Total Marks: 80   **Hours: 3 hrs**

Note: 1. Question no. **1** is compulsory.
2. Attempt any **three** questions out of remaining **five** questions.

Q.1. [a] Evaluate $\int_0^\infty 5^{-4x^2}\, dx$. [3]

[b] Solve $\frac{dy}{dx} = xy$ with the help of Euler's method, given that y (0) = 1, and find y when x = 0.3 (h = 0.1). [3]

[c] Evaluate $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = 0$. [3]

[d] Evaluate $\int_0^1 \sqrt{\sqrt{x} - x}\, dx$. [3]

[e] Solve $(1 + \log xy)dx + \left(1 + \frac{x}{y}\right) dy = 0$. [4]

[f] Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{dxdy}{1+x^2+y^2}$. [4]

Q.2.[a] Solve $xy(1 + xy^2)\frac{dy}{dx} = 1$. [6]

[b] Find the area inside the circle $r = a\sin\theta$ and outside the cardioide $r = a(1 + \cos\theta)$. [6]

[c] Apply Runge-kutta Method of fourth order to find an approximate value of y when x = 0.2 given that $\frac{dy}{dx} = x + y$ when y = 1 at x = 0 with step size h = 0.2. [8]

Q.3.[a] Show that the length of the curve $9ay^2 = x(x-3a)^2$ is $4\sqrt{3}\, a$. [6]

[b] Change the order of the integration of $\int_0^1 \int_{-\sqrt{2y-y^2}}^{1+\sqrt{1-y^2}} f(x,y)\, dx\, dy$. [6]

[c] Find the volume of the paraboloid $x^2 + y^2 = 4z$ cut off by the plane z = 4. [8]

Q.4. [a] Show that $\int_0^1 \frac{x^a-1}{\log x}dx = \log(a+1)$. [6]

[b] If y satisfies the equation $\frac{dy}{dx} = x^2y - 1$ with $x_0 = 0$, $y_0 = 1$, using Taylor's Series Method find y at x=0.1 (take h=0.1). [6]

[c] Find the value of the integral $\int_0^1 \frac{x^2}{1+x^3}dx$ using (i) Trapezoidal rule (ii) Simpson's 1/3rd rule (iii) Simpson's 3/8th rule. [8]

Time: 2 hours **Marks: 60**

N. B. 1) Question no **1** is **compulsory**.
  2) Attempt any **three** questions from **Q.2 to Q.6**
  3) Assume suitable data wherever required.
  4) Figures on the **right** indicates **marks**.

1   Attempt **any five** 15
 a Why X-rays are used to study the crystal structure?
 b Calculate the frequency and wavelength of photon whose energy is 75eV.
 c Draw the energy band diagram of p-n junction diode in forward and reverse bias condition.
 d "Superconductor is a perfect diamagnetic", Explain.
 e What is reverberation time? How is it important? Write the factor affecting reverberation time.
 f A quartz crystal of thickness 1.5mm vibrating with resonance. Calculate it's fundamental frequency if the Young's modulus of quartz crystal is $7.9 \times 10^{10} N/m^2$. and density is $2650 kg/m^3$.
 g Mobility's of electron and hole in a sample of Ge at room temperature are $0.36 \ m^2/V\text{-sec}$ and $0.17 m^2/V\text{-sec}$. respectively. If electron and hole densities are equal and it is $2.5 \times 10^{13}/cm^3$, calculate its conductivity.

2 a Arrive at Heisenberg's uncertainty principle with single slit electron diffraction. 4
   An electron has a speed of 300m/sec. with uncertainty of 0.01%. Find the accuracy in its position. 4
 b Write the Fermi Dirac distribution function and terms in it. 7
   What is the probability of an electron being thermally excited to the conduction band in Si at 30^0C. The band gap energy is 1.12eV.

