

PT-111 ELEMENTS OF ELECTRICAL
ENGINEERING

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

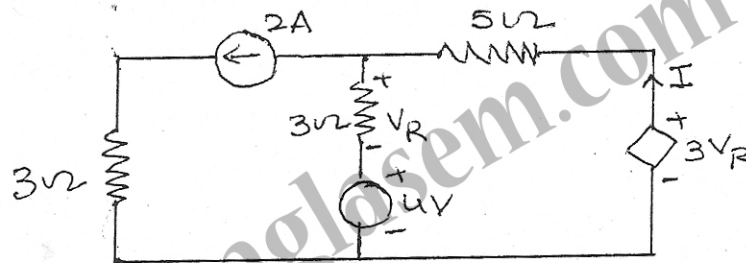
Assume suitable missing data, if any.

- 1 A single core cable of conductor diameter 1.5 cm and overall diameter of 2.9 cm has an insulation resistance of $800 \text{ M}\Omega$ per km. What is the resistivity of the insulation in $\text{M}\Omega\text{-cm}$? The insulation resistance is to be increased to $1500 \text{ M}\Omega$ per km by an additional layer of insulation of resistivity $6.5 \times 10^8 \text{ M}\Omega\text{ cm}$. What thickness of insulation is required.

3

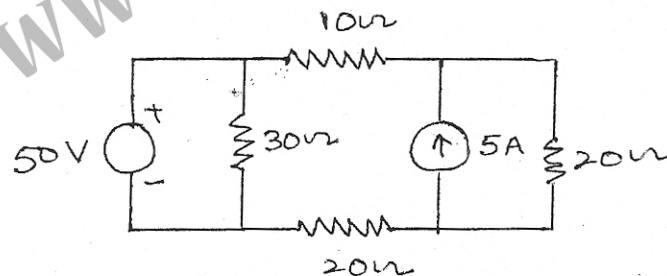
- 2 Determine the current I , supplied by the voltage controlled source.

3



- 3 Determine the current in the 10Ω resistor using Thevenin's theorem.

3



- 4 Explain briefly the eddy current losses and hysteresis losses in an electrical machine

3

- 5[a] Explain the terms 'critical speed' and critical field resistance' of a self excited d.c. shunt generator.

2

- [b] What are the conditions for the self excitation of a d.c. shunt generator.

3

- 6 A d.c. series motor runs at 500 rpm drawing 40 A from 600 V mains. Determine the resistance to be added in series with the armature for the motor to run at 450 rpm. The motor operates in unsaturated region.

3

SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION

March

2007

PT-112 MATHEMATICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions, by selecting any **TWO** parts from each question.

Assume suitable missing data, if any.

1[a] If $u = \cos ec^{-1} \left(\frac{x^{1/2} + y^{1/2}}{x^{1/3} + y^{1/3}} \right)^{1/2}$ prove that

$$x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} = \frac{\tan u}{12} \left(\frac{13}{12} + \frac{\tan^2 u}{12} \right)$$

[b] If $f(x, y) = 0$, $\phi(y, z) = 0$, show that

$$\frac{\partial f}{\partial y} \cdot \frac{\partial \phi}{\partial x} \cdot \frac{dz}{dx} = \frac{\partial f}{\partial x} \cdot \frac{\partial \phi}{\partial y}$$

[c] In a plane triangle, find the maximum value of $\cos A, \cos B, \cos C$.

7

2[a] Calculate by double integral, the volume generated by the revolution of the cardioid $r = a(1 - \cos \theta)$ about its axis.

[b] Find the volume of the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

[c] Find the area of the surface of the cone $x^2 + y^2 = z^2$ cut off by the surface of the cylinder $x^2 + y^2 = a^2$ above the xy -plane.

6

3[a] Test the consistency and solve if possible

$$4x - 5y + z = 2$$

$$3x + y - 2z = 9$$

$$x + 4y + zx = 5$$

[b] Using Cayley-Hamilton theorem find the inverse of

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

[c] Find the eigen values and eigen vectors of the following matrix.

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

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SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION

March 2007

PT-113 MECHANICAL SCIENCES

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.

Assume suitable missing data, if any.

Use of steam table/Mollier chart is permitted.

- 1[a] A candle is burning in a well insulated room. Taking the room (the air plus candle) as a system, determine (a) If there is any heat transfer during this burning process (b) If there is any change in internal energy of the system. 2
- [b] The energy of a fluid increases as it is accelerated in an adiabatic nozzle. Where does this energy come from? 1
- [c] Will the temperature of air rise as it is compressed by an adiabatic compressor. Why? 1
- [d] A rigid tank contains 10 kg of water and water vapour mixture at 90°C. If 8 kg of the water is in liquid form and the rest is in vapour form, determine
- (i) The pressure in the tank
- (ii) The volume of the tank 2
- [e] A steam turbine, operating under steady flow conditions, receives 4500 kg of steam per hour. The steam enters the turbine at a velocity of 2800 mts/min, an elevation of 5.5 m and a specific enthalpy of 2800 kJ/kg. It leaves the turbine at a velocity of 5600 mts/min, an elevation of 1.5 m and a specific enthalpy of 2300 kJ/kg. Heat losses to the surroundings amount to 16000 kJ/hr. Determine the power output of the turbine in MW. 4
- 2[a] In the absence of any friction and other irreversibility, can a heat engine have an efficiency of 100%. Justify. 1
- [b] Why is the second law of thermodynamics called directional law of nature? 1

