy 6 configuration when the radius of anion is 2·02 $\mathring{A}$. **5**

   (b) In an n type semiconductor the Fermi level lies 0·4 ev below the conduction band. If the concentration of donor atom is doubled, find the new position of the Fermi level w.r.t. the conduction band. **5**

   (c) Explain the origin of electronic, ionic and orientational polarization and temperature dependence of respective polarizability. **5**

5. (a) Find out the intercepts made by the planes. (1 0 1) and (4 1 4) in a cubic unit cell. Draw [$\bar{1}$ 2 1) and [1 2 4] in a cubic unit cell. **5**

   (b) A bar of n type Ge of size 0·010m × 0·001m × 0·001m is mounted in a Magnetic field of 2 x 10^{-1}T. The electron density in the bar is 7 × $10^{21}/m^3$. If one millivolt is applied across the long ends of the bar, determine the current through the bar and the voltage between Hall electrodes placed across the short dimensions of the bar. Assume μ_e = 0·39 m^2/vs. **5**

   (c) Define reverberation time. Write Sabine's formula explaining every term. What are the factors which determine the average absorption co-efficient of a material. **5**

6. (a) Explain the differences between three different liquid crystal phases w.r.t. the order in the arrangement of molecules, with the help of diagram. Which property of the liquid crystal is used for display. **5**

   (b) How a p-n junction diode is used to generate a potential difference in a photovoltaic solar cell. **5**

   (c) What is piezoelectric effect. Explain the working of a piezoelectric oscillator used to produce ultrasonic wave. **5**

F.E Sem I Rev (CGS) 11/5/2013

Applied maths - I

D : PH (April Exam) 181

Con. 6865-13. **(REVISED COURSE)** **GS-5103**

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

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from Question Nos. **2** to Questions No. **6**
(3) **Figures** to the **right** indicate **full** marks.

1. (a) If $\cos hx = \sec \theta$ prove that $x = \log (\sec \theta + \tan \theta)$. **3**

(b) If $u = \log (x^2 + y^2)$, prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ **3**

(c) If $x = r \cos \theta$, $y = r \sin \theta$. Find $\frac{\partial(x, y)}{\partial(r, \theta)}$. **3**

(d) Expand $\log (1 + x + x^2 + x^3)$ in powers of x upto x^8. **3**

(e) Show that every square matrix can be uniquelly expressed as sum of a symmetric and a Skew-symmetric matrix. **4**

(f) Find n^{th} order derivative of **4**
$y = \cos x. \cos 2x. \cos 3x.$

2. (a) Solve the equation $x^6 - i = 0$. **6**

(b) Reduce matrix A to normal form and find its rank where :– **6**

$$A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$

(c) State and prove Euler's theorem for a homogeneous function in two variables and **8**
hence find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ where $u = \frac{\sqrt{x} + \sqrt{y}}{x + y}$

3. (a) Determine the values of λ so that the equations $x + y + z = 1$; $x + 2y + 4z = \lambda$; **6**
$x + 4y + 10z = \lambda^2$ have a solution and solve them completely in each case.

(b) Find the stationary values of **6**
$x^3 + y^3 - 3axy$, $a > 0$.

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

[TURN OVER

4. (a) If $x = u \cos v, \quad y = u \sin v$ **6**

Prove that $\frac{\partial(x, y)}{\partial(u, v)} \cdot \frac{\partial(u, v)}{\partial(x, y)} = 1$.

(b) If $\tan [\log (x + iy)] = a + ib$, prove that $\tan [\log (x^2 + y^2)] = \frac{2a}{(1 - a^2 - b^2)}$ where **6**

$a^2 + b^2 \neq 1$.

(c) Using Gauss-Siedel iteration method, solve **8**

$10x_1 + x_2 + x_3 = 12$

$2x_1 + 10x_2 + x_3 = 13$

$2x_1 + 2x_2 + 10x_3 = 14$

upto three iterations.

5. (a) Expand $\sin^7 \theta$ in a series of sines of multiples of θ. **6**

(b) Evaluate $\lim_{x \to 0} \frac{(x^x - x)}{(x - 1 - \log x)}$ **6**

(c) If $y^{1/m} + y^{-1/m} = 2x$, prove that **8**

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

6. (a) Examine the following vectors for linear dependence/Independence. **6**

$X_1 = (a, b, c), \; X_2 = (b, c, a), \; X_3 = (c, a, b)$ where $a + b + c \neq 0$.

(b) If $z = f(x, y), \quad x = e^u + e^{-v}, \; y = e^{-u} - e^v$, prove that **6**

$$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \frac{\partial z}{\partial x} - y \frac{\partial z}{\partial y}$$

(c) Fit a straight line to the following data and estimate the production in the year 1957. **8**

Year :	1951	1961	1971	1981	1991
Production in the Thousand tons :	10	12	08	10	13

FE|sem-I (R) 18|5|13
BEE

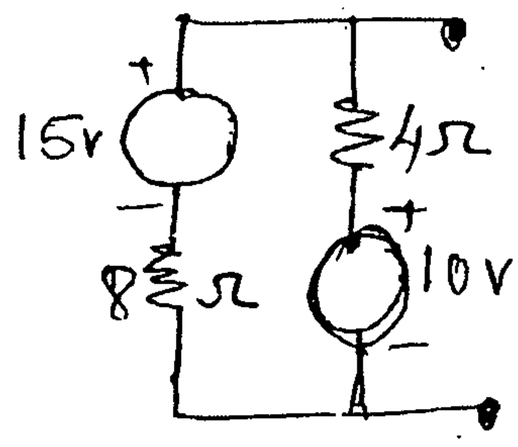
P3–upq–Feb.–13KL–108 A4 E

Con. 6889–13. **(REVISED COURSE)** **GS–5139**

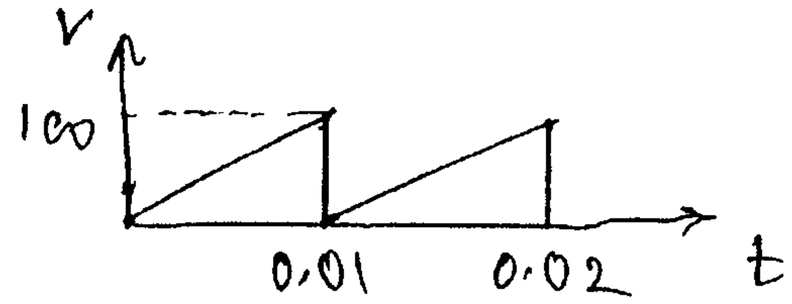
(3 Hours) **[Total Marks : 80**

N.B. :(1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions out of **remaining**.
(3) Assume **suitable** data if **necessary**.

