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## SECOND SEMESTER

B.E. (PT)

MID SEMESTER EXAMINATION **MARCH**

**2005**

### PT-111 ELEMENTS OF ELECTRICAL ENGINEERING

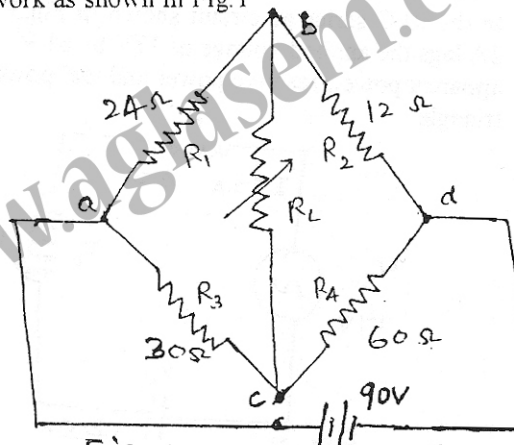
Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Attempt **ALL** questions.

Assume suitable missing data, if any.

- 1[a] State and explain superposition theorem. What are the limitations of superposition theorem? 2
- [b] Find the Thevenin equivalent across  $R_L$  of the Wheatstone bridge network as shown in Fig. 1 3



- 2[a] Explain the similarities and dissimilarities between electric circuit and magnetic circuit. 3
- [b] Three coils are all acting on the same magnetic circuit. Coil 1 has 4,000 turns and  $40\ \Omega$  resistance ; coil 2, 3,000 turns and  $30\ \Omega$ ; coil 3, 2,000 turns and  $20\ \Omega$ . All three coils are connected in series and supplied by a 230 V dc supply. Find the resultant MMF on the magnetic circuit under the following conditions.

- (i) All three coils aiding magnetically  
(ii) Coil 3 opposing coil 1 and 2 magnetically.

2

- 3[a] An ac circuit has a RL branch parallel to a RC branch as shown in Fig.2. Find the total current, phase angle between supply voltage and total current, and impedance of this circuit.

3

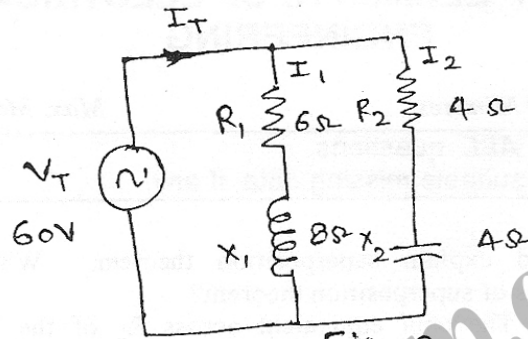


Fig-2

- [b] In the RLC series ac circuit shown in Fig.3, the line current of 2A lags the applied voltage of 17V by  $61.9^\circ$ . Find power factor, apparent power, reactive power and real power. Draw the power triangle.

3

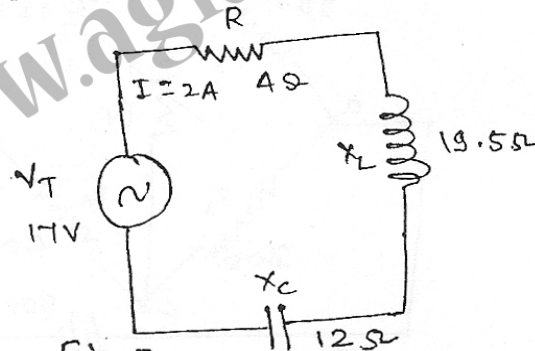


Fig-3

- 4 When the secondary of a 120/240 V transformer is open, the primary current is 0.3 A at a power factor of 0.2. The transformer rating is 4 KVA. Find (i) the full load current  $I_P$  (ii) the no load exciting current  $I_E$ , (iii) the core loss current  $I_H$ , and (iv) the magnetizing current  $I_M$ . (v) Determine the percentages of each current with respect to full load current (vi) Draw the phasor diagram.

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## SECOND SEMESTER

**B.E. (PT)**

MID SEMESTER EXAMINATION **MARCH 2005**

### PT-112 MATHEMATICS II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions, choosing any **TWO** parts from each.

Assume suitable missing data, if any.

