QP Code : 28579

REVISED COURSE
(3 Hours)   [Total Marks : 100

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

1. (a) Solve the equation 7coshx+8sinhx = 1 for real values of x   3

   (b) If z (x+y)= (x-y) find $\left(\dfrac{\partial z}{\partial x} - \dfrac{\partial z}{\partial y}\right)^2$ 3.

   (c) If u = r^2cos2θ , v = r^2 sin 2 θ find $\dfrac{\partial(u,v)}{\partial(r,\theta)}$ 3

   (d) Prove that $Sec^2 x = 1 + x^2 + \dfrac{2x^4}{3} + \ldots\ldots$ 3

   (e) Find the rank of the Matrix by reducing it to normal form.   4

   $$\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$$

   (f) Find n^{th} derivatives of $\dfrac{x}{(x-1)(x-2)(x-3)}$ 4

2. (a) If α, β are the roots of the equation $x^2 - 2\sqrt{3}\cdot x + 4 = 0$ 6
   find the value of $\alpha^3 + \beta^3$

   (b) Examine whether the vecotrs   6

   $X_1 = \begin{bmatrix} 3 & 1 & 1 \end{bmatrix}$, $X_2 = \begin{bmatrix} 2 & 0 & -1 \end{bmatrix}$
   $X_3 = \begin{bmatrix} 4 & 2 & 1 \end{bmatrix}$

   are linearly independent.

   (c) (i) State and prove Euler's theorem for a Homogeneous function in two   4
       variables.

     (ii) If y = x cos u   4
         find the value of $x^2 u_{xx} + 2xy\, u_{xy} + y^2 u_{yy}$

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FW-Con. 8276-16.

2

3. (a) Is the following system has trivial or non trivial solution ? Obtain the non trival solution if exist.   6

$$3x_1 + 4x_2 - x_3 - 9x_4 = 0$$
$$2x_1 + 3x_2 + 2x_3 - 3x_4 = 0$$
$$2x_1 + x_2 - 14x_3 - 12x_4 = 0$$
$$x_1 + 3x_2 + 13x_3 + 3x_4 = 0$$

(b) Discuss the stationary points for Maxima and Mininima of   6
$$x^3 + xy^2 - 12x^2 - 2y^2 + 21x + 10$$

(c) (i) If $\tan(x+iy) = a + ib$ prove that $\tanh 2y = \dfrac{2b}{1 + a^2 + b^2}$ 4

(ii) Separate into real and imaginary parts of $\text{Log}(3+4i)$ 4

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

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

(b) Show that $\log\left[e^{i\alpha} + e^{i\beta}\right] = \log\left[2\cos\left(\dfrac{\alpha-\beta}{2}\right)\right] + i\left(\dfrac{\alpha+\beta}{2}\right)$ 6

(c) (i) Solve the system of equation by Gauss Jordan Method   4
$$x + 2y + 6z = 22, \quad 3x+4y+z = 26, \quad 6x - y - z = 19$$

(ii) Solve the system of equation by Gauss Siedel Method.   4
Correct upto three decimal.
$$2x - 4y + 49z = 49$$
$$43x + 2y + 25z = 23$$
$$3x + 53y + 3z = 91$$

5. (a) Prove that $\text{Cos}^6\theta + \text{Sin}^6\theta = \dfrac{1}{8}[3\cos 4\theta + 5]$ 6

(b) Find the value of a and b   6

if $\displaystyle\lim_{x\to 0} \dfrac{x(1 + a\cos x) - b\sin x}{x^3} = 1$

(c) (i) If $y = e^x \cos 2x \cos x$ find y_n 4

(ii) If $y = e^{\tan^{-1}x}$ prove that $(1+x^2)y_{n+2} + [2(n+1)x - 1]y_{n+1} + n(n+1)y_n = 0$ 4

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5. (a) Find non-Singular Matrices P & Q such that,   6

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \\ 3 & 0 & 5 & -10 \end{bmatrix}$$ is redued to normal form. Also find rank.