1. (a) Using source transformation convert the circuit given below to a single voltage source in series with a resistor. **3**

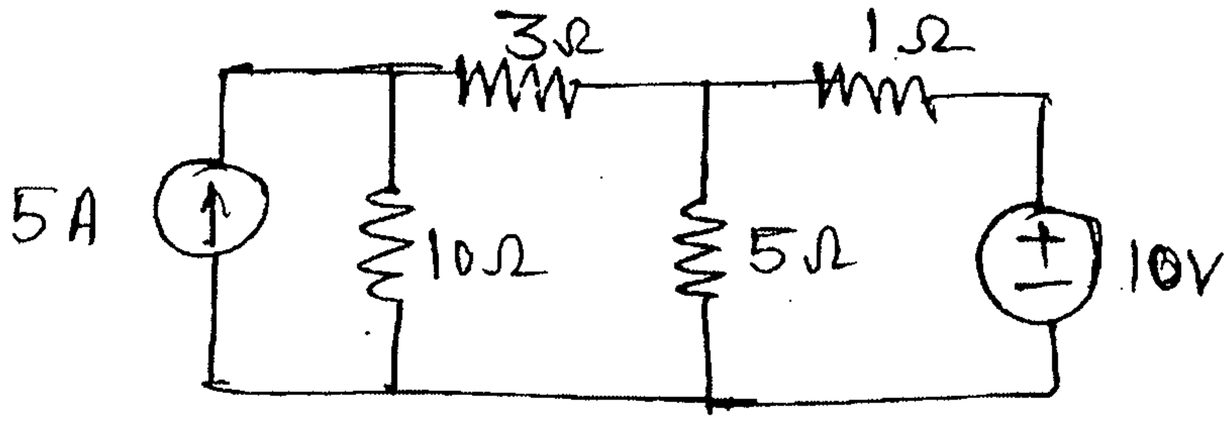


(b) Derive the condition for maximum power transfer through the network. **3**
(c) Determine the rms value of voltage wareform shown below :— **3**



(d) Give the comparison between series and parallel resonance circuits. **3**
(e) Draw the phasor diagram of 3–phase star connected load with lagging power factor. **2**
(f) State the working principle of Transformer and derive expression for emf induced. **4**
(g) Define Ripple factor and Voltage Regulation for rectifier circuits. **2**

2. (a) For the network given below find current through 3Ω resistor using nodal analysis. **6**



[TURN OVER

(b) Two coils A and B are connected in series across 240V, 50H_z supply. The resistance of A is 5Ω and inductance of B is 0·015H. If the input from supply is 3kW and 2 kVAR. Find inductance of A and resistance of B. Calculate voltage across each coil. **8**

(c) A 3000/200-V, 50 Hz, single phase transformer has a cross-sectional area of 150 cm^2 for the core. If number of turns on the low voltage winding is 80, determine number of turns on the high voltage winding and maximum value of flux density in the core. **6**

3. (a) Each phase of a delta connected load consist of a 50 mH inductor in series with a parallel combination of 5Ω resistor and a 5μF capacitor. The load is connected to a three phase, 550V, 50Hz ac supply. **8**
Find (i) Phase current, (ii) Line current (iii) Power drawn (iv) power factor, (v) Reactive power and kVA rating of the load.

(b) A 5 kVA, 1000/200V, 50 Hz, single phase transformer gives following test results— **6**

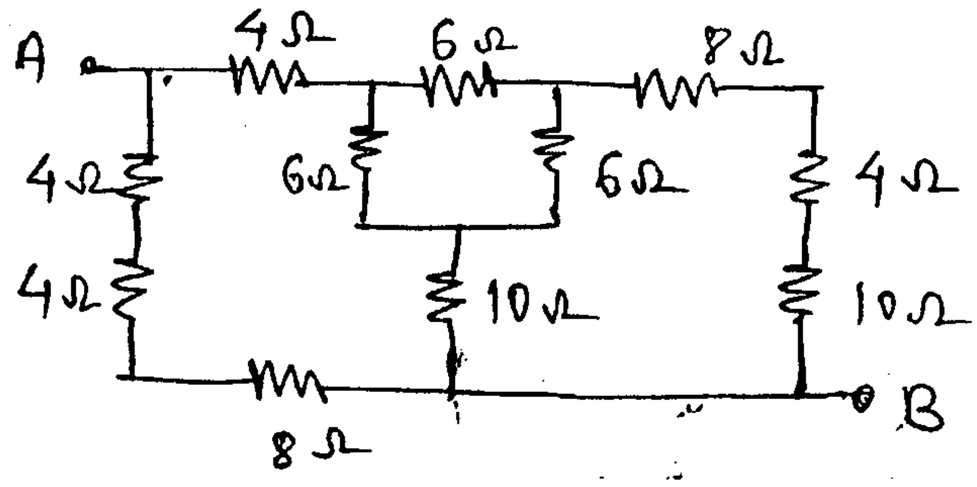
OC test (LV side)	200V	1·2 A	90 W
SC test (HV side)	50V	5 A	110 W

Determine efficiency as half load at 0·8 p.f. lagging.