3 a With neat diagram of unit cell, explain the structure of NaCl crystal and calculate the no of ions per unit cell, coordination no. and lattice constant. Calculate the packing factor of NaCl crystal assuming the radius of Na^+ is $0.98A^0$ and radius of Cl^- is $1.81A^0$. 8
 b State the Hall effect. Derive the expression for Hall voltage and Hall coefficient with neat diagram. 7

4 a What is working principle of SQUID? Explain how it is used to detect the magnetic field? 5
 b A hall of dimensions $25 \times 18 \times 12 m^3$ has an average absorption coefficient 0.2. Find the reverberation time. If a curtain cloth of area $150 m^2$ is suspended at the Centre of hall with coefficient of absorption 0.75, What will be the reverberation time? 5
 c State the piezoelectric effect. With neat circuit diagram explain the principle and working of piezoectric oscillator. 5

5   a   With energy band diagram, explain the variation of Fermi energy level with   5
        impurity concentration in extrinsic semiconductor.
    b   Explain with example how to determine crystal structure by Bragg's X-ray   5
        spectrometer.
    c   Obtain one dimensional time independent Schrodinger equation.   5

6   a   Define ligancy and critical radius ratio. Calculate critical radius ratio for 5
        ligancy 8.
    b   What is the significance of wave function? Derive the expression for energy   5
        eigen values for free particle in one dimensional potential well.
    c   What is photovoltaic effect? Explain the principle and working of Solar cell.   5

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Q.P. Code : 37759

[Time: 2 Hours] **[Marks: 60]**

Please check whether you have got the right question paper.

N.B:
1. Question.No.1 is compulsory.
2. Attempt any three questions from the remaining five.
3. All questions carry equal marks.
4. Figures to the right indicate full marks.
5. Atomic weights : H = 1, Mg = 24, Ca = 40, C = 12, O = 16, N = 14, S = 32, Cl = 35.5 , Na = 23

Q.1.   Attempt any five from the following :- 15
a) Discuss the drawbacks of natural Rubber.
b) Explain disinfection of water by addition of bleaching Powder.
c) What are the limitations of Phase Rule?
d) Discuss fullerenes. Give its applications.
e) Write a note on Greases.
f) A 10ml of sample of water was refluxed with 20ml potassium dichromate solution and after refluxing, the excess unreacted dichromate required 26.2ml of 0.1M FAS solution. A blank 10ml of distilled water on refluxing with 20ml of dichromate solution required 36ml of 0.1M FAS solution. Calculate the COD of waste water.
g) Discuss the role of Polymers in Medicine and surgery.

Q.2. a)   Calculate the amount of lime (85% pure) and Soda (95% pure) required to soften one million liter of water which contains $CaCO_3$ = 12.5ppm, $Mg\,CO_3$ = 8.4ppm, $CaCl_2$ = 22.2ppm, $MgCl_2$ =9.5 ppm, CO_2 = 33ppm, HCl = 7.3ppm, Organic matter = 16.8ppm. 6

b) i) Give the preparation, properties and uses of Kevlar. 3

   ii) Define Cloud Point and Pour Point of a lubricant. 2

c)   Write a note on Decay of Concrete. 4

Q.3. a)   Define Moulding. List the different techniques of moulding. Explain injection moulding with the help of neat diagram. 6

b) i) Explain the term 'Phase' with appropriate examples. 3

   ii) Discuss the role of gypsum during the manufacturing of Portland cement. 2

c)   Calculate the total hardness in ppm, in given water sample. 4
   : 50ml of standard hard water, containing 1mg pure $CaCO_3$ per ml consumed 20ml EDTA solution.
   : 50ml of water sample consumed 30ml EDTA solution using EBT indicator.

