1 : 1st half.10-AM(k) (Library) Sem-I | Rev | All Branches   17/6/2010.

Con. 2640-10.   B.E & E.E.   AN-9769
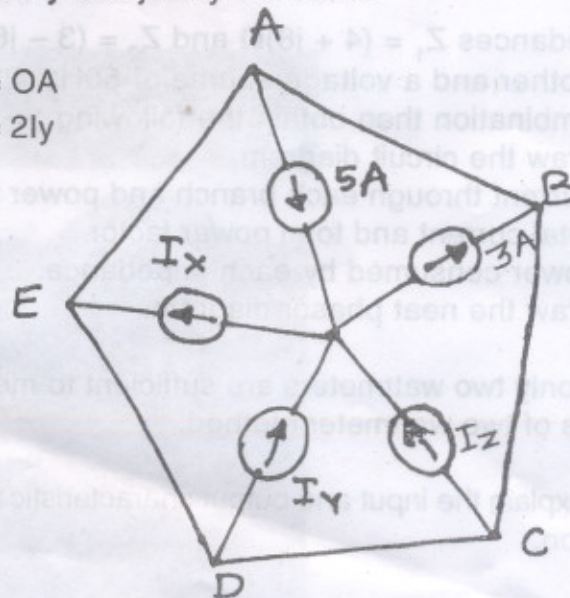
(3 Hours)   [Total Marks : 100

N.B.: (1) Question No. 1 is **compulsory** and solve any **four** from remaining **six** questions.
    (2) **In all** attempt **five** questions.
    (3) **Figures** to the **right** indicate **full** marks.
    (4) All resistances are in ohms, if unit not mentioned.
   (5) Assume data if **necessary** and justify the **same**.

1. (a) Find :—   4
    (i) I_X if I_Y = 2A and I_Z = OA
   (ii) I_Y if I_X = 2A and I_Z = 2Iy
    (iii) I_Z if $I_X = I_Y = I_Z$

(b) A resistance of 10Ω is connected in series with two resistances each of 15Ω   4
arranged in parallel. What resistance must be shunted across this parallel
combination, so that the total current taken shall be 1·5 Amp. with 20 Volts applied ?

(c) Determine the RMS value of semi-circular current wave which has a maximum   4
value of 'a'.

