

F.E. Sem-I 15/05/06
Applied Mathematics-I
 [REVISED COURSE]

CON/2662-06.

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No.1 is compulsory.
 (2) Attempt any four out of remaining six questions.
 (3) Figures to the right indicate full marks.

1. a). Prove that 05
 $16\sin^3\theta = \sin 5\theta - 5\sin 3\theta + 10\sin\theta$
- b) If $u = f(2x-3y, 3y-4z, 4z-2x)$, prove that, 05
 $\frac{1}{2} \frac{\partial u}{\partial x} + \frac{1}{3} \frac{\partial u}{\partial y} + \frac{1}{4} \frac{\partial u}{\partial z} = 0$
- c) Given the segment of the parabola $y = x^2$ in (1,3), find the point at which the tangent is parallel to the chord. 05
- d) If $y = x^2 e^x$ then show that, 05
 $y_n = \frac{1}{2} n(n-1)y_2 - n(n-2)y_1 + \frac{1}{2} (n-1)(n-2)y$
2. a) If $a = \cos\alpha + i\sin\alpha$, $b = \cos\beta + i\sin\beta$, $c = \cos\gamma + i\sin\gamma$ 06
 prove that,

$$\frac{(a+b)(b+c)(c+a)}{abc} = 8 \cos\left(\frac{\alpha-\beta}{2}\right) \cos\left(\frac{\beta-\gamma}{2}\right) \cos\left(\frac{\gamma-\alpha}{2}\right)$$
- b) Prove that 08
 $(1 + e^{i\theta})^{-1/2} + (1 - e^{i\theta})^{-1/2} = \sqrt{1 + \operatorname{cosec}(\theta/2)}$
- c) Given $u = e^{r\cos\theta} \cos(r\sin\theta)$, $v = e^{r\cos\theta} \sin(r\sin\theta)$ 06
 Prove that,

$$\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta} \quad \text{and} \quad \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$$
3. a) Find the equation of the oscillating plane and the normal plane to the 06
 curve $x = 2 \cosh(t/2)$, $y = 2 \sinh(t/2)$, $z = 2t$ at $t=0$
- b) if $\mathbf{r} = a \cos t \mathbf{i} + a \sin t \mathbf{j} + at \tan \alpha \mathbf{k}$, 06
 Find the value of: i) $\left| \frac{d\mathbf{r}}{dt} \times \frac{d^2\mathbf{r}}{dt^2} \right|$
 ii) $\frac{d\mathbf{r}}{dt} \cdot \frac{d^2\mathbf{r}}{dt^2} \times \frac{d^3\mathbf{r}}{dt^3}$
- c) If $z = f(u, v)$, where $u = x^2 - 2xy - y^2$ and $v = y$, show that, 08
 $(x+y) \frac{\partial z}{\partial x} + (x-y) \frac{\partial z}{\partial y} = 0$ is equivalent to
 $\frac{\partial z}{\partial v} = 0$
4. a) Show that the curvature equals the torsion for the curve 08
 $\mathbf{r} = 3t \mathbf{i} + 3t^2 \mathbf{j} + 2t^3 \mathbf{k}$
- b) If $e^z = \sin(u+iv)$, where $z = x+iy$, prove that, 06
 $2e^{2x} = \cosh 2v - \cos 2u$
- c) Prove that, 06
 $\tan^{-1} [i(x-a)/(x+a)] = i \log(x/a)$