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Q.4. a) Explain the zeolite method for softening of water giving suitable diagram and reactions. What are the limitations of this method. 6

b) i) 6gms of oil was saponified with 50ml of 0.5N alcoholic KOH solution. After refluxing for 2 hours the mixture was titrated with 25ml 0.5 N HCl. Find the saponification value of Oil. 3

ii) Distinguish between the wet and Dry process for manufacturing of Portland cement. 2

c) Discuss the following additives in compounding of plastics. 4
: Fillers   : Plasticizers

Q.5. a) Write notes on : (any two) 6
: Glass transition temperature : Buna – S rubber   : Vulcanisation

b) i) Distinguish between : BOD and COD. 3

ii) Define Oilness. What is its significance. 2

c) Discuss the application of Phase Rule to the one component system based on : 4
Diagram , triple point

Q.6. a) Define lubricants and lubrication. Mention the various mechanisms involved in lubrication of machines. Discuss boundary lubrication. 6

b) i) What is reduced or condensed Phase Rule. 3

ii) Discuss Reverse Osmosis. 2

c) What are carbon nanotubes. What are its types. Discuss the laser method for its production. 4

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FE / Sem-I [Choice Based] / Engineering Mechanics/

May - 2018

[Time : 3 hours]   Marks: 80

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

(2) Attempt any 3 questions from remaining five questions

(3) Assume suitable data if necessary, and mention the same clearly.
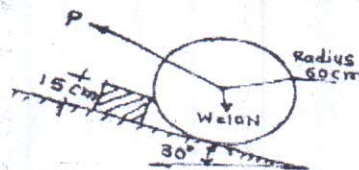
(4) Take g=9.81m/s^2, unless otherwise specified.

Q1 a) Find fourth force (F4) completely so as to give the resultant of the system of   4
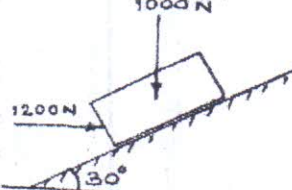   force as shown in figure.
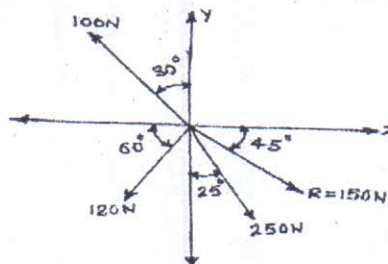
    b) Determine the magnitude and direction of the smallest force 'P' requied to start   4
        the wheel W=10N over the block

    c) If a horizontal force of 1200N is applied to block of 1000N, then block will be   4
        held in equilibrium or slide down or move up? Take μ=0.3

    d) Starting from rest at S=0, a car travels in a straight line with an acceleration as   4
        shown by the a-s graph. Determine the car's speed when S=20m, S=100m and
   S=150m

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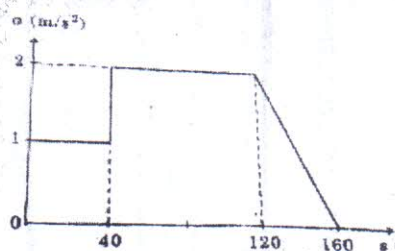
e) Three m1, m2 and m3 of masses 1.5kg,2kg and 1kg respectively are placed on a   4
rough surface with coeff. Of friction 0.20 as shown. If a force 'F' is applied to
accelerates the blocks at 3m/s². What will be the force that 1.5kg block exerts on
2kg block.
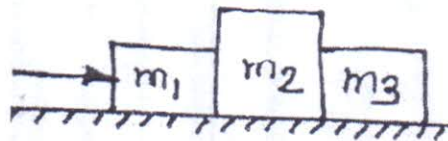
Q2 a)   A dam is subjected to three forces as shown in fig. Determine the single   6
equivalent force and locate its point of intersection with base AD
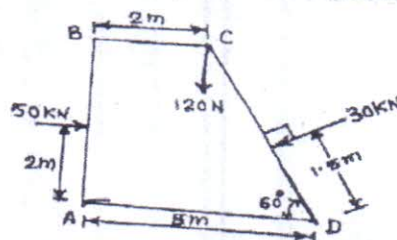
b)   A cylinder weighing 1000N and 1.5m diameter is supported by a beam AB of   8
length 6m and weight 400N as shown. Neglecting friction at the surface of
contact of the cylinder . Determine i) Wall reaction at 'D' ii) Hinged reaction
at support 'A' iii) Tension in the cable BC
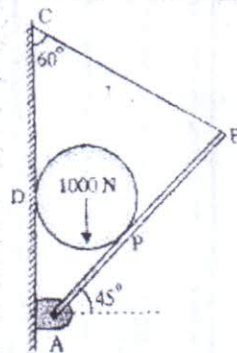
c)   Two balls of 0.12kg collide when they are moving with velocities 2m/sec and 6   6
m/sec perpendicular to each other as shown in fig. If coefficient of restitution
between 'A' and 'B' is 0.8 determine the velocity of 'A' and 'B' after impact