(d) Explain the Quality Factor in case of series resonance.   4

(e) Derive the relation between power in Delta and Star system.   4

2. (a) Using NORTON's th^m, find the current which would flow in a 25Ω resistance   10
connected between points 'A' and 'B'.
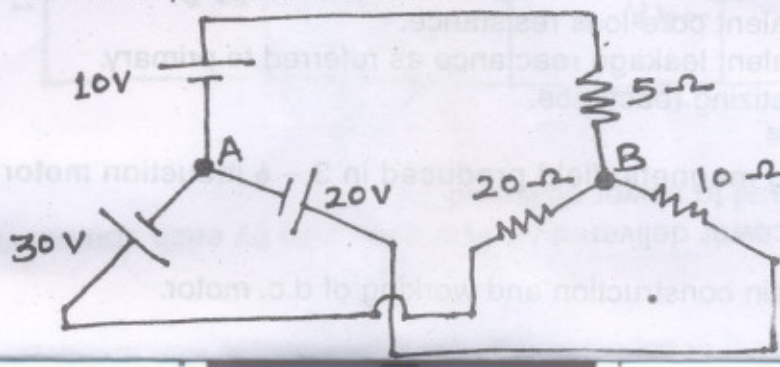
(5) Find the maximum power delivered across P-Q.
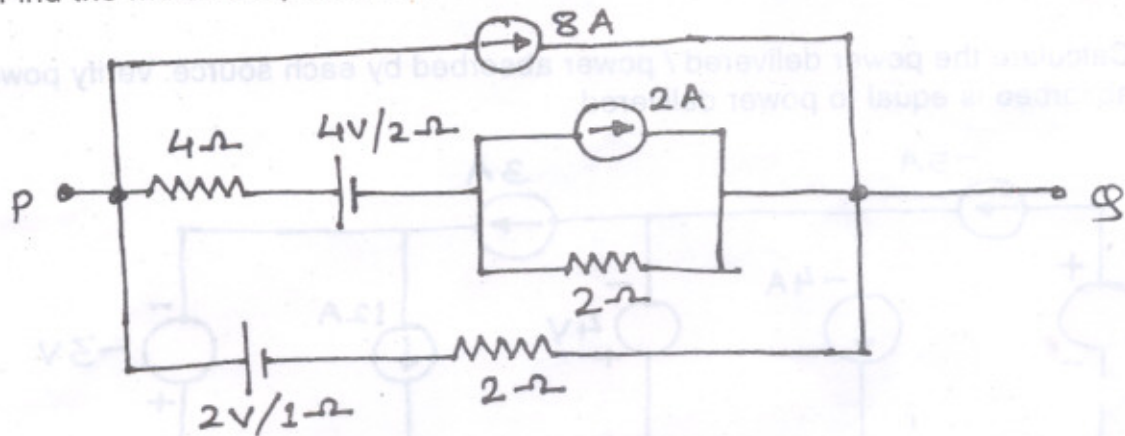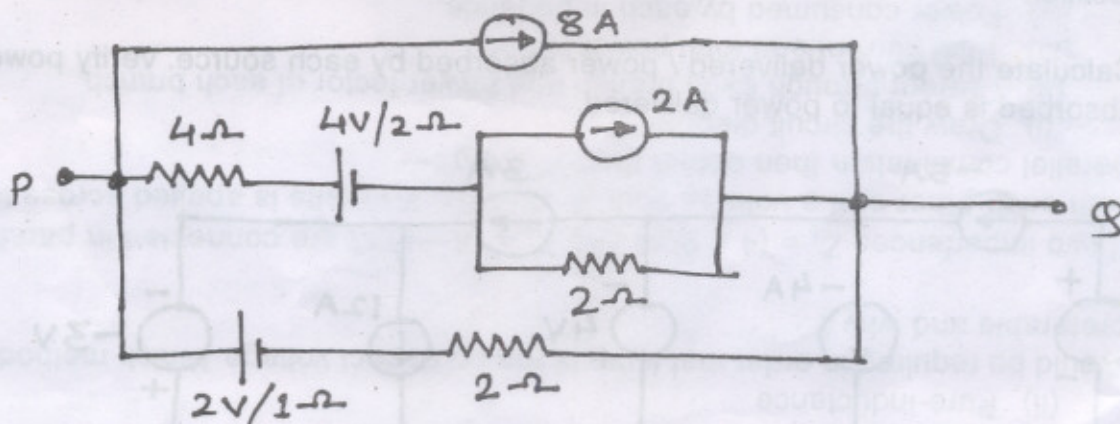

[TURN OVER

3. (a) A 120V, 60W metal filament lamp is to be operated on 220V, 50Hz supply mains. **10**
        Calculate what value of
                (i) Non-Inductive resistance
                (ii) Pure-Inductance
        Would be required in order that lamp is run on correct voltage. Which method is
        preferable and why ?

    (b) If two impedances $Z_1 = (4 + j8)\Omega$ and $Z_2 = (3 - j6)\Omega$ are connected in parallel **10**
        with each other and a voltage source of 50Hz, 230Volts is applied across the
        parallel combination then obtain the following :—
                (i) Draw the circuit diagram.
                (ii) Current through each branch and power factor of each branch.
                (iii) Total current and total power factor.
                (iv) Power consumed by each impedance.
                (v) Draw the neat phasor diagram.

4. (a) Show that only two wattmeters are sufficient to measure $3 - \phi$ power. Also state **10**
        advantages of two wattmeter method.

    (b) Draw and explain the input and output characteristic for a transistor common emitter **6**
        configuration.

    (c) Explain slip in 3-phase induction motors.   **4**

5. (a) A 15 KVA, 2200/110 V transformer has $R_1 = 1 \cdot 75\Omega$, $R_2 = 0 \cdot 0045\Omega$. The leakage **10**
        reactances are $X_1 = 2 \cdot 6\Omega$ and $X_2 = 0 \cdot 0075\Omega$. Calculate :—
                (i) Equivalent resistance referred to primary and secondary.
                (ii) Equivalent reactance referred to primary and secondary.
                (iii) Equivalent impedance referred to primary and secondary.
                (iv) Total copper loss.