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5. a) If $y = \frac{x^2}{(2x^2 + 7x + 6)}$, Find y_n 06
- b) Prove that, 06
- i) $\sin^{-1} z = \frac{1}{i} \log [iz + \sqrt{(1-z^2)}]$
- ii) $\tanh^{-1} x = \sinh^{-1} \{x/\sqrt{(1-x^2)}\}$
- c) State the Euler's theorem and verify 08
- $$x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$$
- for the function
- $$u = \log[(xy + yz + zx)/(x^2 + y^2 + z^2)]$$
6. a) Verify the Rolle's theorem for, 06
- $$f(x) = \frac{\sin x}{e^x} \quad \text{in } [0, \pi]$$
- b) Show that, 08
- $$\log(1+e^x) = \log 2 + \frac{x}{2} + \frac{x^2}{8} - \frac{x^4}{192} + \dots$$
- c) Evaluate 06
- $$\lim_{x \rightarrow 0} \frac{e^x \sin x - x - x^2}{x^2 + x \log(1-x)}$$
7. a) If $u = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$ 06
find the extreme values, if any, of the function.
- b) If $u = \tan^{-1}(y/x)$, where $x = e^t - e^{-t}$ and $y = e^t + e^{-t}$, 06
Find the total differential coefficient $\frac{du}{dt}$.
- c) The diameter and the altitude of a can in the shape of a right circular cylinder are measured as 4 cm and 6 cms respectively. The possible error in each measurement is 0.1 cm. Find approximately the possible errors in the values computed for volume and lateral surface. 08

P.E. Sem-I 19/5/06
Applied Sciences-I
 (REVISED COURSE)

(3 Hours)

{Total Marks : 100

Section I

- N.B. :** (1) Questions No. 1 is **compulsory**.
 (2) Answer any **two** from Q. Nos. 2 to 5.
 (3) Assume **suitable** data if **required**.
 (4) **Figures** to the **right** indicate **full** marks.

1. Answer any **four** :-
 - (a) Explain in short – 5
 - (i) Ligancy (iv) Fermi energy
 - (ii) Single crystal (v) Natural frequency of the crystal.
 - (iii) Lattice parameters
 - (b) What are the atomic planes ? 5
 Sketch the planes (3 2 1) (1 2 3) and directions [2 1 0] [1 1 1].
 - (c) Discuss diamond crystal structure. 5
 - (d) What are the energy band in the solids ? Discuss the formation of energy bands with suitable example. 5
 - (e) Show that electron traces a parabolic path when passes through an electric field perpendicular to the electron velocity. The field is formed between two conducting plates of length 'l' and separated by a distance 'd'. 5
 - (f) Explain the various axes and possible cuts in natural crystal of quartz. 5
2. (a) What are the miller indices ? 7
 Derive an expression for interplaner spacing for the planes having h k l as the miller indices.
 (b) How many atoms per mm² surface area are there in (1 0 0) (1 1 0) and (1 1 1) plane for Copper which has FCC structure and lattice constant a = 3.61 Å. 8
3. (a) What is the net charge on P type and N type semiconductor ? Justify your answer. Explain the construction and working PNP transistor with proper biasing. 7
 (b) Explain with circuit diagram production of ultrasonic using quartz crystal. Find the echo time of ultrasonic pulse travelling with velocity 5.9×10^3 m/sec in a mild steel whose correct thickness displayed by gauge is 18 mm. 8
4. (a) Electrons initially at rest are accelerated by potential difference of 50 V. Then they pass through an electric field and a magnetic field at right angle to each other and also at right angles to the electron beam. Electron beam emerge out of field in a straight path. The electric field was found to be 5 KV/m and magnetic field was 1.19 Wb/m² calculate their specific charge. 7
 (b) When electron is moving in the parallel electric field between two parallel conducting plate separated by distance 'd' and connected to the potential V_A find expression for : 8
 - (i) Acceleration on electron at any time 't'
 - (ii) Velocity of electron at any time 't'
 - (iii) Distance of electron from negative plate at any time 't'
 - (iv) Velocity at any distance 'x'
 - (v) Velocity with which electron strikes on the positive plate.
 - (vi) Total time taken for the journey of electron.
 Assuming that electron is at negative plate at time $t = 0$.
5. Write short notes on any **three** : 15
 - (a) Wave particle duality of matter and debroglies hypothesis
 - (b) Applications of C.R.O.
 - (c) Applications of ultrasonic
 - (d) Velocity selector.

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Section II

- N.B. :** (1) Answer of each **Section** should be written on **separate** answer sheet.
 (2) Questions No. 6 is **compulsory**.
 (2) Attempt any **two** from remaining **four** questions.
 (4) **Figures** to the **right** indicate **full** marks.
 (3) Assume **suitable** data if **necessary**.
 (4) At. Wt. (**Ca = 40, Mg = 24, H = 1, O = 16, C = 12, Cl = 35.5, S = 32, K = 39, Si = 28**).