(b) If $u = f(e^{y-z}, e^{z-x}, e^{x-y})$ find $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z}$ 6

(c) (i) Fit a straight line to the following data :   4

Year x :	1951	1961	1971	1981	1991
Production y :	10	12	8	10	15

(ii) Fit a second degree parabolic curve to the following data :   4

x :	1	2	3	4	5	6	7	8	9
y :	2	6	7	8	10	11	11	10	9

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QP Code : 28603

(2 Hours)   [Total Marks :60

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

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

  (a) Draw (a) $(1\bar{1}2)$ (b) $(0\ 4\ 0)$ (c) $[0\ 4\ 0]$ with reference to a cubic unit cell.

  (b) What is the probability of an electron being thermally promoted to the conduction band in diamond at $27^{o}C$, if the bandgap is 5.6 eV wide?

  (c) Define drift current, diffusion current and mobility of charge carriers.

  (d) What is dielectric polarization and dielectric susceptibility? Write the relation between them.

  (e) State and explain Ohm's law in magnetic circuit.

  (f) Write Sabine's formula and explain the terms used in it.

  (g) Calculate the length of an iron rod which can be used to produce ultrasonic waves of 20kHz Given - $Y = 11.6 \times 10^{10} N/m^2$, $\rho = 7.23 \times 10^3 kg/m^3$

2. (a) Explain formation of energy bands in solids and explain classification on the basis of energy band theory.   8

  (b) Zn has hcp structure. The nearest neighbour distance is 0.27nm. The atomic weight of Zn is 65.37. Calculate the volume of unit cell, density and atomic packing fraction of Zn.   7

3. (a) What is hysteresis? Draw a hysteresis loop for ferromagnetic material and explain various important parameters.   8

  A magnetic material has a magnetization of 2300 A/m and produces a flux density of 0.00314 wb/m², Calculate magnetizing force and relative permeability of the material.

  (b) Explain the statement "crystal act as three dimesional grating with X-rays".   7

  Monochromatic X-ray beam of wavelength $\lambda = 5.8189\ A^0$ is reflected strongly for a glancing angle of $\theta = 75.86^0$ in first order by certain planes of cubic of lattice constant $3A^0$. Determine Miller indices of the possible reflecting planes.

4. (a) Define Ligancy. Find the value of critical radius ratio for ligancy 4.   5

  (b) An impurity of 0.01 ppm is added to Si. The semiconductor has a resistivity of $0.25\Omega m$ at 300K. Calculate the hole concentration and its mobility. Atomic weight of Si is 28.1, density of $Si = 2.4 \times 10^3 kg/m^3$ 5

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

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5. (a) The density of copper is $8980 kg/m^3$ and unit cell dimension is 3.61 A^0. Atomic 5 weight of copper is 63.54. Determine type of crystal structure. Calculate atomic radius and interplanar spacing of (1 1 0) plane.

(b) What is Hall effect? Derive expression for Hall voltage with neat labelled diagram. 5

(c) Explain how the reverberation time is affected by (i) size (ii) nature of wall 5 surface (iii) audience in an auditorium.

6. (a) Estimate the ratio of vacancies at (i) -119°C (ii) 80°C where average required 5 to create vacancy is 1.8eV.

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

(c) Explain with neat labelled diagram the construction and working of a piezoelectric 5 oscillator.

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Q.P. Code : 28592

(2. Hours) | Total Marks : 60

N.B. : (1) Question No. 1 is compulsory.
(2) Answer any three questions from remaining five questions.
(3) Figure to the right indicates full marks.
(4) Atomic weights : Ca = 40, Mg = 24, Cl = 35.5, S = 32, H = 1, C = 12.
O = 16.

1. Attempt any **five** from the following :   15
    (a)   Write two balanced equations to describe the changes that occur when hard water is boiled.
    (b)   Give reasons to explain why natural rubber needs vulcanization.
    (c)   Give the preparation and uses of silica bricks.
    (d)   Give the number of phases in the following system (any three) :
        (i)   Saturated solution of NaCl
        (ii)   Mixture of rhombic and monoclinic sulphur
        (iii) Mixture of O_2 and N_2
        (iv)   Ice $\rightleftharpoons$ Water equilibrium
    (e)   What is grease ? What are the conditions in which greases are used?
    (f)   Thermosetting polymers cannot be reshaped and reused. Give reasons.
    (g)   Calculate the COD of an effluent sample if 25c.c. of the effluent sample required 8.3 c.c. of 0.001M $K_2Cr_2O_7$ for oxidation.