    (b) Explain transformer tests to find the following parameters of transformer :—   **10**
                (i) Equivalent resistance as referred to primary.
                (ii) Equivalent core-loss resistance.
                (iii) Equivalent leakage reactance as referred to primary.
                (iv) Magnetizing reactance.

6. (a) How is rotating magnetic field produced in $3 - \phi$ induction motor ? (Explain **10**
        graphically).

    (b) Draw and explain construction and working of d.c. motor.   **10**

7. (a) Explain the working of capacitor filter using waveforms, with reference to full wave **10**
        rectifier.

2. (a) Using NORTON's th^m, find the current which would flow in a 25Ω resistance 10
connected between points 'A' and 'B'.
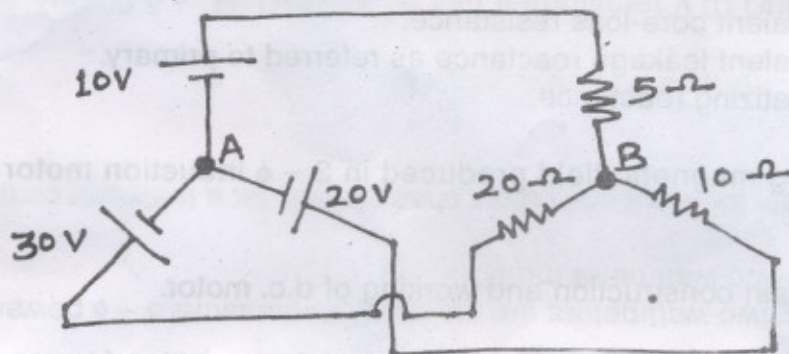
(b) Find the maximum power delivered across P-Q. 10

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Con. 2648-10.   (REVISED COURSE)   AN-9752

(3 Hours)   [Total Marks : 100]

N.B. (1) Question No. 1 is **compulsory**.
    (2) Attempt any **four** questions from remaining **six** questions.
    (3) **Figures** to the **right** indicate the **full** marks.
    (4) Assume the **suitable** data if **needed** with justification.

1. (a) If $|z - 1| < |z + 1|$ prove that Re z > 0   5
    (b) If $u = \log(\tan x + \tan y + \tan z)$. Prove that—   5

$$\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} + \sin 2z \frac{\partial u}{\partial z} = 2.$$

    (c) Find $\phi(r)$ s.t. $\nabla \phi = \frac{\bar{r}}{r^5}$ and $\phi(1) = 0$.   5

    (d) Prove that : $e^{x \cos x} = 1 + x + \frac{x^2}{2} + ...$ 5

2. (a) If $x + \frac{1}{x} = 2\cos\theta$, $y + \frac{1}{y} = 2\cos\phi$ then show that—   6

$$x^2 y^2 + \frac{1}{x^2 y^2} = 2\cos(2\theta + 2\phi)$$

    (b) Prove : $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right) = \frac{1}{2}\left(x - \frac{x^3}{3} + \frac{x^5}{5} - ....\right)$ 6

    (c) Find all the stationary points of   8
         $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$
    Determine which are maximum and minimum.

3. (a) If $a, a^2, a^3, ..., a^6$ are the roots of $x^7 - 1 = 0$ prove that   6
         $(1 - a)(1 - a^2) ..... (1 - a^6) = 7$
    (b) Test the convergence of —   6

$$\frac{3+4}{4+5}, \frac{3^2+4^2}{4^2+5^2}, \frac{3^3+4^3}{4^3+5^3}, ...$$

    (c) Verify : $(\bar{a} \times \bar{b}) \times \bar{c} = (\bar{a} \cdot \bar{c})\bar{b} - (\bar{b} \cdot \bar{c})\bar{a}$ and   8

$$\bar{a} \times (\bar{b} \times \bar{c}) = (\bar{a} \cdot \bar{c})\bar{b} - (\bar{a} \cdot \bar{b})\bar{c}$$

    For $\bar{a} = 3i - 2j + 2k$; $\bar{b} = 6i + 4j + 2k$; $\bar{c} = 3i + 2j + 4k$

[TURN OVER

4. (a) If $x = e^u$ tan v, $y = e^u$ sec v find, $\left(x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} \right) \cdot \left(x\dfrac{\partial v}{\partial x} + y\dfrac{\partial v}{\partial y} \right)$ 6

(b) Prove that the equation $2x^3 - 3x^2 - x + 1 = 0$ has one root between 1   6
and 2.