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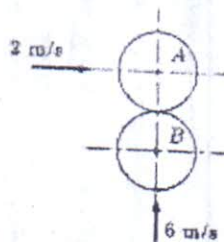
**Q3** a) Find the centroid of the shaded portion of the given area shown in figure.   8
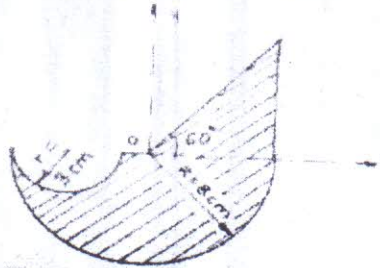
  b) Knowing that the tension in AC is T_2= 20KN. Determine required values   6
      T_1(tension in AB) and T_3(tension in AD) So that the resultant of the three forces
   at 'A' is vertical. Also calculate this resultant.
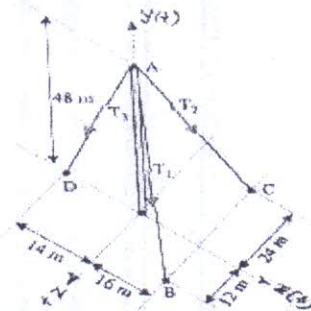
  c) Fig. shows a collar of mass20Kg which is supported on the smooth rod. The   6
      attached sprigs are both compressed0.4m when d=0.5m.Determine the speed of
      the collar after the applied force F=100N causes it to be displaced so that
      d=0.3m, Knowing that collar is at rest when d=0.5m
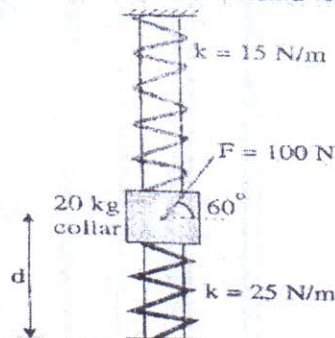
**Q4** a) Find the support reactions at point 'A' and 'B' of the given beam   8

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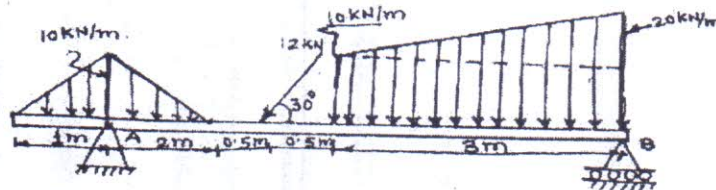
b) The motion of the particle is defined by the relation a=(0.8t)m/sec² where' t' is measured in sec. It is found that at X=5m,V=12m/sec when t=2sec. Find the position and velocity at t=6sec.   6

c) Rod EB in the mechanism shown in fig. has angular velocity of 4 rad/sec at the instant shown in counter clockwise direction. Calculate i)angular velocity of rod AD ii) velocity of collar 'D' iii) Velocity of point 'A'   6
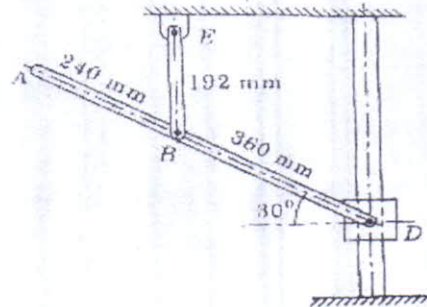