6. Answer any **six** of the following :- 18
- What is hardness of water ? Distinguish between alkaline and non-alkaline hardness.
 - Write the preparation, properties and uses of poly propylene.
 - Find out temporary, permanent and total hardness in a sample of water with following impurities :

(i) Ca (HCO ₃) ₂ = 81 ppm	(iv) MgSO ₄ = 60 ppm
(ii) MgCO ₃ = 84 ppm	(v) KCl = 30 ppm
(iii) CaCl ₂ = 22.2 ppm	
 - Explain the term photochemical smog. How does it influence the environment ?
 - Distinguish between thermoplastics and thermosetting resins.
 - 20 ml. of a lubricating oil was dissolved in alcohol. Solution was titrated against 0.1 N KOH solution. At the end point burette reading was found to 2.5 ml. Calculate the acid value of the oil. (density of oil = 0.86 gm/ml)
 - What are blended oils ? How are they superior to vegetable and mineral oils ?
7. (a) A water sample on analysis gave the following data : 7
- | | |
|-------------------------------------|---------|
| (i) MgCl ₂ | 95 ppm |
| (ii) CaSO ₄ | 272 ppm |
| (iii) MgSO ₄ | 120 ppm |
| (iv) H ₂ SO ₄ | 49 ppm |
| (v) SiO ₂ | 4 ppm. |
- Calculate the lime and soda requirement in kg. for the softening of 10,000 liters of water if it is given that lime is 85% pure and soda is 90% pure. 9
- (b) Write short notes on the following :
- Condensation polymerization
 - Caustic-embrittlement
 - Boundary layer lubrication.
8. (a) Write the synthesis, properties and uses of any **one** of the following : 7
- | | |
|-------------------------|-------------------------|
| (i) Phenol formaldehyde | (ii) Urea formaldehyde. |
|-------------------------|-------------------------|
- (b) Explain following properties of lubricant : 9
- Viscosity and viscosity index
 - Flash point and fire point temperature
 - De-emulsification
- What are their importances ?
9. (a) What are Zeolites ? Explain theory, procedure and limitations of Zeolite process for softening of water with the help of a neat diagram. 7
- (b) Write short notes on the following : 9
- Transfer moulding
 - B.O.D. and C.O.D.
 - Phosphate conditioning.
10. (a) Write the preparation, properties and uses of the following : 6
- | | |
|-------------------------|----------------------|
| (i) Polyurethane rubber | (ii) Silicon rubber. |
|-------------------------|----------------------|
- (b) Write short notes on any **two** of the following : 10
- Vulcanization
 - Semi-solid Lubricant
 - Primary Air Pollutants.

F.E. Sem I
Engineering Mechanics
(REVISED COURSE)

29/05/06

10: MyDoc-1sthalf-E

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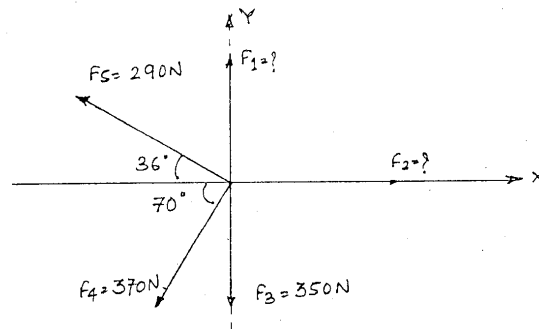
(3 Hours)

[Total Marks : 100

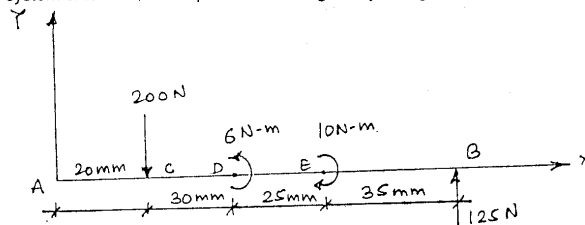
- I.B. (1) Question No. 1 is compulsory.
(2) Solve total five questions.
(3) Assume suitable data if necessary.
(4) Figures to the right indicate marks.
(5) Take value of $g = 9.81 \text{ m/s}^2$.