(c) Show that $\log\left(e^{i\alpha} + e^{i\beta} \right) = \log 2\cos\left(\dfrac{\alpha - \beta}{2} \right) + i\left(\dfrac{\alpha + \beta}{2} \right)$.   8

5. (a) State and prove Euler's Thm. For function of two variables.   6

(b) If $\sin(\theta + i\phi) = \tan\alpha + i\sec\alpha$ then show that —   6
$\cos 2\theta \cosh 2\phi = 3$.

(c) If $y = \cos^{-1} x$ prove that,   8
$(1 - x^2)\, y_{n+2} - (2n + 1)\, x\, y_{n+1} - n^2\, y_n = 0$

6. (a) If $y = \dfrac{\log x}{x}$ prove that   6

$y_5 = \dfrac{5!}{x^6}\left[1 + \dfrac{1}{2} + \dfrac{1}{3} + \dfrac{1}{4} + \dfrac{1}{5} - \log x \right]$

(b) Find the product of all values of $\left(\dfrac{1}{2} - \dfrac{i\sqrt{3}}{2} \right)^{\frac{3}{4}}$ 6

(c) If $u = x^3 \sin^{-1}\dfrac{y}{x} + x^4 \tan^{-1}\dfrac{y}{x}$ find the value of,   8

$x^2\dfrac{\partial^2 u}{\partial x^2} + 2xy\dfrac{\partial^2 u}{\partial x \partial y} + y^2\dfrac{\partial^2 u}{\partial y^2} + x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y}$ at $x = 1$ and $y = 1$

7. (a) Find 'a', 'b', 'c' if $\displaystyle\lim_{x \to 0} \dfrac{x(a + b\cos x) - c\sin x}{x^5} = 1$ 6

(b) State the Lagrange's Thm and give its geometrical interpretation.   6

(c) If $u = x^y$ show that $\dfrac{\partial^3 u}{\partial x^2 \partial y} = \dfrac{\partial^3 u}{\partial x \partial y \partial x}$.   8

Con. 2652-10

N. B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Q. No. **2** to **7**.
(3) Assume **suitable** data and symbols if **required**.
(4) Figures to **right** indicate **full** marks.

1. Attempt any **five** :—   15
   (a) Draw the following planes and directions in cubic cell. (101), (100), [111]
   (b) Define superconductivity and explain critical magnetic field.
   (c) Explain measurement of frequency of a.c. signal using CRO.
   (d) Explain cavitation effect and give it's two applications.
   (e) Define mobility of charge carrier and state its S.I. unit.
   (f) What are liquid crystals ? State its different phases.

2. (a) Explain atomic arrangement in diamond structure and calculate.   10
       Total number of atoms per unit cell (n)
       Atomic radius (r)
       Co-ordination number (CN)
       Atomic packing factor (APF)
       Packing efficiency (PE)
       Void space and density
   Also write the materials exhibiting diamond structure.
   (b) The critical field of niobium is 1×10^5 A/m at 8°k and 2×10^5 A/m at 0°k. Calculate   5
       critical temperature of the element.

3. (a) Explain formation of energy bands in solid and classify the solids on the basis   10
       of energy band diagram.
       A copper strip 2 cm wide and 1mm thick is placed in a magnetic field with
       B = 1·5 wb/m². If current of 200A is set up in the strip, calculate Hall Voltage
       that appears across the strip. (Given : R_H = 6×10^{-7} m³/C)
   (b) Molybdenum has a BCC structure. Its density is $1\cdot02\times10^4$kg/m³ and its atomic   5
       weight is 95·94. Determine the radius of molybdenum atom.

4. (a) Derive Bragg's law. Explain Bragg's Spectometer and its use to analyze crystal   10
       structure.
   (b) Two ships are anchored at some distance from each other. An ultrasonic signal   5
       is sent by two routes through water and air. The difference between times at
       which the signals reach the other ship is 2 seconds. If velocity of sound in
       air and water is 348 m/s and 1392 m/s respectively, find distance between
       the ships.