Q5 a) A simply supported pin jointed truss is loaded and supported as shown in fig. i) Identify the members carrying zero forces ii) Find support reactions iii) Find forces in members CD,CG,FG and CF using method of section.   8
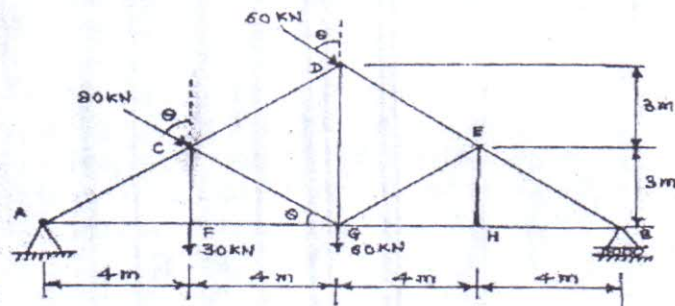

b) A jet of water discharging from a nozzle hits a vertical screen placed at a distance of 6m from the nozzle at a height of 4m. When the screen is shifted by 4m away from the nozzle from its initial position the jet hits the screen again at the same point. Find the angle of projection and velocity of projection of the jet at the nozzle.   6


Page 4 of 5
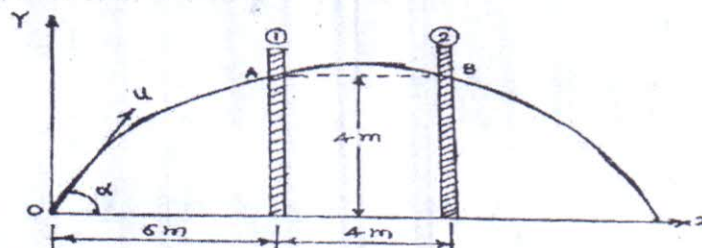
c) In a crank and connecting rod mechanism the length of crank and connecting   6
rod are 300mm and 1200mm respectively. The crank is rotating at 180rpm. Find
the velocity of piston, when the crank is at an angle of 45^0 with the horizontal
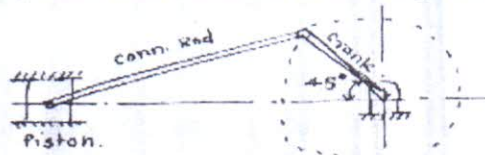
Q6 a) Force F=80i+50j- 60k passes through a point A(6,2,6). Compute its moment   4
about a point B(8,1,4)

b) A horizontal force of 5KN is acting on the wedge as shown in fig. The   8
coefficient of friction at all rubbing surfaces is 0.25. Find the load 'W' which
can be held in position. The weight of block 'B' may be neglected.
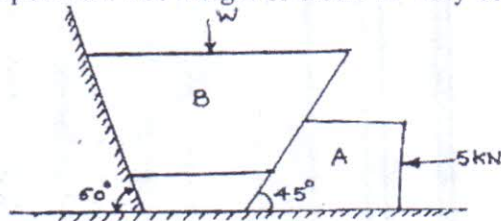
c) The stiffness of the spring is 600N/m. Find the force 'P' required to maintain   4
equilibrium such that $\Theta=30^0$.The spring is unstretched when $\Theta =60^0$ Neglect
weight of the rods. Use method of virtual work
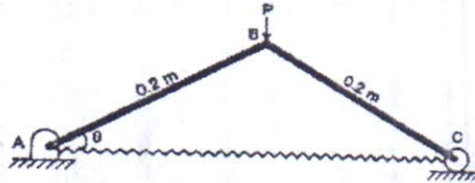
d) Two masses are interconnected with the pulley system. Neglecting frictional   4
effect of pulleys and cord, determine the acceleration of mass m2. Take
m1=50kg and m2=40kg.