2. (a)   Calculate the quantity of lime and soda required for softening 50,000 L of   6
water containing following salts per litre.
$Ca(HCO_3)_2$ = 16.2mg; $Mg(HCO_3)_2$ = 7.5mg;
$CaSO_4$ = 13.6mg; $MgSO_4$ = 24.0mg,
$MgCl_2$ = 10.0mg.

    (b)   Explain the following terms :   5
        (i)   Condensed Phase rule
        (ii)   Triple point

    (c)   What are carbon nanotubes ? Describe the laser method of preparation of   4
CNT.

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FW-Con.11225-16.

3. (a) (i) Discuss the mechanism of Extreme pressure lubrication.
 (ii) Name any four additives in blended oil and give two examples of each. 6
 (b) Describe a moulding method suitable for thermoplastic resins. 5
 (c) Discuss the limitations of phase rule. 4

4. (a) Give the preparation, properties and uses of (any two) :
 (i) PMMA (ii) Silicone rubber (iii) BunaS. 6
 (b) Write brief notes on any two methods of disinfecting municipal water with reactions. 5
 (c) 1.5g of an oil was saponified with 50ml of 0.1N KOH solution. After refluxing the mixture required 7.5ml of 0.1N HCl for neutralisation. Find the saponification value of oil. 4

5. (a) Draw a neat diagram of rotary kiln in the manufacture of portland cement and mention the reactions in each zone. 6
 (b) What is glass transition temperature ? What are the factors affecting glass transition temperature ? What is its significance ? 5
 (c) The hardness of 10,000 litres of a water sample was completely removed by passing it through a zeolite softener. The softener then required 400litres of sodium chloride solution containing 100g/L of NaCl for regeneration. Calculate the hardness of the water sample. 4

6. (a) (i) Discuss the softening and regeneration reactions in the Ion-exchange process.
 (ii) Discuss the Reverse Osmosis method of purification of water. 6
 (b) Explain the functions of the following constituents in the compounding of plastic (any two) :
 (i) Plasticiser (ii) Lubricants (iii) Stabiliser. 5
 (c) Define and explain the significance of the following properties of lubricants (any two) :
 (i) Flash and Fire point
 (ii) Acid value
 (iii) Viscosity and viscosity Index. 4

QP Code : 28584

(3 Hours) [Total Marks 80

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

(2) Attempt any three questions from remaining five questions.

(3) Assume suitable data if necessary and mention the same clearly.

(4) Take g=9.81 m/s^2

Q.1 a. Determine the resultant of the forces acting as given in figure below. Find the [4] angle which the resultant makes with the positive x-axis.
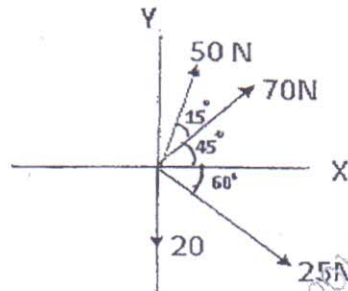
b. Two spheres A and B are kept in a horizontal channel. Determine the reactions [4] coming from all the contact surfaces. Consider the radius of A and B are 40mm and 30mm respectively. Take W_A =500 N and W_B = 200N.
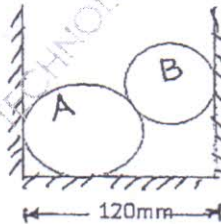
c. Define Angle of Friction and Angle of Repose [4]

d. Car A starts from rest & accelerates uniformly on a straight road. Another car B [4] starts from the same place 5 seconds later with initial velocity zero & it accelerates uniformly at 5 m/sec^2. If both the cars overtake at 500 m from the starting place, find the acceleration of car A.

e. Find the angle the force P makes with horizontal such that the block of mass 4 [4] kg has an acceleration of 10m/sec^2, when it is subjected to a force of 35 N. μs = 0.7, μk = 0.6.
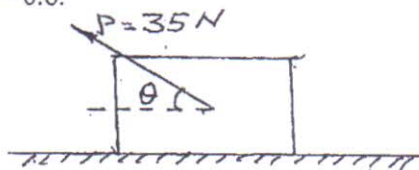
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FW-Con. 10119-16.