(c) What is the function of filter in rectifier circuits. Explain with appropriate waveforms. **2**

(d) Draw and explain output characteristics of transistor in CE configuration. **4**

4. (a) For the circuit shown below find the resistance between terminals A and B. **7**



(b) The voltage drops across four series connected impedances are given :— **5**

$$V_1 = 60 \sin\left(wt + \frac{\pi}{6}\right),\ V_2 = 75 \sin\left(wt - \frac{5\pi}{6}\right)$$

$$V_3 = 100 \cos\left(wt + \frac{\pi}{4}\right),\ V_4 = V_{4m} \sin\left(wt + \phi_4\right)$$

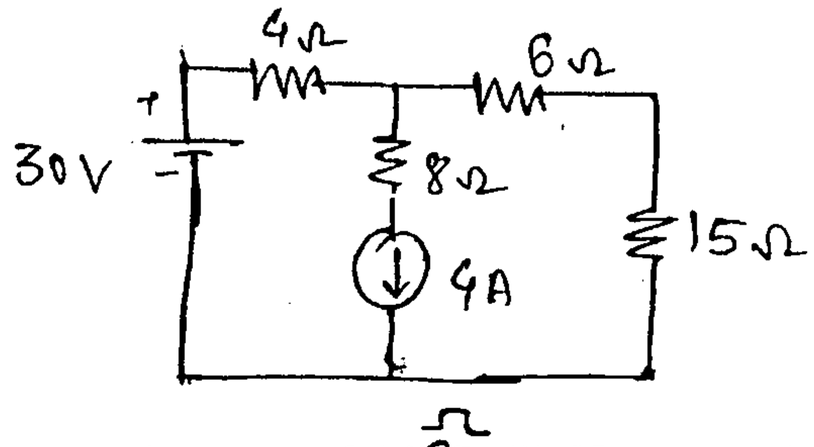
Calculate the values of V_{4m} and ϕ_4 if the voltage applied across series circuit is

$$140 \sin\left(wt + \frac{3\pi}{5}\right)$$

(c) Draw the circuit for measurement of 3–phase power using two wattmeters and state its advantages over other methods of 3-phase power measurement. **4**

(d) Draw and explain Half wave rectifier with appropriate waveforms. **4**

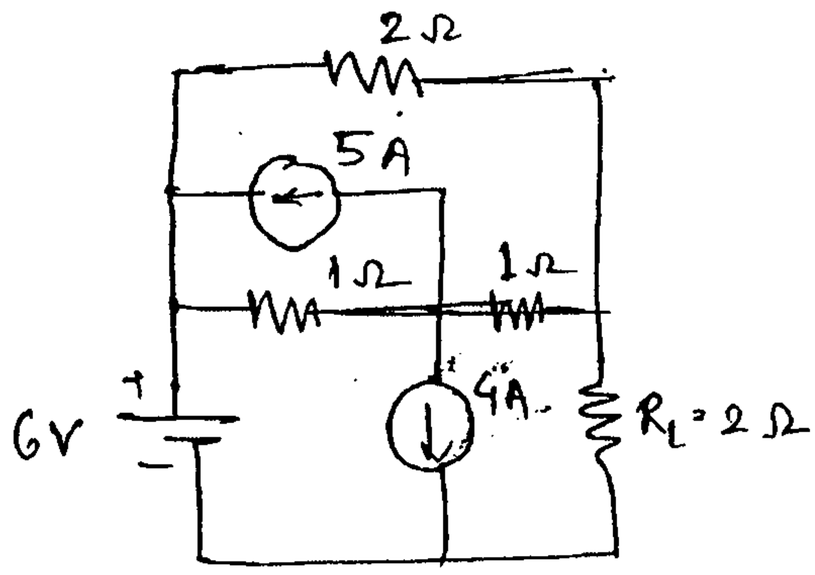
5. (a) Using Norton's theorem, calculate the current flowing through 15Ω load resistor in the given circuit. **8**



(b) A 46 mH inductive coil has a resistance of 10Ω. (i) How much current will it draw if connected across a 100V, 60Hz supply ? (ii) What is the power factor of the coil ? (iii) Determine the value of capacitance that must be connected across the coil to make the power factor of overall circuit units. **4**

(c) A 30kVA, 2400/120V, 50Hz transformer has a high voltage winding resistance of 0·1Ω and a leakage reactance of 0·22Ω. The low voltage winding resistance is 0·035Ω and the leakage reactance is 0·042Ω. Calculate the equivalent winding resistance, reactance and impedance referred to (i) high voltage side (ii) low voltage side and (iii) total copper loss of the transformer. **8**

6. (a) Determine current through $R_L = 2\Omega$ in the circuit shown below using superposition theorem. **7**



(b) An inductor having a resistance of 25Ω and Q_0 of 10 at a resonant frequency of 10kHz is fed from 100 $\angle 0°$ supply. Calculate (i) Value of series capacitance required to produce resonance with the coil. (ii) The inductance of the coil (iii) Q_0 using L/C Ratio (iv) Voltage across capacitor (v) Voltage across coil. **7**

(c) The input power of 3-phase motor was measured by two wattmeter method. The reading of two wattmeters are 5·2kW and –1·7kW and the line voltage is 415V. Calculate the total Active power, Power factor and Line current. **6**

FE - Sem I (CBSGS) Engg. Mech. - I

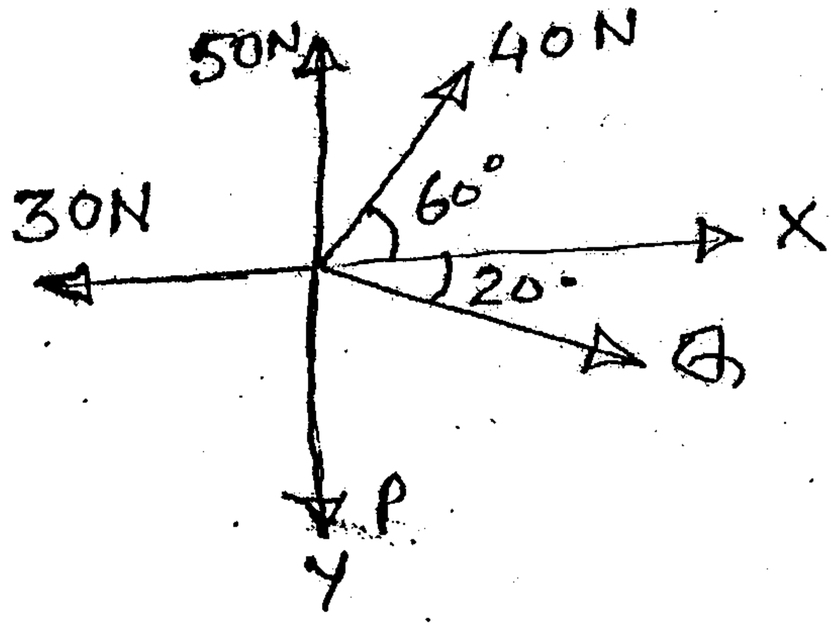
Con. 8797-13. GS-5157

(REVISED COURSE)