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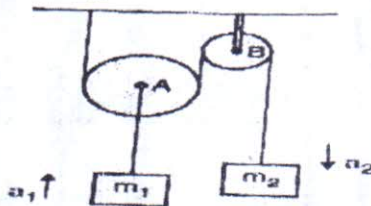
Q.P. Code : 25676

(3 Hours) | Total Marks : 80

N.B. : (1) Question No.1 is compulsory.
  (2) Solve **any three** from remaining questions.
  (3) Assume suitable **data** if **necessary**.
  (4) **Figures** to the **right** indicate **full marks**.

1. Answer **any Five** :   20
  (a) What is the difference between ideal source and actual source? Illustrate the concept using the V-I characteristics of voltage and current source.
  (b) In a balanced three phase circuit the power factor is 0.866. What will be the ratio of two wattmeter reading if the power is measured using two wattmeters.
  (c) Calculate R_{AB}.
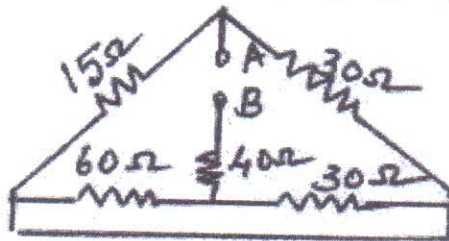
  (b) Derive the equation for resonance frequency for a parallel circuit in which a capacitor is connected in parallel with a coil having resistance R and inductive reactance X_L. What is the resonance frequency if inductor is ideal?
  (e) What are the classifications of DC motor? Specify one application for each one.
  (f) Derive emf equation of a single phase transformer.

2. (a) Using mesh analysis find current through 5Ω.   08
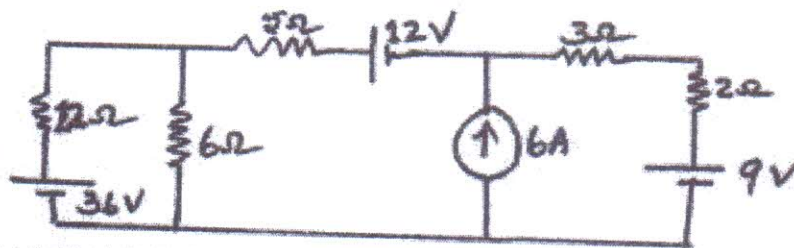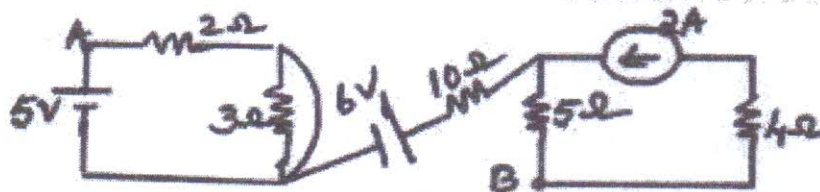

  (b) An emf of 250 V is applied to an impedance $Z_1 = (12.5 + j20)Ω$. An impedance   08
  Z_2 is added in series with Z_1, the current become half of the original and lead the supply voltage by 20°. Determine Z_2.

TURN OVER

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(c) Determine the potential difference V_{AB} for the given network.   04

3. (a) When a voltage of 100 V, 50 Hz is applied to an impedance A current taken is 8   08
A lagging and power is 120 W. When it is connected to an impedance B the
current is 10 A leading and power is 500 W. What current and power will be
taken if it is applied to the two impedances connected in series.

(b) Find current through 10 Ω using Thevenin's theorem.   08
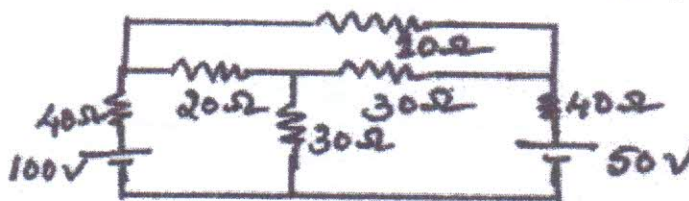
(c) With the help of equivalent circuit of a single phase transformer show how total   04
copper loss can be represented in primary of a transformer.