Q.2 a.   Replace the force system by a single force w. r. to point C   [6]
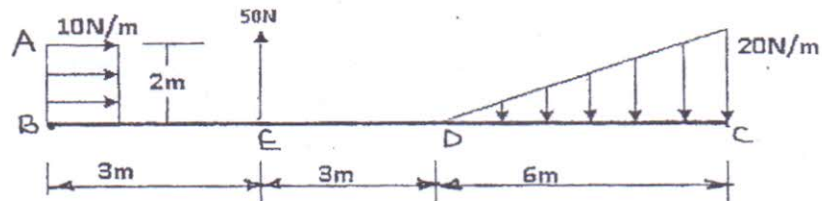

b.   A uniform beam AB hinged at A is kept horizontal by supporting & setting a   [8]
     100 N weight by using a string tied at B & passing over a smooth pulley at C
     The beam also loaded as shown in figure below. Find the reactions at A & C.
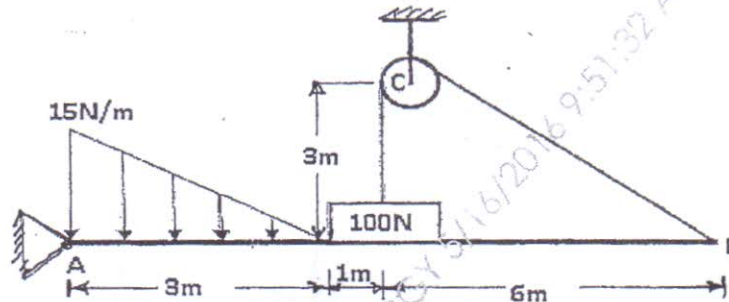
c.   Prove that for a perfectly elastic body, two equal masses participating in   [6]
   collision exchange their velocities.

Q.3 a.   Find Centroid of shaded area with reference to X and Y axes.   [8]
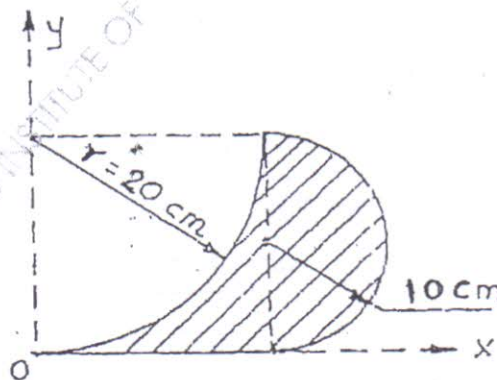
b.   Find the resultant of the spatial concurrent force system concurrent at A(1,0,0) [6]
     and passing through points B(-1,3,5), C(3,5,7), D(0,4,0). Magnitude of forces
     F_{AB}= 100N, F_{AC} =150N, F_{AD}=200N.

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FW-Con. 10119-16.

c. A collar of mass 1 kg is attached to a spring ad slides without friction along a [6] circular rod which lies in a horizontal plane. The spring is undeformed when the collar is at B. knowing that the collar is passing through the point D with a speed of 1.8 m/s, determine the speed of the collar when it passes through point C and B. Take Stiffness of the spring, k= 250 N/m, Radius of the circular path = 300 mm and distance OA = 125 mm.
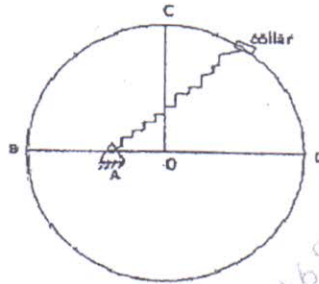
Q.4 a. Find the reactions at supports A and E for the beam loaded as shown in the [8] figure below.
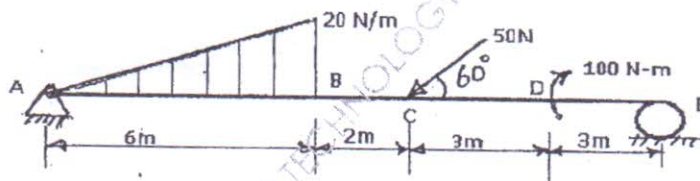
b. A fighter Plane Moving horizontally with a constant velocity of 200 m/seconds releases [6] a bomb from an altitude of 400 m. Find the velocity and direction of the bomb just before it strikes the ground. Also determine the distance travelled by the plane before the bomb just strikes the ground.