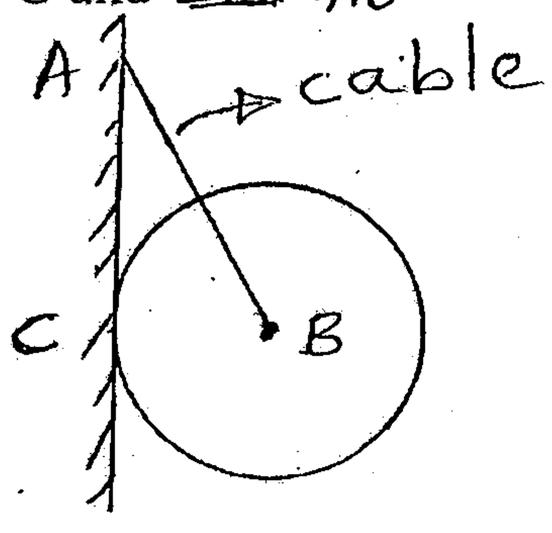
(3 Hours) [Total Marks : ~~100~~ 80

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **three** questions from remaining **five** questions.
(3) Assume suitable **data if required**.

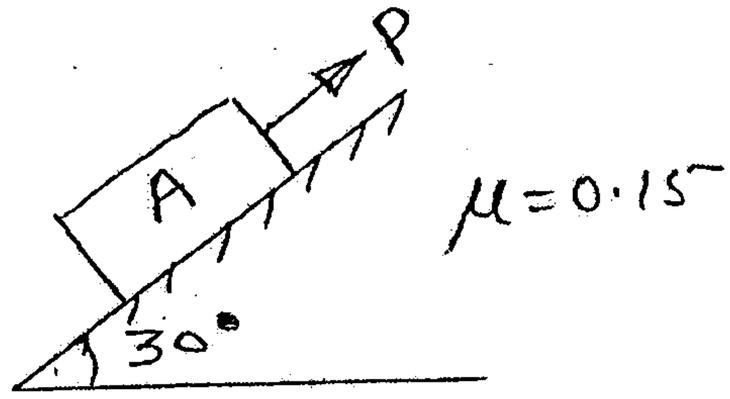
1. (a) Find forces P and Q such that resultant of given system is zero. 4



(b) A cylinder B, W_B = 1000 N, dia. 40 cm, hangs by a cable AB = 40 cm rests against a smooth wall. 4
Find out reaction at C and ~~TAB~~ T_{AB}.



(c) A block of weight 1000 N is kept on a rough inclined surface. Find out range of P for which the block will be in equilibrium. 4