5. (a) Explain the structure of naturally occuring quartz crystal.   10
       With neat circuit diagram explain production of Ultrasonic waves by Piezo-
       electric oscillator.
   (b) A classroom has dimensions 20x15x5 m³. The reverberation time is 3·5 sec.   5
       Calculate the total absorption of surface and average absorption.

6. (a) What are Lissajous figures ? Explain how they are used to measure unknown frequency. **10**

   An electron travels with a velociy of 2.5×10^6 m/s in a uniform magnetic field strength of 0.94×10^{-4} wb/m^2, such that velocity vector makes an angle of $30°$ with the field direction. Determine the distance covered along the magnetic field direction in its one revolution.

   (b) Distinguish between Type–I and Type–II superconductors. **5**

7. (a) State the acoustic requirements of a good auditorium. Explain how these requirements can be achieved. **10**

   (b) If P.D. across an X-ray tube is 25kV and filament current is 10mA. Calculate number of electrons striking the target per second and velocity of electrons striking the target. **5**

Con. 2888-10.

AN-9766

(2 Hours)

[Total Marks : 75

N.B. (1) Question No. 1 is **compulsory**.
(2) Attempt any **four** questions from remaining **six**.
(3) **Figures** to the **right** indicate **full** marks.
(4) Assume **suitable** data if **necessary**.
(5) At. wts — H = 1, C = 12, O = 16, Ca = 40, Mg = 24, cl = 35·5, S = 32, Na = 23.

1. Answer any **five** : 15

    (a) Explain condensation polymerisation with suitable examples.

    (b) Find acid value of given oil whose 20 ml required 2·8 ml of $\frac{N}{10}$ KOH during titration (density of oil = 0·86 gm/ml) state whether oil is proper for lubrication or not from acid value.

    (c) Write a short note on the potential of hydrogen as a fuel.

    (d) Explain the terms :   (i) Degree of freedom   (ii) Component.

    (e) Write a short note on—Hackelites.

    (f) What is the effect of the following alloying elements on the properties of steels—
           (i) Chromium   (ii) Nickel   (iii) Manganese.

    (g). Write a short note on Reverse osmosis membrane.

2. (a) Give synthesis properties and uses of— 5
           (i) PMMA   (ii) Urea formaldehyde.

    (b) What is the principle of lubrication ? Explain mechanism of Boundary lubrication. 5

    (c) Explain the process of biogas production from biowaste. 5

3. (a) Calculate the amount of lime (85% pure) and soda (95% pure) required to soften one million litre of water which contains $CaCO_3$ = 12·5 ppm $MgCO_3$ = 8·4 ppm, $CaCl_2$ = 22·2 ppm $MgCl_2$ = 9·5 ppm, CO_2 = 33·0 ppm, HCl = 7·3 ppm, $NaHCO_3$ = 16·8 ppm. 5

    (b) (i) Define conducting polymer. Explain how polymers are made conductors with suitable examples. 5

      (ii) Write a note on glass transition phenomena.

    (c) What is fabrication ? Explain any two methods of fabrication of plastics in detail. 5

4. (a) How is activated sludge process carried out for the treatment of waste water ? Explain with flow sheet diagram. 5

    (b) Give in brief the functions of various additives employed for the improvement of lubricants. 5

    (c) A zeolite softener was completely exhausted and was regenerated by passing 100 litres of sodium chloride solution containing 120 gm per litre of NaCl. How many litres of sample of water of hardness 500 ppm can be softened by this softener ? 5

[TURN OVER

5. (a) Explain the principle and working of a photovoltaic cell with neat labelled   5
        diagram.
    (b) Describe the demineralisation process. State its advantages and   5
        disadvantages.
    (c) What is phase rule ? Discuss in brief Lead-silver equilibrium with diagram.   5

6. (a) (i) Explain shape memory effect and give its applications.   5
       (ii) Give the classification of plain carbon steels. What are the drawbacks
            of plain carbon steel ?
    (b) What are nanowires ? Describe its structure and applications.   5
    (c) Describe laser method for production of carbon nanotubes. Write   5
        applications of carbon nanotubes.

7. Write short notes on (any three) :—   15
            (a) Advanced polymer material
            (b) Liquid Lubricants
            (c) Rechargeable Nickel-Hydrogen batteries
            (d) One component system-water
            (e) Application of nanotechnology in electronics and mechanics.