c. Find velocity of C and point D at the instant shown ω_{AB} = 3 rad /sec clockwise. [6] AB =400mm.
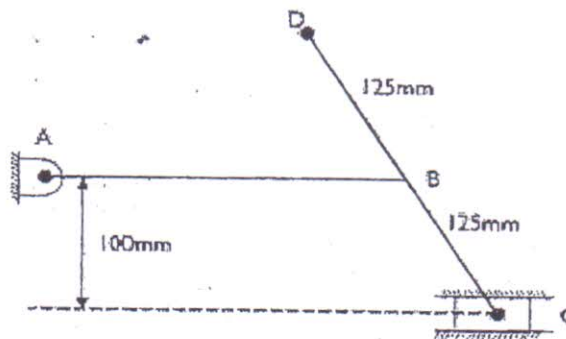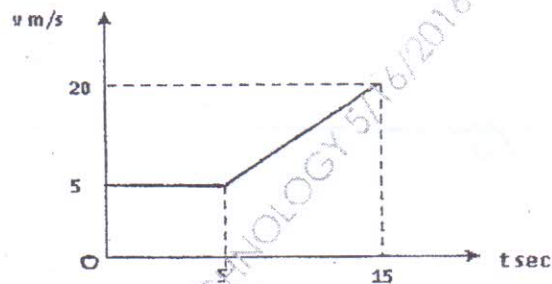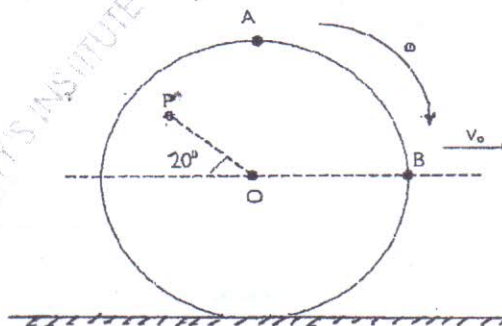

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Q.5   a.   Find the forces in CF and CD by method of section and the remaining by Method of   [8]
            Joints.
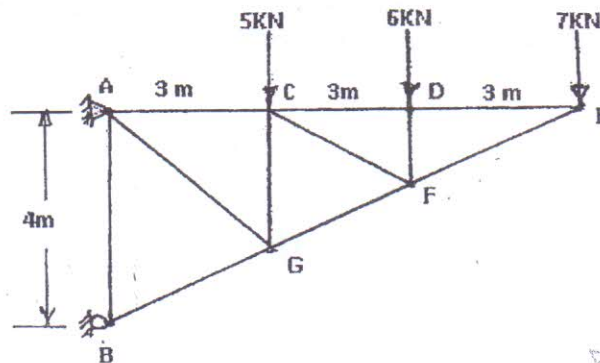
    b.   For a vehicle moving along a straight line, v-t diagram is as shown in figure   [6]
       below. Plot a-t & s-t diagrams for the given time period.

    c.   A wheel is rolling along a straight path without slipping. Determine velocity of   [6]
   points A,B and P. OP = 600mm , ω = 4 rad/sec, Vo = 4m/s

Q.6   a.   A force of magnitude 500N is acting from A(2,3,6) and passes through a point   [4]
            B(6,2, 6). Compute its moment about point C(4, 6, 3).

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b A stone is thrown with a velocity (u) m/sec at an angle of 20^0 with horizontal from a [4] point 2 m above the ground. The stone strikes the ground 5 m away from the original position. The motion of stone is subjected to gravitational acceleration & wind resistance of 0.82 m/sec^2, opposing the horizontal motion. Determine the time of flight of the stone.

c. A heavy metal bar AB rests with its lower end A on a rough horizontal floor having [8] coefficient of friction μ_F & the other end B on a rough vertical wall having coefficient of friction μ_W. If the centre of gravity of the bar is at distances a & b from the ends A & B respectively, show that at impending motion, the inclination of the bar with the horizontal will be:

$$\theta = \tan^{-1}\left(\frac{1}{\mu_F} \frac{a - b\mu_F\mu_W}{a + b} \right)$$
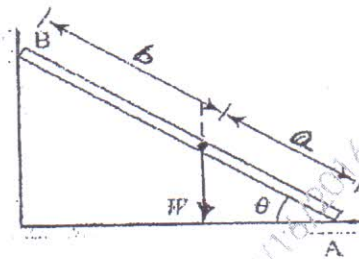
d. Two masses are interconnected with the pulley system Neglecting inertial & frictional [4] effect of pulleys & cord, determine the acceleration of the mass m_2.
Take $m_1 = 50$ kg & $m_2 = 40$ kg