4. (a) Find V_1 using super position theorem.   08
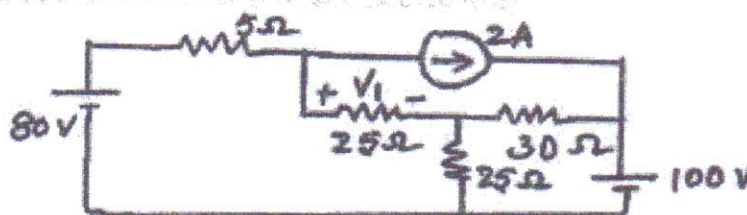
(b) In an R-L-C parallel circuit the current through the resistor, inductor (pure) and   04
capacitor are 20 A, 15 A and 40 A respectively. What is the current taken from
the supply? Draw phasor diagram.

(c) Two sinusoidal sources of emf have rms value E_1 and E_2. When connected in   08
series, with a phase displacement α the resultant voltage read on an
electrodynamometer voltmeter is 41.1 V and with one source reversed 17.52 V.
When the phase displacement made zero a reading of 42.5 V is observed.
Calculate E_1, E_2 and α.

TURN OVER

5. (a) Prove that the power in a balanced three phase delta connected circuit can be deduced from the readings of two wattmeter. Draw relevant connections and vector diagrams. Draw a table to show the effect of power factor on wattmeter. **08**

(b) A 5 kVA 200/400, 50 Hz single phase transformer gave the following test results. **08**

OC test on LV side	200 V	0.7 A	60 W
SC test on HV side	22 V	0.16 A	120 W

   (i) Draw the equivalent circuit of the transformer and insert all parameter values.

   (ii) Efficiency at 0.9 pf lead and rated load.

   (iii) Current at which efficiency is maximum.

(c) Prove that if the phase impedances are same, power drawn by a balanced delta connected load is three times the power drawn by the balanced star connected load. **04**

6. (a) Three identical coils each having a reactance of 20 Ω and resistance of 10 Ω are connected in star across a 440 V three phase line. Calculate for each method : **08**

   (i) Line current and phase current.

   (ii) Active, reactive and apparent power.

   (iii) Reading of each wattmeter connected to measure the power.

(b) A series resonant circuit has an impedance of 500 Ω at resonant frequency. The cut of frequency observed are 10 kHz and 100 Hz. Determine : **06**

   (i) Resonant frequency.

   (ii) Value of R, L and C.

   (iii) Q factor at resonance.

(c) Draw and illustrate transformer phasor diagram for lagging power factor. **06**

———————————

N.B: **QUESTION NO 1 IS COMPULSARY AND ATTEMPT ANY THREE QUESTION FROM REMAINING.**

Answer any five question from following . [15 Marks]

1.A. What is mean by E pollution?

1.B. Explain concept of carbon credit.

1.C. explain the concept of ecological pyramid.

1.D. Differentiate between conventional and non conventional energy

1.E. Explain food chain.

1.F. Explain causes and effect of Ozone layer depletion.

1.G. Explain the concept of acid rain.

Answer any three question from following .

2. [15 Marks]

A. Explain various modes needed for public awareness to protect earth from environmental degradation .

B. Explain need and importance of Environmental studies?

C. Explain the classification of ecosystem.

3 [15 Marks]

.A. How electricity is generated by using wind energy?

B. State and explain principal, construction and working of flat plate collector used for solar energy.

C. What are the limitations of conventional sources of energy?

4. [15 Marks]

A. What are green buildings? what are the advantages of green structure?

B.. Discuss various indoor air pollutants

C. What is the role of disaster management?

5. [15 Marks]

A. Discuss briefly about green house effect.

B. What are the main causes of soil degradation?

C. What are the measures to control the global worming ?

6. [15 Marks]

A. Discuss the role of 3R in sustainable development.

B. How increasing population is exerting extra pressure on land and mineral resource discuss.

C. What do you mean by land filling? Explain briefly.