1. Solve any four of the following :—

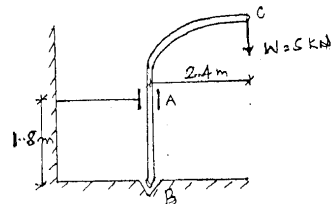
- (a) Determine the magnitude and direction of Force F_1 and F_2 ? When the Resultant of given force system is found to be 800 N along +ve x axis. 5



- (b) Replace the system of forces and couples shown in figure by a single force and couple at a point A. 5

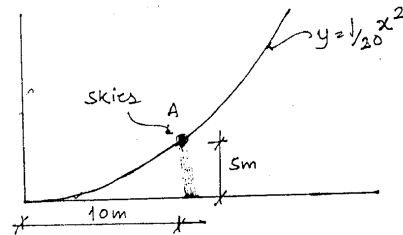


- (c) A crane is pivoted at the end B and is supported by guide at A. Determine the reaction produced at A and B by a vertical load $W = 5 \text{ kN}$ applied at C. Assume guide to be smooth. 5



- (d) The acceleration of a particle which moves with rectilinear translation is given by $a = (t - 2) \text{ m/s}^2$ at $t = 0$, the displacement and velocity are zero. Find the velocity and displacement when $t = 2 \text{ sec}$. and when $t = 4 \text{ sec}$. 5

- (e) A skier travels with a constant speed of 6 m/s along the parabolic path $y = 1/20 X^2$ as shown in figure determine the velocity and acceleration at the instant he arrives at A. Neglect the size of the skier. 5



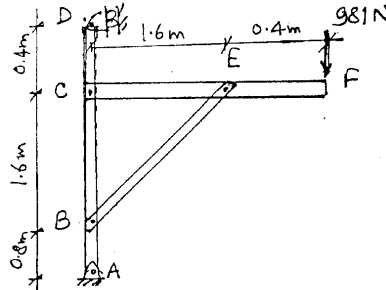
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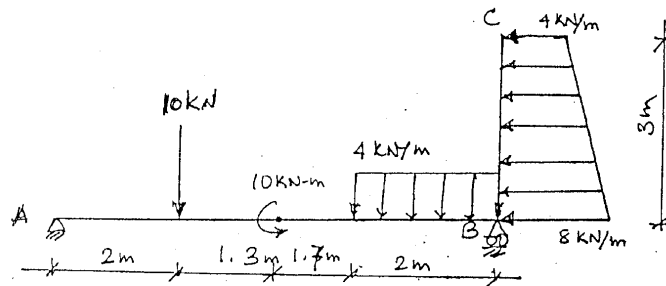
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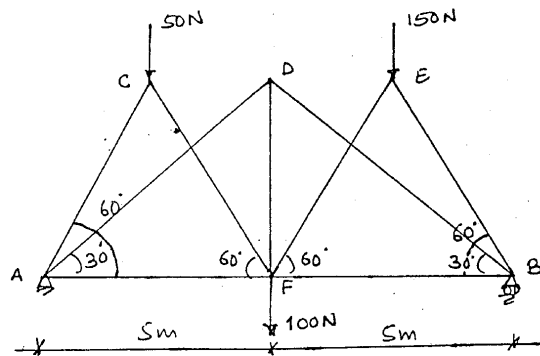
2. (a) Determine horizontal and vertical component of force which the pin at C exerts on member ABCD of the frame shown in figure.



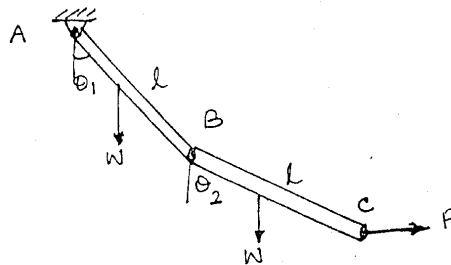
- (b) Find reactions at A and B for a bent beam ABC loaded as shown in figure.