FW-Con. 10119-16.
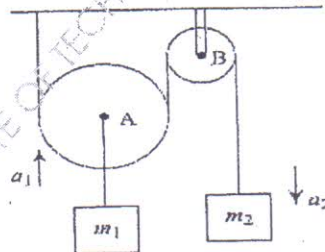
Sem-I (CBSGS)/ Basic Electrical & Electronics Engineering)

QP Code : **28587**   May.2016.

(3 Hours)   [Total Marks : 80

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

1. (a) A resistor of 5Ω is connected in series with a parallel combination of   3
         a number of resistors each of 5Ω. If the total resistance of the
         combination is 6Ω find the no. of resistors connected in parallel.

    (b) Use mesh analysis to find current through 10Ω in the ckt. shown   3
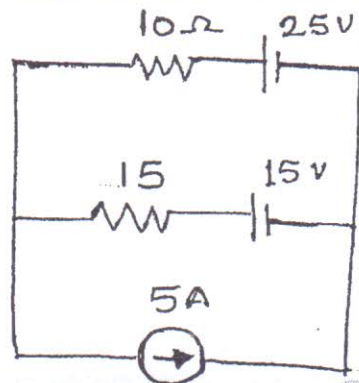
    (c) An alternating voltage is represented by $?? = 141.4 \sin 377\,t$ 3
         find (i) max-value (ii) frequency (iii) time period

    (d) What is the necessary condition for resonance in series circuit. Derive   3
         expression for resonance frequency.

    (e) What is the relationship between line and phase values in star and delta   2
         connected load.

    (f) Draw and explain the phasor diagram of 1-φ transformer on No load.   4

    (g) Define rectifier and state diff. types of it.   2
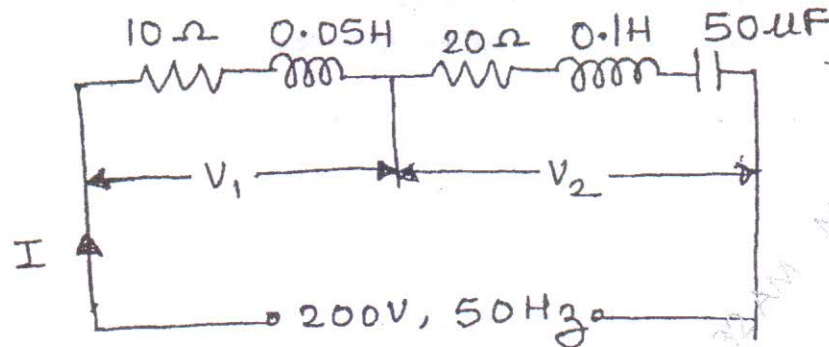
2. (a) Find mode voltages.   6

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FW-Con.10819-16.
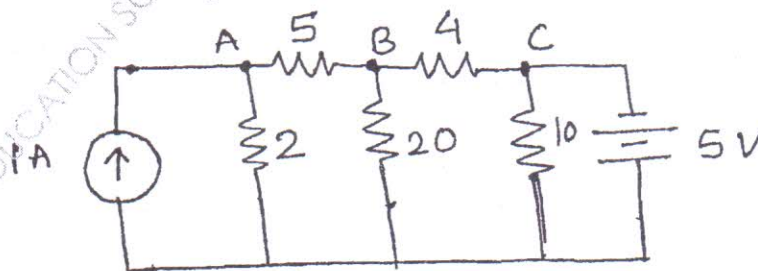
(b) In the circuit shown find   8

       (i) the current I (ii) V_1 and V_2 (iii) Pf. Draw the phasor diagram.

(c) A 150 KVA transformer has iron loss of 1.4 kW and full-load copper   6
loss of 1.6 kW. Det. (i) the KVA load at maximum efficiency (ii) max.
efficiency at 0.8 lagging Pf and (iii) efficiency at half load and 0.8
lagging Pf.