1[a] Using differentials, obtain the approximate value of  $\sqrt{(298)^2 + (401)^2}$  (3)

[b] Expand  $f(x,y) = \sqrt{x+y}$  in Taylor series upto second order terms about the point (1,3) (3)

[c] Find the smallest and largest value of  $x+2y$  on the circle  $x^2+y^2=1$ . (3)

2[a] Change the order of integration and evaluate

$$\int_{y=0}^1 \int_{x=0}^{y+4} \frac{2y+1}{x+1} dx dy \quad (3.5)$$

[b] Find the volume of the solid which is bounded by the paraboloids  $z = x^2 + y^2$  and  $z = 4 - 3(x^2 + y^2)$  (3.5)

[c] Evaluate  $\int_R (x)^2 dx dy$ , boundary of R :  $y = x^2$ ,  $y = (x+2)$  (3.5)

3[a] Find the general solution of the equation

$$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 26e^{-3x} + 5e^{2x} \quad (3.5)$$

[b] Find the solution of the system of equations

$$2\frac{dx}{dt} + 3x + \frac{dy}{dt} - y = e^t$$

$$4\frac{dx}{dt} + 6x + 3\frac{dy}{dt} = e^{-t}$$

(3.5)

[c]  $2x(1-x)\frac{d^2y}{dx^2} + (1-x)\frac{dy}{dx} + 3y = 0$ . Find the series solution to this equation. (3.5)

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## SECOND SEMESTER

B.E. (PT)

MID SEMESTER EXAMINATION MARCH

2005

### PT-113 MECHANICAL SCIENCE

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Attempt ALL questions.  
Assume suitable missing data, if any.

- 1[a] An inventor has developed a refrigeration unit that maintains the cold space at  $-10^{\circ}\text{C}$ , while operating in a room having temperature  $25^{\circ}\text{C}$ . A co-efficient of performance of 8.5 is claimed by the inventor. How do you evaluate this? 2
- [b] An average car consumes about 5 lts. of Petrol a day and the capacity of the fuel tank of a car is about 50 lts. It needs to be refueled once every 10 days. Also density of the Petrol ranges from 0.68-0.78 kg/lit. and its lower heating value is about 44,000 kJ/kg. Suppose all the problems associated with the radio activity and waste disposal of nuclear fuels are resolved, and a car is to be powered by U-235. If a new car comes equipped with 0.05 kg of the nuclear fuel U-235, determine if this car will ever need refueling under average driving conditions. 3
- 2[a] Does a heat engine that has a thermal efficiency of 100% necessarily violate
- (i) the first law of thermodynamics
  - (ii) the second law of thermodynamics? Justify. 2
- [b] Why are engineers interested in reversible processes even though they can never be achieved? 1
- [c] Some body claims to have developed a new reversible heat engine cycle that has a higher theoretical efficiency than a Carnot cycle, operating between the same temperature limits. Prove that the claim made by the inventor is not valid. 2

3[a] When the system is at equilibrium state, why would any conceivable change in entropy be zero? 1

[b] Steam enters a turbine at 20m/sec. and specific enthalpy of 3000 KJ/kg. It leaves the turbine at 40 mts/sec. and specific enthalpy of 2500 KJ/kg. Heat lost to surroundings is 25 KJ/kg of steam as the steam passes through the turbine. If the flow rate of steam is 36,0000 kg/hr, determine the output from the turbine in MW. Change in potential energy may be neglected. 4

4[a] What is PMM-1? Why is it impossible? 1

[b] A piston cylinder device initially contains  $0.5 \text{ m}^3$  of nitrogen gas at 400 KPa and  $27^\circ\text{C}$ . An electric heater within the device is turned on and is allowed to pass a current 2 amp for 5 minutes from a 120 volts source. Nitrogen expands at constant pressure and a heat loss of 2800 Joules occurs during the process. Determine the final temperature of the nitrogen. Take  $C_p = 1.039 \text{ kJ/kg.K}$  for nitrogen at room temperature and  $R = 0.297 \text{ KPa.m}^3/\text{kg.K}$ . 4

OR

A gas turbine plant, working on the Brayton cycle with a regenerator of 75% effectiveness. The air at the inlet to the compressor is at 0.1 MPa,  $30^\circ\text{C}$ , the pressure ratio is 6 and the maximum cycle temperature is  $900^\circ\text{C}$ . If the turbine and the compressor have each an efficiency of 80%, find the percentage increase in cycle efficiency due to regeneration. Take  $C_p = 1.005 \text{ KJ/kg.K}$  for air. 5

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## SECOND SEMESTER

B.E. (PT)

MID SEMESTER EXAMINATION **MARCH 2005**

### PT-114 SCIENCE OF MATERIAL

Time: 1 Hour 30 Minutes

Max. Marks : 20

**Note :** Use **SEPARATE** Answersheets for Part-A and Part-B.  
Answer **ALL** questions from Part A & **TWO** from Part B..  
Assume suitable missing data, if any.