3. (a) Find forces in member CF, AD and AF by method of section and remaining by method of joint.



- (b) Two uniform rods each of length L and weight W are connected as shown in figure. Using the method of virtual work determine θ_1 and θ_2 corresponding to the equilibrium of the bars.

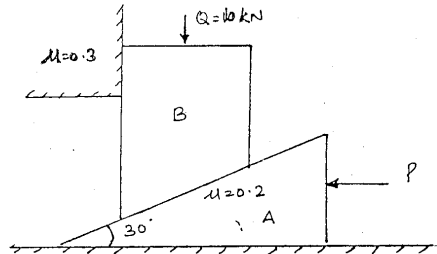


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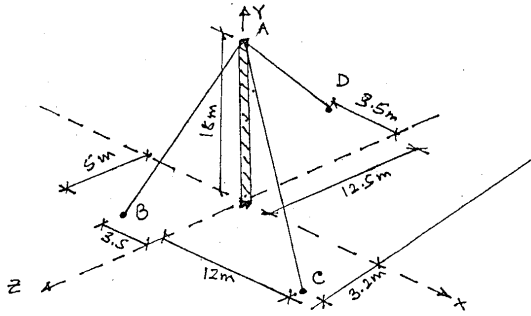
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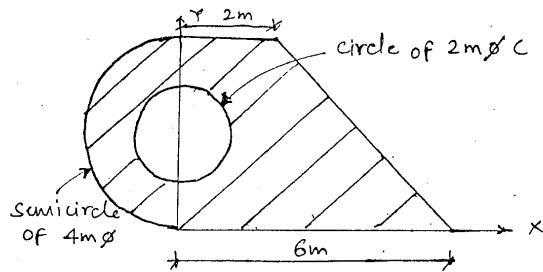
4. (a) A wedge A and block B are subjected to known load $Q = 10 \text{ kN}$ and force P as shown in figure. Determine the range of force P for which there is no motion.



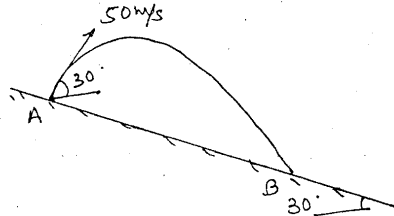
- (b) A transmission tower is held by three wires at B, C and D. If $T_{AB} = 2000 \text{ N}$, $T_{AD} = 1400 \text{ N}$ and $T_{AC} = 1600 \text{ N}$, find components of forces acting at B, C and D. Refer the figure.



5. (a) Find the Moment of Inertia of a given shaded area about its centroidal axis.



- (b) A projectile is projected from position A on an inclined as shown in figure, with a velocity of 50 m/s at an angle of 30° to the horizontal. Incline is making an angle of 30° with horizontal. Find when and where it strikes the incline again.



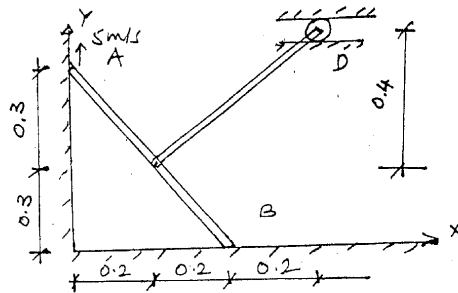
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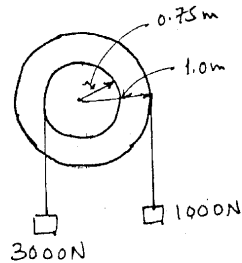
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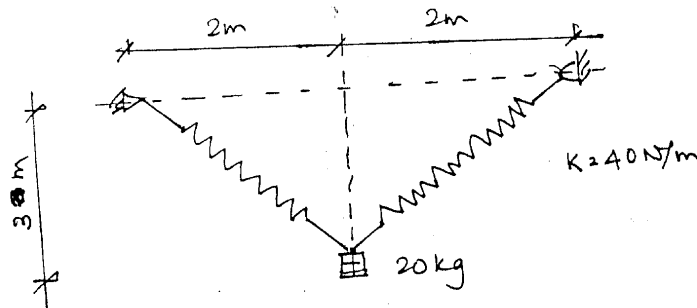
6. (a) In a given mechanism roller D is constrained in horizontal slot. Find velocity of D and angular velocity of rods for given instant if $V_a = 5$ m/s in vertically upward direction.