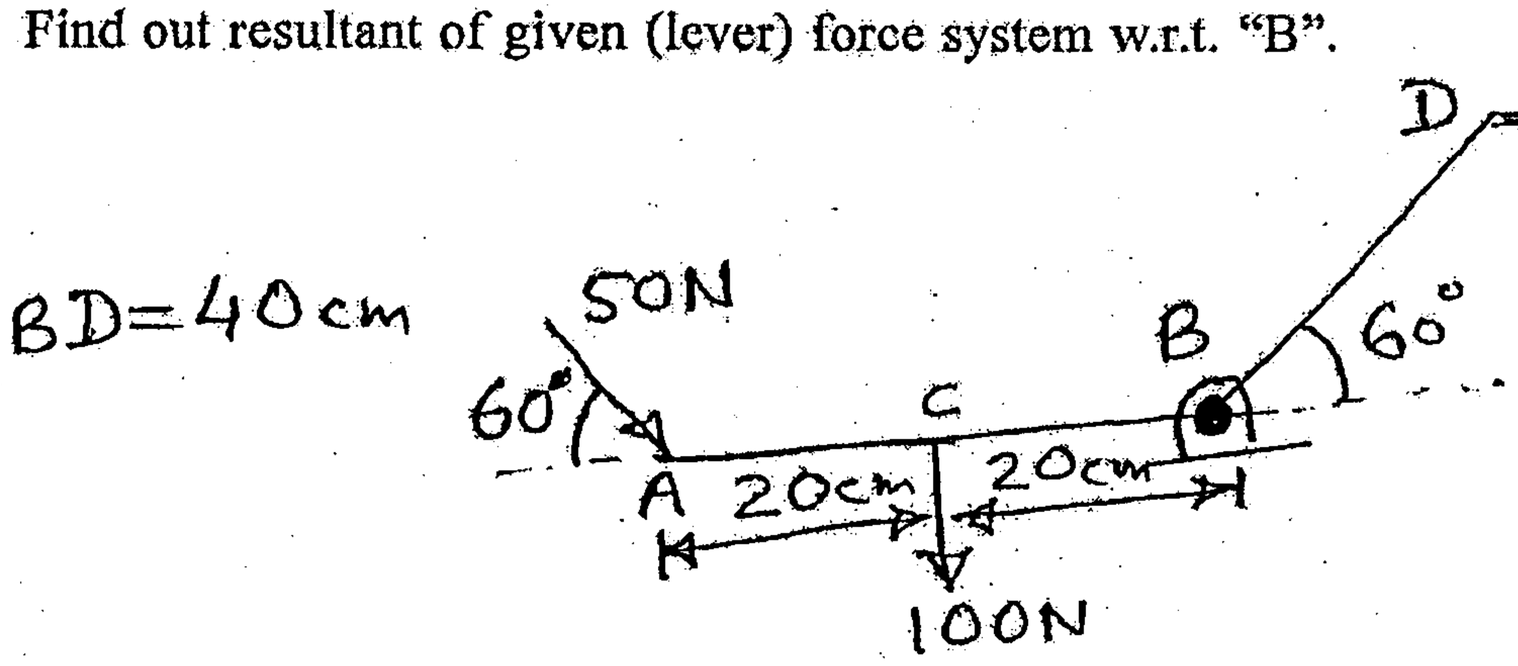


[TURN OVER

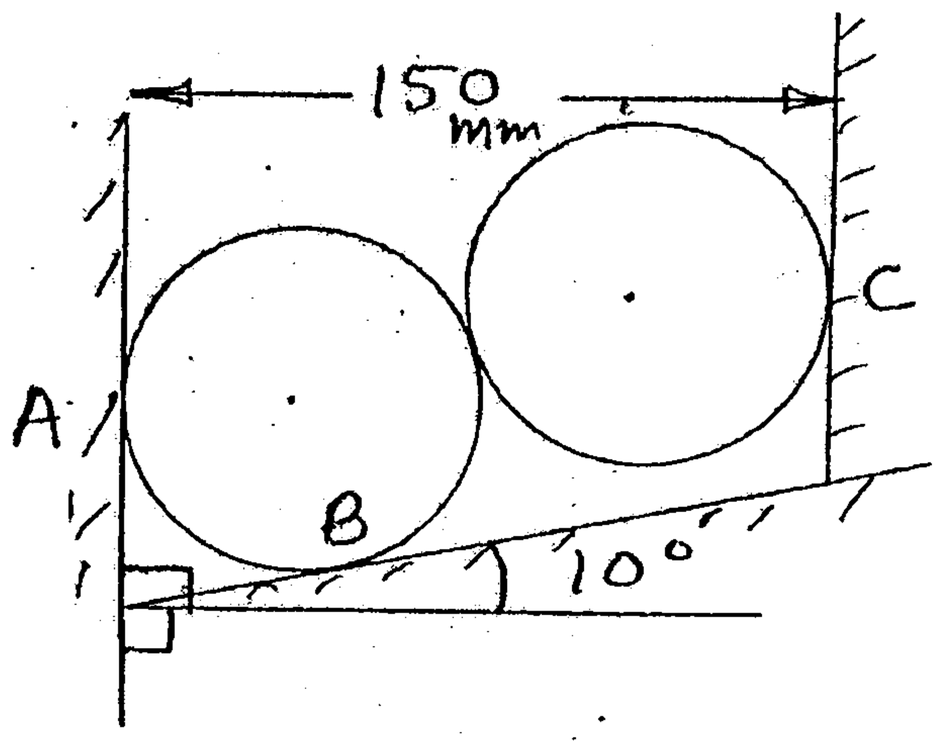
(d) A curvilinear motion of a particle is defined by $v_x = 25-8t$ m/s and $y = 48-3t^2$ m. At $t = 0$, $x = 0$. Find out position, velocity and acceleration at $t = 4$ sec. **4**

(e) State D'Alembert's principle with two examples. **4**

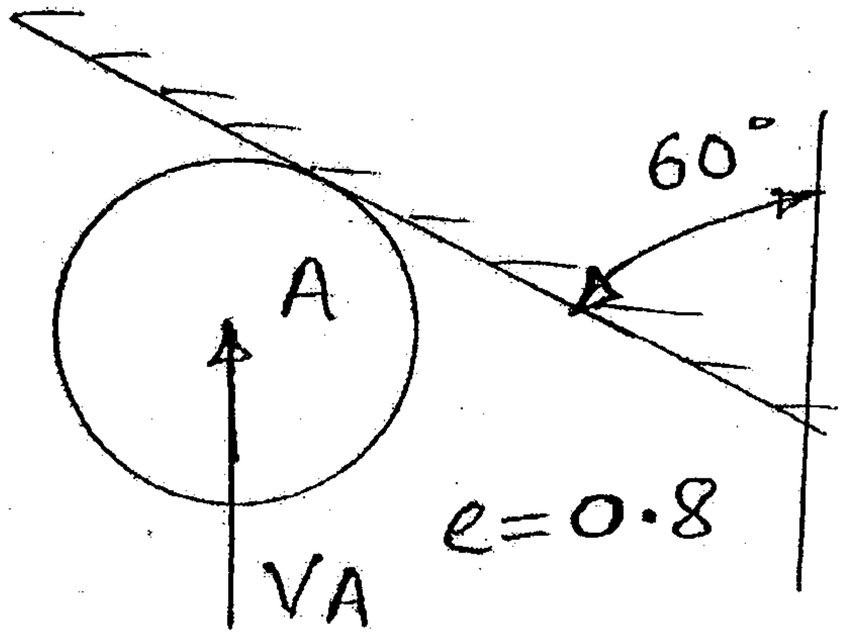
2. (a) Find out resultant of given (lever) force system w.r.t. "B". **6**