F.F All (Por) Sem I / Rev   12-6-2010

Engg Mechanics.

53 : 1st half-Exm.10-Mina-(d)

Con. 2754-10.

(3 Hours)

AN-2140

[Total Marks : 100

(2 Hours)   [Total Marks : 50

N.B. (1) Question No. **1** is **compulsory**.
　　(2) Attempt any **four** questions from the remaining **six** questions.
　　(3) **Figures** to the **right** indicate **full** marks.
　　(4) **Assume** suitable additional data if **necessary** and state the same **clearly** in your answer.
　　(5) Take **g = 9·81 m/s²**.

1. Solve any **four** of the following :—　　　　　　　　　　　5
　　(a) For the **Figure** shown, find resultant force and moment at point A.
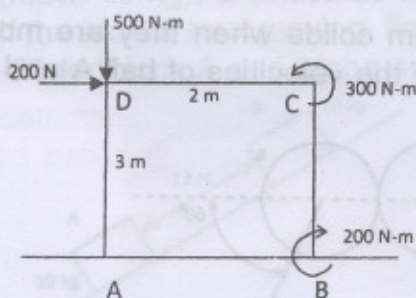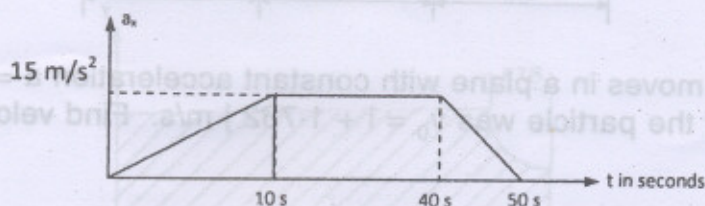

　　(b) Find forces in members AB, AE, ED, BC, CD.　　　　5
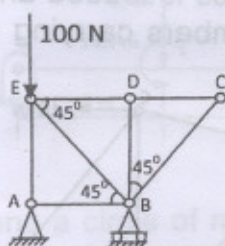
　　(c) **Figure** shows an plot of a_x versus time for a particle moving along x-axis.　5
　　　　What is the speed and distance covered by the particle after 50 seconds ?

　　(d) By what percentage the range of projectile is increased if initial velocity is　5
　　　　increased by 5% ?

　　(e) A ball is dropped from a height of 12 m upon a horizontal slab. If it rebounds　5
　　　　to height of 4 m. Find coefficient of restitution.

[TURN OVER

2. (a) Three cylinders are piled up in a rectangular channel as shown in **figure**.   **12**
        Determine the reactions at point 6 between the cylinder A and the vertical wall of
        the channel. (Cylinder A : redius = 4 cm, m = 15 kg, Cylinder B : radius = 6 cm,
        m = 40 kg, Cylinder C : radius = 5 cm, m = 20 kg).
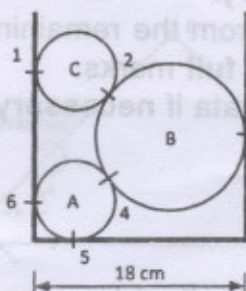

    (b) Two identical balls of 120 gm colide when they are moving with velocities as   **8**
        shown in **figure**. Determine the velocities of ball A and B completely after the
   impact. Take e = 0·8.
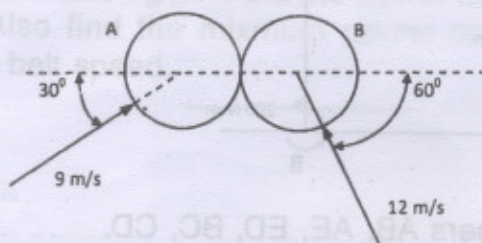
3. (a) A simply supported pin jointed truss is loaded and supported as shown in the   **12**
        following **figure**. Identify the members carrying zero force and find forces in
   members by method of joints.
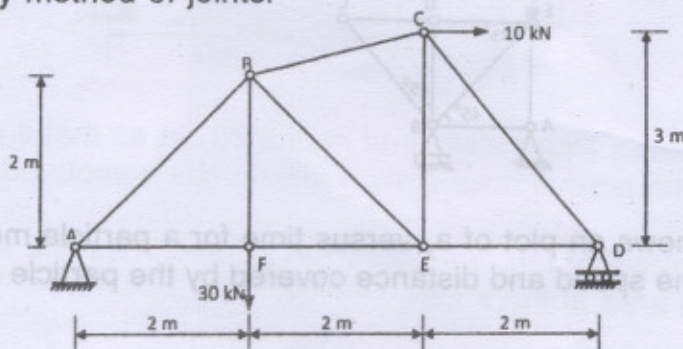
    (b) A particle moves in a plane with constant acceleration a = 4i m/s^2. At t = 0 the   **8**
        velocity of the particle was v_0 = i + 1·732 j m/s. Find velocity of the particle at
        t = 1 sec.