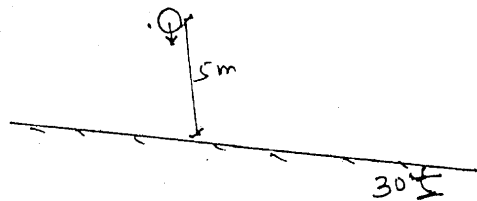
- (b) The composite pulley weighs 600 N and has a radius of gyration of 0.6 m. The 1000 N and 3000 N blocks are attached to the pulley by inextensible strings as shown in figure. Neglecting the weight of spring, determine the tension in the string and angular acceleration of the pulley.



7. (a) The cylinder has a mass of 20 kg and is released from rest when $h = 0$. Determine its speed when $h = 3$ m. The springs each have an unstretched length of 2 m.



- (b) A ball is dropped from a height of 5 m on inclined surface of 30° inclination, find the velocity of ball after impact, take $e = 0.8$.



F.E. Sem-I 2/06/06
Basic Electrical & Electronics Engineering

Con. 2730-06.

(REVISED COURSE)

TV-8782

(3 Hours)

[Total Marks : 100]

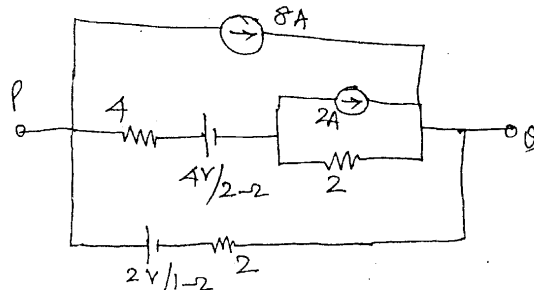
- N.B. :** (1) Question No. 1 is compulsory.
 (2) Attempt in all five questions (including Q. No. 1).
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data if necessary.
 (5) All resistors are in ohms.

Q. 1 Write briefly ;

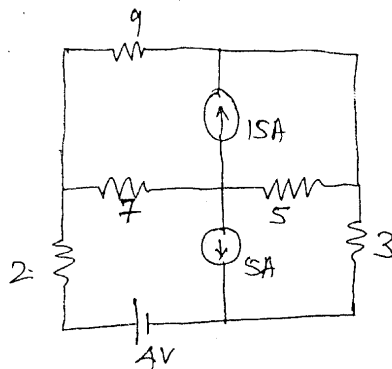
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|--|---|
| a) How does the temperature change the resistor? | 2 |
| b) Show power absorbed by pure capacitor is zero. | 2 |
| c) What is the condition for maximum power transfer in electrical networks? | 2 |
| d) State Norton's theorem. | 2 |
| e) What is the transformation ratio of an ideal transformer? | 2 |
| f) What is the back emf in motor? | 2 |
| g) Full wave rectifier is more efficient than half wave rectifier, justify. | 2 |
| h) What is power triangle, name the sides with units. | 2 |
| i) Resistor can be used as temperature and pressure transducer as well, justify. | 2 |
| j) Write briefly about PMMC instrument. | 2 |

Q. 2

- a) Find the maximum power delivered across P-Q. 8



- b) Find the potential across 3 Ohm resistor by using Mesh Analysis and verify the same by Superposition theorem. 12



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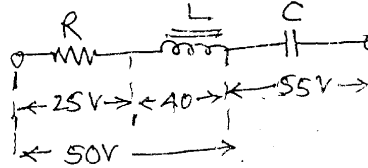
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Q. 3.