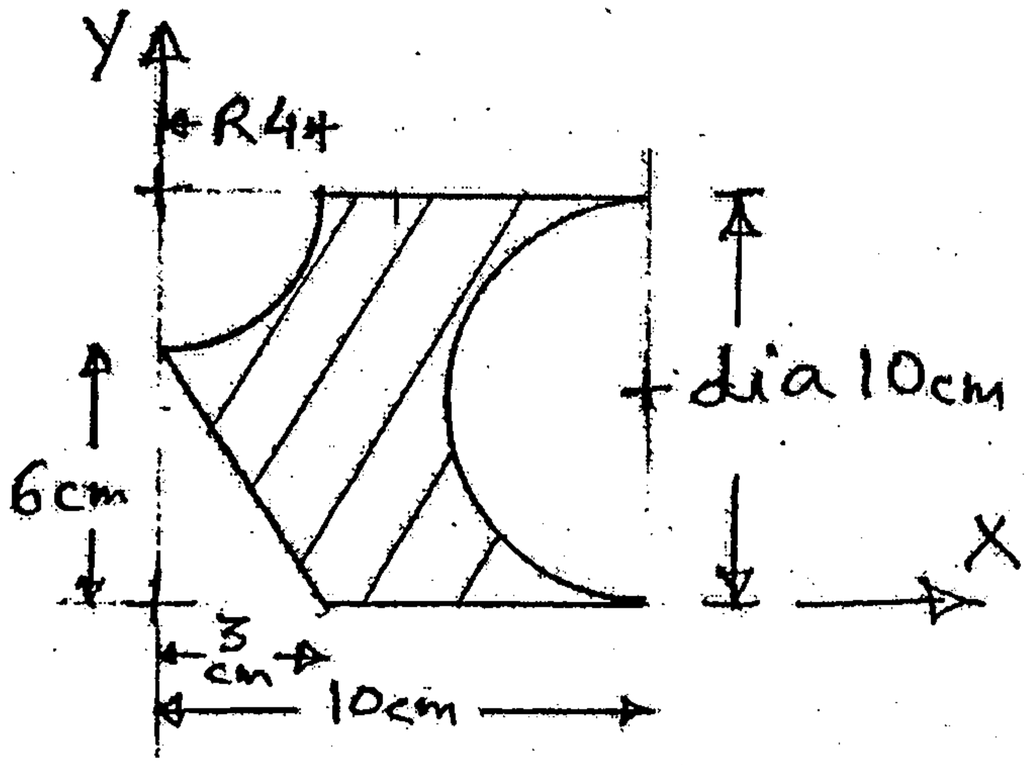
(b) Two identical cylinders dia 100 mm weight 200 N are placed as shown. All contacts are smooth. Find out reactions at A, B and C. **8**



(c) A ball of mass m kg hits an inclined smooth surface with a velocity $V_A = 3$ m/s. Find out velocity of rebound. **6**



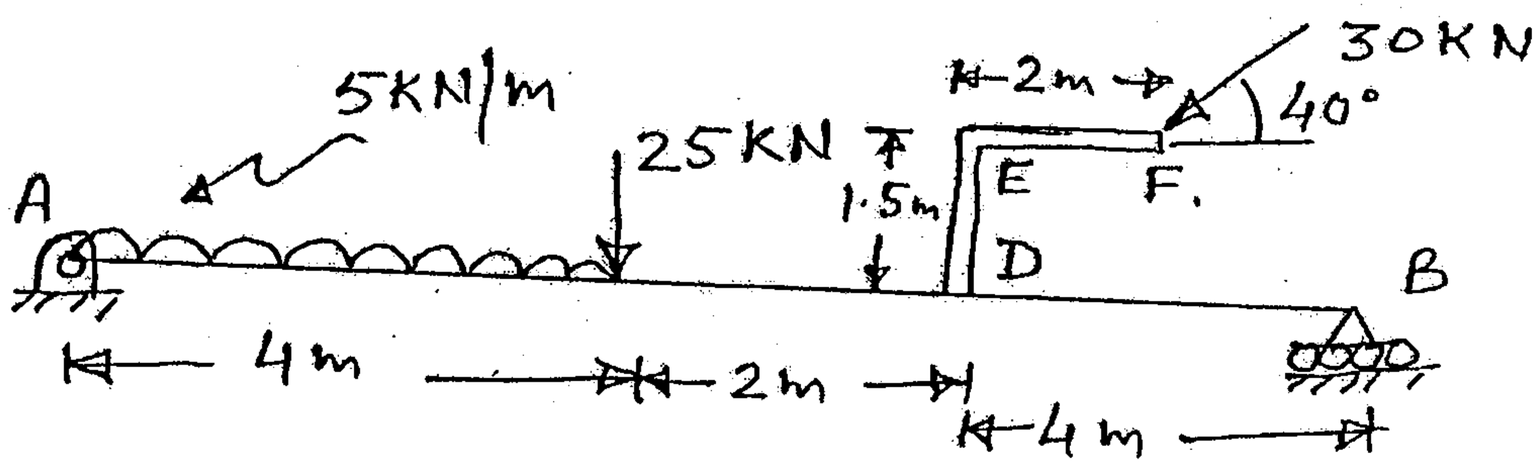
3. (a) Find centroid of the shaded area. 8