- [c] Some-body claims to have developed a new reversible heat engine cycle that has a higher theoretical thermal efficiency than the Carnot cycle operating between the same temperature limits. Prove that claim is invalid. 2
- [d] A domestic food freezer maintains a temperature of -15°C . The ambient air temperature is 30°C . If heat leaks into the freezer at a continuous rate of 1.75 KJ/s , what is the least power necessary to pump this heat out continuously? 2
- [e] In a gas turbine plant working on Brayton cycle, the air at the compressor inlet is 27°C , 100 kPa . The pressure ratio is 6.25 and the maximum temp is 800°C . The turbine and compressor efficiencies are 80% each. Find the efficiency of the cycle and turbine exhaust temperature. Mass of air may be considered as 1 kg . 4

OR

Steam at a pressure of 15 bar , 250°C is expanded through a turbine at first to a pressure of 4 bar . It is then reheated at a constant pressure to the initial temperature of 250°C and is finally expanded to 0.1 bar . Using Mollier chart estimate the work done per kg of steam and the amount of heat supplied during the process of reheat. 4

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SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION

March

2007

PT-114 SCIENCE OF MATERIALS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions from Part A and **TWO** from Part-B.

Use separate answer sheet for Part A and B.

Assume suitable missing data, if any.

Part-A

- 1[a] Distinguish between covalent and metallic bonds. 1
- [b] Draw the curve showing the variation of attractive, repulsive and resultant potential energy with distance between two atoms in a diatomic molecule. 1
- [c] What are Schottky defect and colour centers? Give two examples of materials that can have these defects. 1
- [d] If (326) are the Miller indices of a plane, find the intercepts of this plane on the three crystallographic axes. 1
- [e] With a neat diagram show that there is no end centered cubic lattice. 1
- 2[a] Lead is face centered cubic having atomic radius 0.175 nm. Find the volume, face diagonal and the body diagonal of the unit cell. 2
- [b] What are vacancy and interstitial defects? Calculate the equilibrium number of vacancies per cubic meter of copper at 1000° C. Given that the energy for vacancy formation is 0.9 eV/atom and atomic weight and density at 1000° C are 63.5 gm/mol and 8.4 gm/cm³ respectively. (Avogadro's no. is 6.023×10^{23} atoms/mol). 3

Part-B

- 1 Distinguish between temporary and permanent hardness of water. How can you determine the total hardness of water by EDTA method? 5
- 2 Write the physical and chemical characteristics of different refractory materials. Draw a flow sheet diagram and explain the manufacture of refractory bricks. 5
- 3 Define dielectric and insulating materials. Write a short note on type of polarization in dielectric materials. 5
- 4 How will you synthesize the following polymers (Any TWO):
- i. Novolak
 - ii. Polycarbonates
 - iii. Epoxy resins
 - iv. Unsaturated polyesters
 - v. High Impact polystyrene. 5

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SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION

March 2007

PT-115 MECHANICS OF SOLIDS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1[a] State the main laws of dry friction. 3
- [b] A leather belt of thickness 12 mm and width 100 mm connects two pulleys; their centres being 2.5 m apart. There is transmission of 11.25 kW power from a shaft running at 100 r.p.m to another shaft which turns 200 r.p.m. If the diameter of smaller pulley is 500 mm and the coefficient of friction between the belt and pulley rims is 0.25, determine the stress induced in the belt material if the open belt drive is used. 3
- 2[a] State and explain the parallel axis theorem of moment of inertia. 3
- [b] Consider a square section ABCD having each side equal to 100 mm. What will be the ratio of the moment of inertia of this section about centroidal axis parallel to the side to that about the diagonal AC. 4
- 3 A cantilever truss is loaded as shown in Fig.1. Determine the forces in all the members of the truss. 7

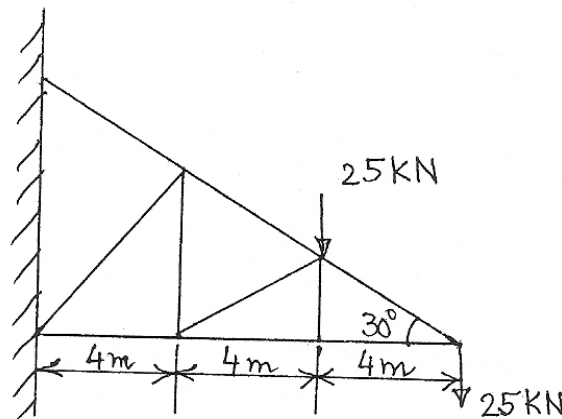


Fig.1