- a) An iron cored coil takes 4A at p.f. of 0.5 when connected to 200 volts, 50 Hz supply. When iron core is removed and the voltage is reduced to 40 volts the current rises to 5A at p.f. of 0.8. Find the iron loss in the core and inductance value in each case. 10

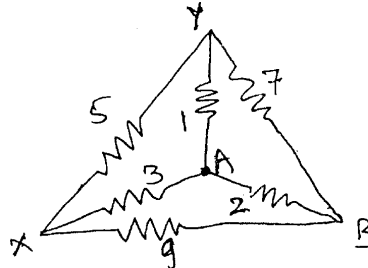
- b) In the arrangement shown $C = 20$ micro-Farads and the current flowing through circuit is 0.345 A. If the voltages are indicated, find the applied voltage, the frequency and the loss in iron cored inductor. Draw the phasor diagram. 10



Q. 4.

- a) Find the relation between the readings of two watt-meters connected to measure the total power in 3-phase balanced circuit with (i) UPF (ii) Zero PF (iii) 0.5 lagging PF. 9

- b) Find R_{AB} by solving the outer delta (X-B-Y) only. Also derive the relation used. 11



Q. 5.

- a) The efficiency of 400 KVA, 50 Hz, 1-phase transformer is 98.77 % delivering F.L. at 0.8 pf and 99.13 % at half load at UPF. Determine maximum efficiency at 0.8 pf. 8

- b) If a 36-0-36 volts transformer is used with FWR circuit having an internal resistance of 1 Ohm. If the load resistor is 19 Ohms, determine (i) Load current (ii) Load power (iii) Rectifier efficiency and (iv) If L-section filter with $L = 1.5$ H and $C = 470$ micro-Farads is inserted between rectifier & load, then what will be the improvement in the ripple factor. 12

Q. 6.

- a) NPN transistor for which $\alpha = 0.98$, $I_c = 2$ mA is used in CE configuration with $V_{cc} = 12$ volts, $R_e = 4$ K Ohms. What is the minimum base current to drive the transistor in saturation? 6
- b) How does the JFET work? Explain. 7
- c) Explain the working of SCR with help of transistor analogy. 7

Q. 7.

- a) Explain with neat diagram, construction and working of moving iron instrument. 7
- b) What is transducer? Explain the construction and working of LVDT. 7
- c) A 220 volts dc shunt machine has an armature resistance of 0.5 Ohm. If the full load armature current is 20 Amp, find the induced emf when the machine acts as (i) Generator (ii) Motor. 6

R.E. Sem-I
Computer Programming-I
 (REVISED COURSE)

24/5/06

Con. 2847-06.

(3 Hours)

TV-8775

[Total Marks : 100

- N.B. (1) Question No. 1 is compulsory.
 (2) Attempt any four out of remaining six questions.
 (3) All programs must be in c programming language.
1. (a) Write a c program to count the frequency of a given letter in a string. 10
 (b) Write a c program to find s2 in s1 where s1 is the main string and s2 is substring. 10
 2. (a) Write a c program to find all permutations. 10
 Tipt : a string is given of characters and then find out all the possible combinations of the different characters of the string. 10
 (b) Write a c program to perform following operations. 10
 (i) Display any numbers or stars on the screen by using for loop.
 (ii) Display the menu containing the following :-
 (a) Whole screen (b) Half screen (c) Top 3 lines (d) bottom 3 lines.
 3. (a) Write a c program to display number of days in calendar format of an entered month of year 2005. 10
 (b) Write a c program to accept any string upto 15 characters. Display the elements of string with their element nos. in a separate coluinn. 10
 4. (a) Write a c program to copy up to 100 characters from a file to an array then copy the contents of an array to another file. 10
 (b) Write a c program using command line argument to perform the task of Del command of DOS. 10
 5. (a) Write a c program for read the names of mobile customers through keyboard and sort them alphabetically on last name. Display the sorted list on the monitor ? 10
 (b) Develop a c program to read a record of 'n' students sort the record on basis of seat no. and then print the record on the standard output device. 10
 6. (a) Explain Unix system structure and kernel in detail ? 10
 (b) Explain Unix security and File access permission. 10
 7. (a) Explain with example :- 10
 (i) \$ cat command (iv) changing file ownership
 (ii) \$ grep command (v) mkdir command.
 (iii) \$ date command
 (b) (i) What is the difference between copy and move command ? 5
 (ii) What are the redirection operations ? How it redirect errors to errorfile ? 5