(b) Explain conditions for equilibrium for forces in space. 6

(c) Explain work energy principle. 6

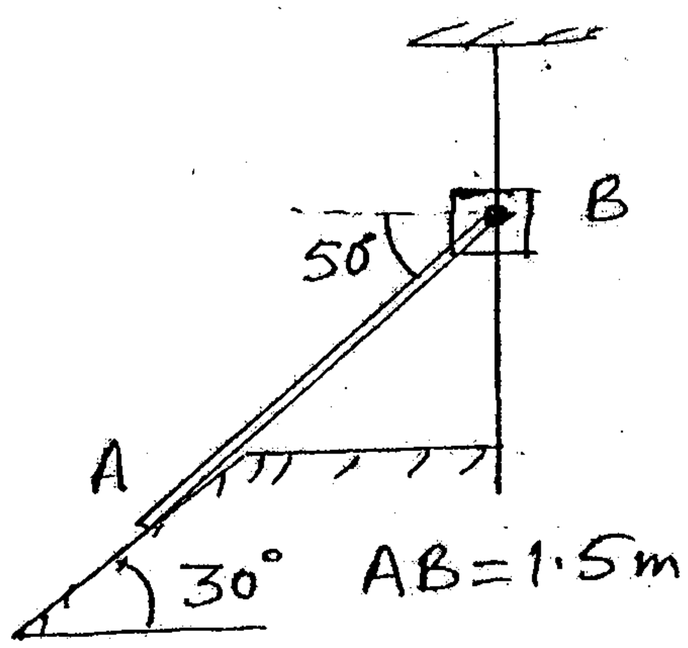
4. (a) 8



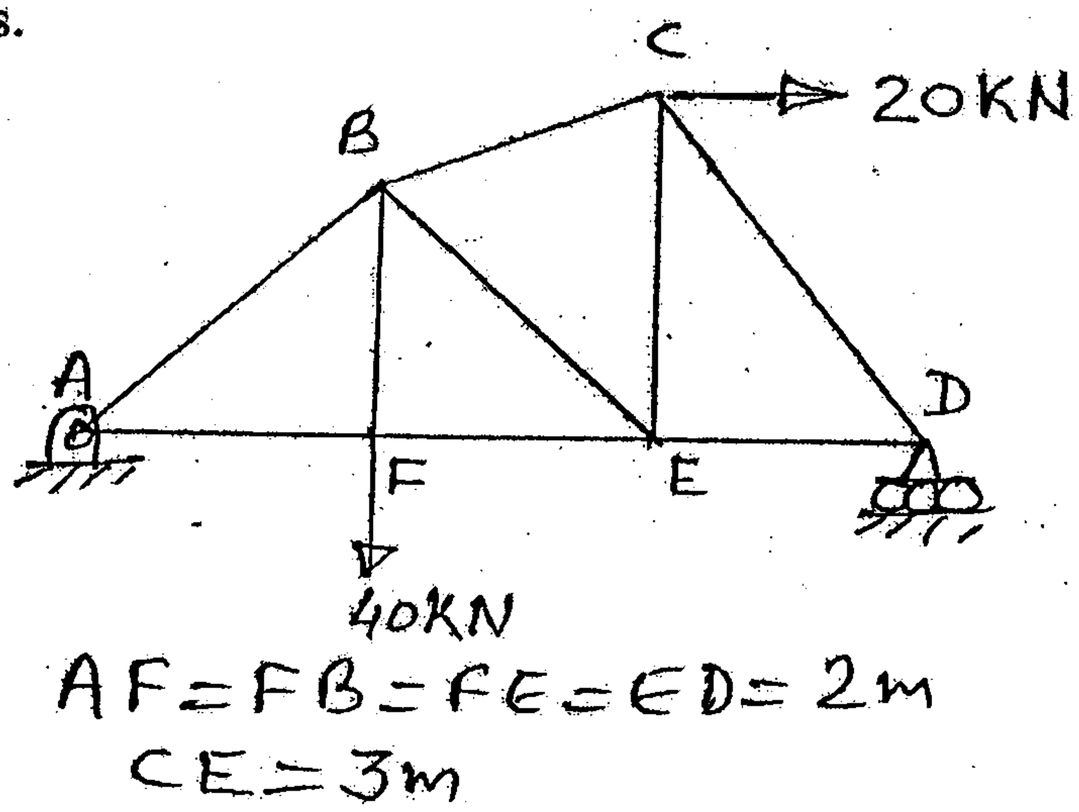
Find the support reactions at Hinge A and Roller B.

(b) Explain x–t, v–t and a–t curves in Kinematics. 6

(c) Collar B moves up with constant velocity $V_B = 2$ m/s. Rod AB is pinned at B. 6
Find out angular velocity of AB and velocity of A.



5. (a) Find out forces in FB and BE using method of section and other members by method of joints. 8

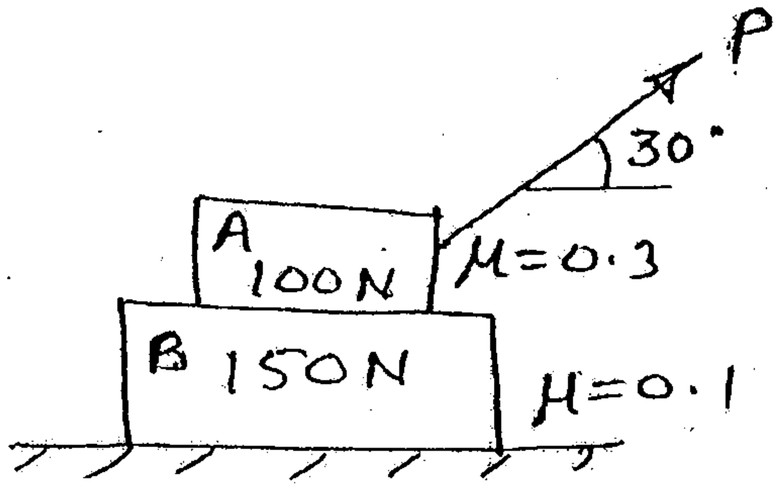


(b) A stone is thrown vertically upwards and returns to the starting point at the ground in 6 sec. Find out max. height and initial velocity of stone. 6

(c) Explain instantaneous centre of rotation. 6

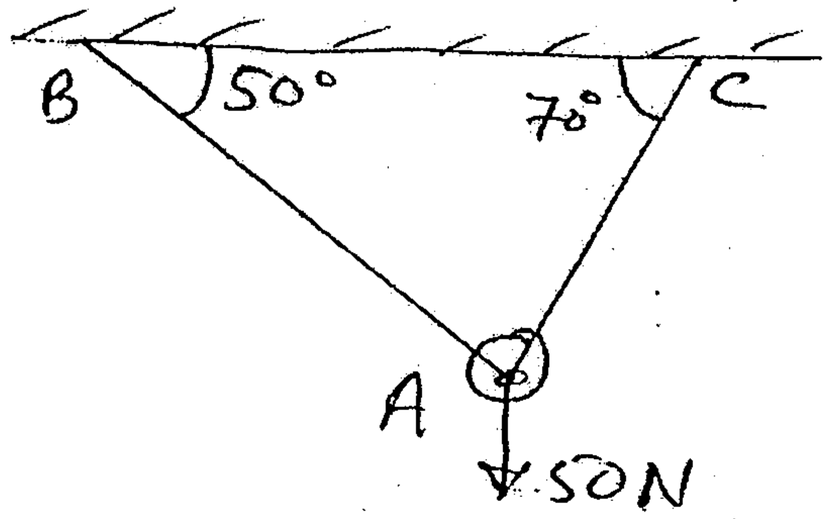
6. (a) Force F = (3i – 4j + 12k)N acts at point A (1, –2, 3). Find — 4
   (i) Moment of force about origin
   (ii) Moment of force about point B(2, 1, 2)m.