3. (a) A balanced three-phase load connected in delta, draws a power of 10kW   8
at 440 V at a Pf of 0.6 lead, find the values of circuit elements and
reactive volt-ampers drawn.

   (b) The wattmeter reads iron losses in OC test and reads copper losses in   6
SC test of a transformer. Justify.
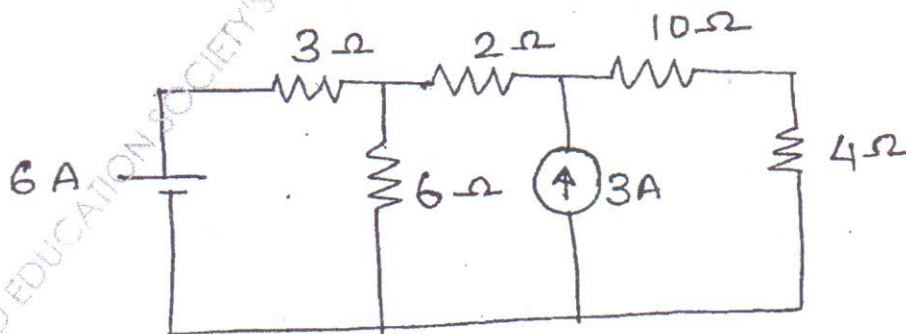
   (c) What is meant by filter.   2

   (d) Draw and explain O/P characteristic of transistor in CE configuration.   4

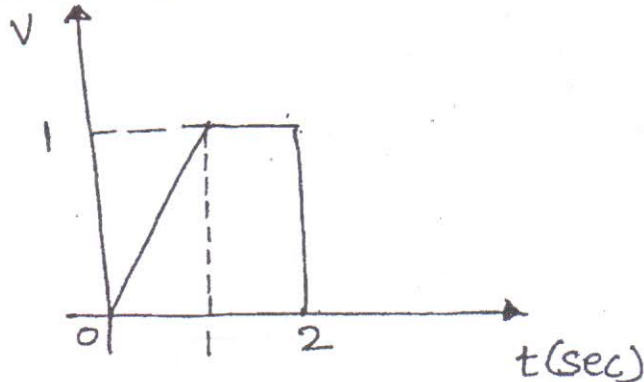4. (a) Using source transformation tech. calculate voltage across 4Ω   7

FW-Con.10819-16.
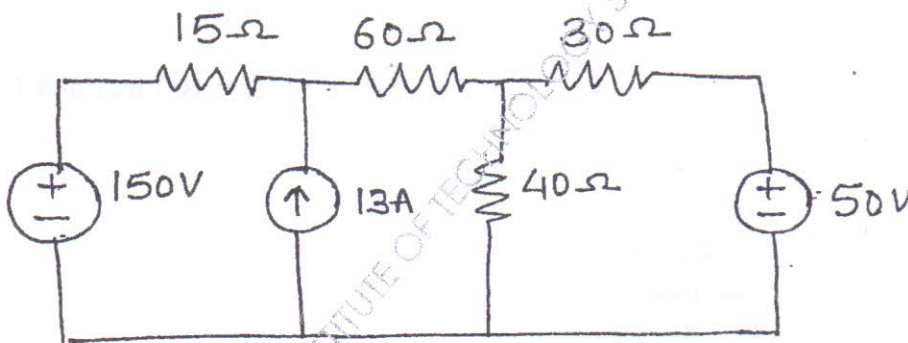
(b) Find the average and rms value of the waveform.   5

(c) The power in a 3-φ ckt is measured by two wattmeters. If the total power is 50kW and Pf is 0.6 lagging, find the reading of each wattmeter.   4

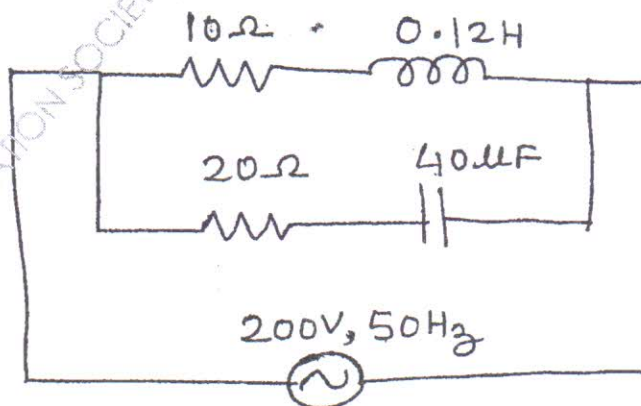(d) Explain the working of centre tapped full wave rectifier.   4