4. (a) Determine the tension developed in chords attached to each block and the   **12**
        accelerations of the blocks when the system shown is released from rest. Neglect
   the mass of the pulleys and chords.
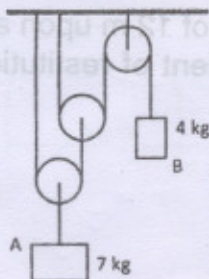
(b) The water sprinkler positioned at the base of a hill releases a stream of water **8** with a velocity of 6 m/s as shown. Determine the point B (x,y) where the water particles strike the ground on the hill. Assume that the hill is defined by the equation y = 0·2 x² m, and neglect the size of the sprinkler.
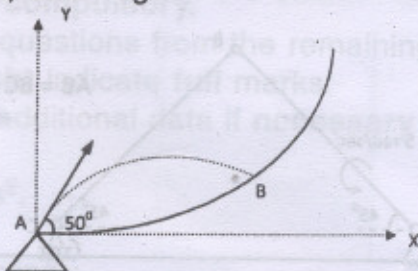

5. (a) Two blocks A (mass 10 kg), B (mass 28 kg) are separated by 12 m as shown **12** in the **figure**. If the blocks start moving, find the time 't' when the blocks collide. Assume μ = 0·25 for block A and plane and μ = 0·10 for block B and plane.
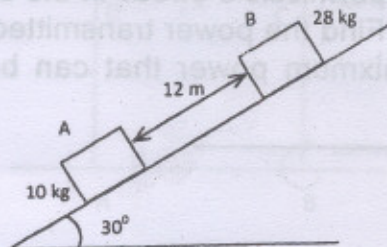
(b) Find the reactions at the supports of the beam applying conditions of equilibrium. **8**
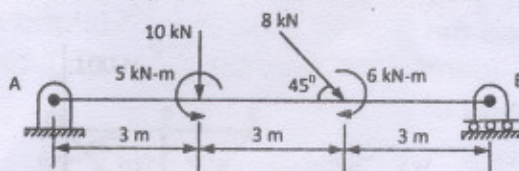
6. (a) A particle moves along a circle of radius 20 cm so that s = 20 πt² cm. Find its **8** tangential and normal acceleration after it has completed a revoluation.

(b) Find the centroid of the area shown in **figure**. Also find the moment of inertia **12** of the same area about x axis.

[**TURN OVER**
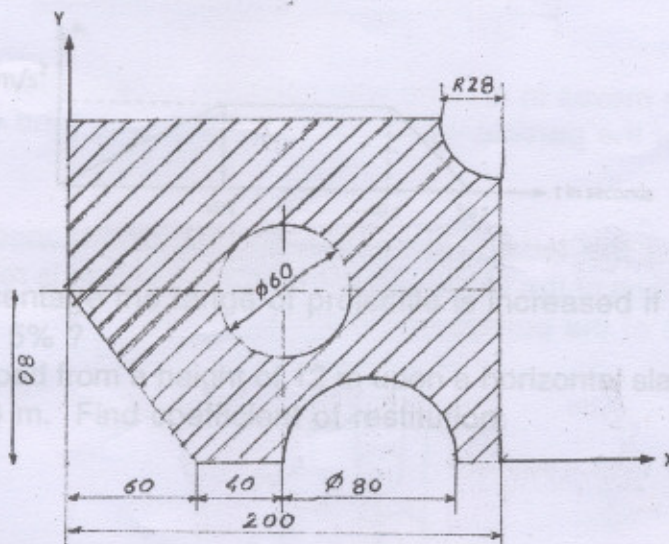
7. (a) In the mechanism shown, find velocity of point C and angular velocity of link   8
     BC if angular velocity of link AB is 4 red/sec. Solve the problem when link AB
     and link BC make angle of 45° with horizontal as shown in the **figure**.
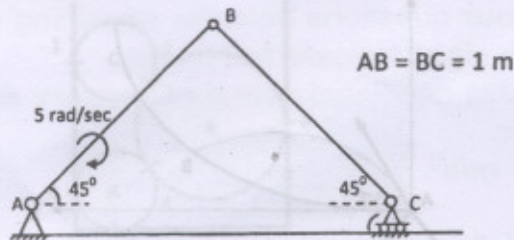
(b) A belt 120 mm wide and 8 mm thick is transmitting power at a belt speed of   12
    1400 m/min. The angle of lap of the smaller pulley is 160° and coefficient of
    friction is 0·3. The maximum permissible stress in the belt is 2 N/mm² and the
    mass of the belt is 0·8 kg/m. Find the power transmitted and the initial tension
    in the belt. Also find the mixmum power that can be transmitted and the
    corresponding belt speed.