#### PART-A

- 1 Atomic radius of body centered cubic molybdenum is 1.1363 nm. Calculate the interplaner spacing of (1 1 1) plane. (1)
- 2 How will the density be affected in an ideal crystal when (i) Schotky defects (ii) Frenkel defects are created ? (1)
- 3 What are the different methods of creation of colour centers? What is F-center? (1)
- 4 Draw a face centered cubic diamond structure clearly specifying each step of the drawing. (1)
- 5 A certain metal undergoes transformation from body centered to face centered cubic structure at 800°C. If the radius of the metal atoms remain same after the transition, what will be the percentage change in volume. (2)
- 6 The energy of two interacting particles in the field of each other is given by

$$V(r) = -\frac{\alpha}{r} + \frac{\beta}{r^8}$$

where  $\alpha$  and  $\beta$  are constants and  $r$ -distance between atoms.  
At what distance these particles form a stable compound?  
Show that the energy of attraction is 8 times the energy of repulsion. (2)

- 7 The average energy required for creation of a Frenkel defect in an ionic crystal is 1.4 eV. Calculate the ratio of Frenkel defect at 20°C and 300°C. Given Boltzmann constant =  $8.625 \times 10^{-5}$  eV/K. (2)

### PART-B

- 1[a] What are silicones? Draw the structure of siloxane polymer obtained by hydrolyzing dichlorodimethyl silane? Mention its uses  
[b] Derive an expression for the longitudinal strength of a fibre reinforced composite, based on "rule of mixtures" (2½+2½)

- 2 Discuss the potential applications of composites in any TWO of the following fields  
(i) aircraft and aerospace  
(ii) construction  
(iii) transportation (2½x2)

- 3 Give the preparation, properties and uses of any TWO of the following :  
(i) PMMA  
(ii) PTFE  
(iii) KEVLAR (2½x2)



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## SECOND SEMESTER

B.E. (PT)

MID SEMESTER EXAMINATION MARCH 2005

### PT-115 MECHANICS OF SOLIDS

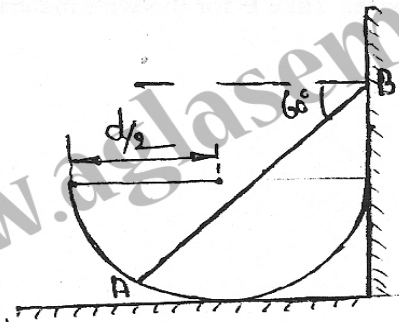
Time: 1 Hour 30 Minutes

Max. Marks : 20

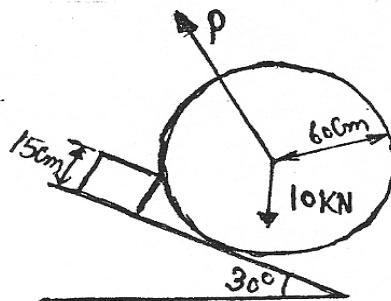
Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1[a] A smooth hemispherical bowl of diameter 'd' is placed so that its edge touches a smooth vertical wall. A heavy uniform rod is in equilibrium at  $60^\circ$  to horizontal with one end resting against the wall. Find out the length of the rod in terms of diameter d. (5)



- [b] Determine the magnitude and direction of the smallest force P required to start the wheel over the block. (3)



- [c] Derive an expression for elongation of a tapered rod due to weight when its diameter changes from  $d_1$  to  $d_2$  ( $d_2 > d_1$ ) and its length be  $l$ . (2)

- 2[a] A steel bar is placed between two copper bars, each having the same area and length as steel bar at  $20^\circ\text{C}$ . At this stage, they are rigidly connected together at both the ends. When the temperature is raised to  $320^\circ\text{C}$ , the length of the bars increases by 1.5 mm. Determine the original length and final stresses in the bars.

$$\begin{aligned} \text{Take } C_s &= 220 \text{ GN/m}^2 & E_c &= 110 \text{ GN/m}^2 \\ \alpha_s &= 0.000012 \text{ per}^\circ\text{C} & \alpha_c &= 0.0000175 \text{ per}^\circ\text{C} \end{aligned}$$

(5)

- [b] A steel wire of 1 mm diameter is stretched horizontally between two fixed points 2 m apart. A vertical load applied at the mid span of the wire causes a vertical displacement of 45 mm of the point of application of the load applied. What will be the stress induced in the wire and the load applied? Neglect the weight of the wire. Take  $E$  for the wire material as  $200 \text{ GN/m}^2$ . (5)