5. (a) Find current through 30Ω using theveninis theorem   8

(b) For the shown ckt, find supply current, current in each branch and total Pf.   4
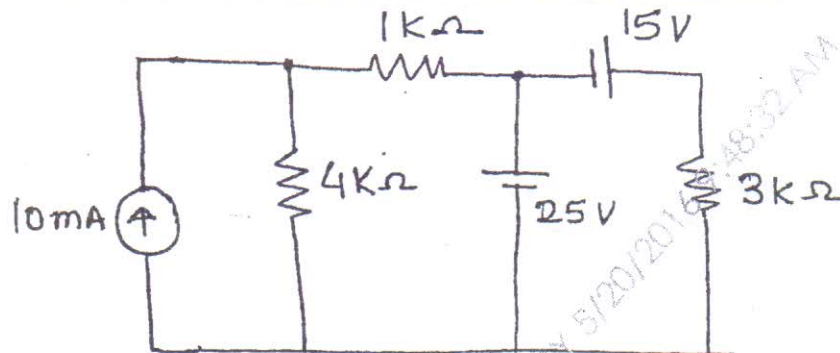

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(c) A 1000/200 V, 50Hz, 1–phase transformer gave the following test   8
results

OC test (hv side) :   1000V   0.24 A   90 W
SC test (hv side) :   50V   5A   110W

Draw equivalent ckt of transformer reffered to primary and secondary
side.

6. (a) Using superposition theorem, find the voltage across 4KΩ   7

(b) A series R-L-C circuit consists of R = 1000 Ω, L = 100 mH and C   7
= 10μF. The applied voltage across the circuit is 100 V.
     (i)   Find the resonance freq of the ckt.
     (ii)   Find Q of the ckt at resonant freq.
     (iii)   At what angular freq. do the half power points occur.
     (iv)   Calculate the bandwidth of the ckt.

(c) Show that the total power and Pf. in a 3-φ balanced system can be   6
determined using two wattmeter method.

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FW-Con.10819-16.

Q.P. Code : **28604**

(2 Hours) [Total Marks : 60

N.B. : (1) All questions are compulsory.
(2) Answer any three from Question No 2 to 6
(3) Draw neat diagrams wherever necessary

1. Attempt any five from the following: - 15
   (a) Discuss the global environmental crisis.
   (b) Explain in brief the concept of socio-economical aspect of sustainable development.
   (c) Discuss coagulation and flocculation in water treatment.
   (d) Define the term "Noise Pollution" and explain its causes.
   (e) What are the general powers of the Central Government stated in Chapter-11 of the Environmental Protection Act 1986?
   (f) Which are the various renewable sources of energy?
   (g) What is the role of technology with respect to environment and health?

2. Answer the following:- 15
   (a) How is environmental education important for sustainable development?
   (b) What are the constituents in the municipal solid waste?
   (c) What are the limitations of conventional sources of energy?

3. Answer the following:- 15
   (a) How ozone is getting depleted from the atmosphere? Explain with chemical reactions.
   (b) What are the important functions of Central Pollution Control Board?
   (c) Explain the main aspects of Disaster Management Technique in detail.

4. Answer the following:- 15
   (a) Write a note on depleting nature of environmental resources-minerals.
   (b) What environmental clearances are required to set up an industrial unit?
   (c) Explain the working principle of generating electricity by using wind energy.

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FW-Con.12290-16.

5. Answer the following:- 15
    (a) What do you mean by "3R" with respect to sustainable development?
    (b) What do you understand by "Green House Effect"?
    (c) State the working of Photovoltaic Cell used for solar energy.

6. Answer the following:- 15
    (a) Discuss the importance of Environmental Study.
    (b) Draw a neat labelled diagram of "Venturi scrubber" and brief its working.
    (c) Explain the terms Tsunami and Earthquake.

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