_____

Con. 2644-10.

(3 Hours)

AN-9802

[Total Marks : 100]

N.B. : (1) Question No. **1** is **compulsory**.
    (2) Attempt any **four** questions from remaining **six** questions.
    (3) Assume any data if **required** and **state** the assumption.
    (4) Every program must be **properly** commented.

1. (A) Select the correct answer :–   10
        (a) I = 10 ;
           do
           {
               .... do something ......
           } while (I < 10) ;
           (i) "do something" will be executed at least once
           (ii) "do something" will not be executed at all
           (iii) do-while loop is not a valid loop
           (iv) None of the above.

        (b) Int a = 29, b = 10 ; float c ;
           c = (float) (a/b) ;
           The correct value of c is
           (i) 2·9
           (ii) 2
           (iii) 3
           (iv) Compiler dependent.

        (c) #define square (A) A * A
           a = square (2 + 3)
           value of a will be
           (i) 25
           (ii) 13
           (iii) 11
           (iv) 10

        (d) Two static variables are declared in one file with the same name. One
           of them is global, another is local to a function. Then
           (i) Compiler will give syntax error
           (ii) Local static variable will be ignored
           (iii) Global variable will be ignored
           (iv) None of the above.

        (e) Int * P, i[3] ;
           i[0] = 0 ; i[1] = 1 ; i[2] = 2 ;
           P = &i[1] ;
           What is the value of expression * P++ ?
           (i) 0
           (ii) 1
           (iii) 2
           (iv) undefined.

    (B) What is object oriented programming ? How it is different from procedure oriented 10
        programming ? Write the difference in two column format.

[TURN OVER

2. (a) Write a program in C++ to convert a given integer to binary format. (Use of class 10 is optional) Write output of your program for two different type of inputs.

   (b) What are the different types of inheritance ? Explain each with example.   10

3. Create a class "matrix". Define member functions for following operations :–   20
       (a) Reading matrix elements
       (b) Printing a matrix
       (c) Addition of two matrices
       (d) Multiplication of two matrices
       (e) Transpose of a matrix.
   Write main() to create objects of class matrix. Invoke all the above functions in main (). Write the output of your program. The program should have comment statement for every function.

4. (a) Write a program to display following pattern using nested for loops.   10

       P
       P   Q
       P   Q   R
       P   Q   R   S
       P   Q   R   S   T

   (b) Explain storage classes giving example for each class.   10

5. (a) Write a program to create two base classes B1 and B2, each of which is publicity 10 inherited by derived class D. Use parameterised constructor and a destructor function in each class and demonstrate the order of execution of constructors.

   (b) What is a pointer ? How will you declare and initialize a pointer ? Write a program 10 to swap two integers using pointers and using reference variables. The program should have two different functions. (Use of class is optional).

6. (a) Write a program to find whether a given string is a palindrome or not.   10
   (b) Write the rules for operator overloading.   5
   (c) What are the characteristics of a friend function ?   5

7. Distinguish between the following :–   20
       (a) Virtual function and Virtual class
       (b) Overloading and Overriding
       (c) Data abstraction and data encapsulation
       (d) ios member functions and manipulators.