(b) Find out min. value of P to start the motion. 8



(c) For a particle in rectilinear motion $a = -0{\cdot}05\ V^2\ m/s^2$, at v = 20 m/s, x= 0. Find x at v = 15 m/s and acc^n at x = 50 m. 4

(d) Sphere A is supported by two wires AB, AC. Find out tension in wire AC :— 4
   (i) before AB is cut
   (ii) just after AB is cut.



3/6/13

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

Con. 6907–13.

(REVISED COURSE)

(2 Hours)

GS–5220

[Total Marks : 60

N.B. (1) Question No. **1** is **compulsory**.
(2) Answer any **three** questions from the remaining.
(3) **All** questions carry **equal** marks.

Atomic weight :—

Ca	**=**	**40**	**Mg**	**=**	**24**
H	**=**	**1**	**Cl**	**=**	**35·5**
C	**=**	**12**	**Na**	**=**	**23**
O	**=**	**16**			

1. Solve any **five** :— **15**
   (a) Differentiate between BOD and COD.
   (b) What are natural rubbers ? What are their drawbacks ?
   (c) Define grease. Under which situation it is used as a lubricant.
   (d) Define phase, component and degree of freedom.
   (e) Write composition of portland cement.
   (f) What are plasticizer and give its functions ?
   (g) What is the total hardness of sample of water which has the following impurities in mg/l.

$Ca(HCO_3)_2$	=	162	$CaCl_2$	=	22·2
$Mg\ Cl_2$	=	95	NaCl	=	20

2. (a) 0·5g of $CaCO_3$ was dissolved in dilute HCl and diluted to 500 ml, 50 ml of this solution required 45 ml of EDTA solution for titration. 50ml of hard water sample required 15 ml of EDTA solution for titration. 50 ml of same water sample on boiling, filtering requires 10 ml of EDTA solution. Calculate the temporary permenant and total hardness in ppm. **6**
   (b) Draw and explain the phase diagram of ice-water-water vapour system. **5**
   (c) Explain CVD method for preparation of carbonnanotubes. **4**

3. (a) What are solid lubricants explain with two examples. **6**
   (b) Explain fabrication of plastic with example of injection molding. **5**
   (c) Give limitations of phase rule. **4**

4. (a) Write preparation, properties and uses of following polymers :— **6**
      (i) Buna S
      (ii) Kevlar
   (b) Explain deminoralization of water by ion exchange method. **5**
   (c) 2·5 g of vegetable oil was mixed with 50 ml of KOH solution and heated for 1 hour. The mixture required 26·4 ml of 0·4 N HCl. The blank titration reading was 49·0 ml. Find the saponification value of oil. **4**

5. (a) Write preparation properties and uses of – **6**
      (i) Dolomite bricks
      (ii) Silicon carbide
   (b) Explain effect of heat on polymers and factors affecting it. **5**
   (c) A zeolite softener was completly exhausted and was regenerated by passing 150 lit of NaCl solution, containing 50 g/litre of sodium chloride. How many litres of water sample of hardness 450 ppm can be softened by this zeolite container. **4**

6. (a) With the help of chemical equations explain the principle of lime soda process. **6**
   (b) Write short notes on :— **5**
      (i) Conducting polymers
      (ii) Polymers in medicine and surgery.
   (c) Explain the following properties and discuss its significance **4**
      Viscosity and Viscosity index.

FE/Sem.-I (CGS) 7/6/13

EVS

42 : 1st half.13-AM(aa)

Con. 6916-13. **(REVISED COURSE)** **GS-5238**

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

N.B. : (1) Question No. **1** is **compulsory** and in addition to this, solve any **three** questions from **rest** of questions.
(2) **Each** of questions carries **15** marks.
(3) Assume suitable **data** wherever **necessary**.
(4) Draw **figures** wherever **necessary**.

1. Solve any **five** of the following :—
   (a) List :— **15**
      (i) the various sources of water pollution
      (ii) common water pollutant.
   (b) What is the role of Ministry of Environment and Forests ?
   (c) Define and explain the term sustainable development.
   (d) Explain in brief, what is food web.
   (e) Explain scientifically the concept of Green building.
   (f) List the conventional energy sources and state their limitations.
   (g) Define the term Noise pollution and explain its sources as well as ill effects.

2. (a) Explain how the environmental resource water is depleting. **5**
   (b) Explain working of Venturi scrubber with help of neat skech. **5**
   (c) Explain working of hydropower electricity plant with help of neat sketch. **5**

3. (a) Explain how a geothermal electricity plant works. Draw a neat and labelled schematic diagram for the same. **5**
   (b) Define any **five** of the terms from Environmental Protection Act, 1986 :— **10**
      (i) Environment
      (ii) Environmental pollutant
      (iii) Environmental pollution
      (iv) Hazardous substane
      (v) Occupier
      (vi) Handling
      (vii) Precribed.

4. (a) Explain various modes needed for public awareness to protect earth from environmental degradation. **5**
   (b) Explain the term "E pollution". What are its sources and ill effect ? **5**
   (c) State and explain working principle of flat plate collector used for solar energy. **5**

[TURN OVER

5. (a) What you mean by appropriate technology ? What is their criteria for selection ? **5**
   (b) Write case study on Mina Mata disease in Japan. **5**
   (c) Explain what is Indoor pollution. Give examples of such pollutants, state ill effects of them. **5**

6. (a) Write a case study on Tsunami and Earthquakes in Japan. **5**
   (b) When one is setting up an industrial unit, what is the role of Environmental clearance consent and authorisation mechanism ? **5**
   (c) Explain generation of electricity using wind energy, with help of neat and labelled sketch of wind Turbine. **5**
