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SECOND SEMESTER

B.E. (EE/EC/COE)

MID SEM EXAMINATION

March. 2006

EE/EC/COE-111 PRINCIPLES OF ELECTRICAL ENGINEERING

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

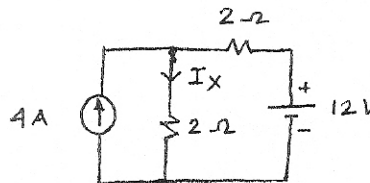
- 1[a] Taking the resistance temperature co-efficient to be $(1/234.5)$ per $^{\circ}\text{C}$ at 0°C , prove that the resistance R_1 of a circuit of copper wire at a temperature $t_1^{\circ}\text{C}$ is related to the resistance R_2 at $t_2^{\circ}\text{C}$ by the expression

$$\frac{R_1}{R_2} = \frac{234.5 + t_1}{234.5 + t_2} \quad 2$$

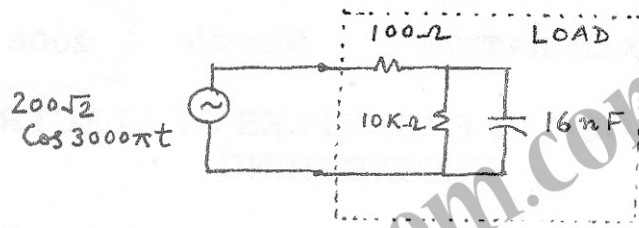
- [b] Find the current flowing at the instant of switching on a 100 W metal filament lamp on to a 220 V circuit. The incandescent filament temperature is 2000°C and the resistance temperature coefficient at room temperature of 20°C is 0.005. 3

- 2[a] Derive formulae for star to delta and delta to star transformations for three unequal resistances. 2

- b] In the circuit given below, compute the current I_x by superposition theorem. 3



- 3[a] Explain the terms apparent power, active power and reactive power. How are they related to complex power? What are their units? 2
- [b] In the circuit given below, compute the complex, average, reactive and apparent power absorbed by the load. 3



- 4[a] Elucidate the significance of power factor in electric circuits. 2
- [b] Two circuits having the same numerical value of impedance in ohms are joined in parallel. The power factor of one circuit is 0.8 and the other is 0.6. Compute the power factor of the combination. 3

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SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEM EXAMINATION

March 2006

COE/EC/EE-112 APPLIED MECHANICS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.

Assume suitable missing data, if any.

- 1[a] A $1.80\text{m} \times 3.50\text{m}$ rectangular plate is subjected to a system of four coplaner forces as shown in Figure 1. Determine the value and location of a single force resulting in equivalent action. 4

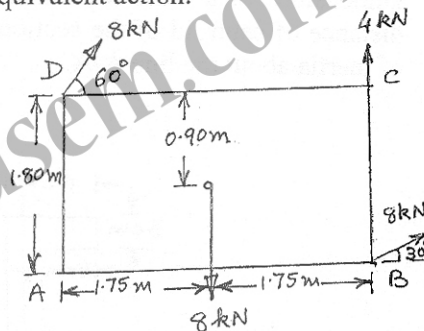


Figure 1

- [b] Explain varignons theorem. 1

- 2[a] Explain point of contraflexure. 1

- [b] A beam ABCDE, 12m long, cantilevered over the portion AB = 4m long, supported at point B and E, BE = 8m long carries a concentrated load of 20 kN at end A, 30 kN at C, 2m from B and 40 kN at D, 2m from E. In addition it carries a uniformly distributed load of 10 kN/m run over the portion CD. Draw SF and BM diagrams of the beam. Determine the position of the point of contraflexure if any. 5

- 3[a] Explain cone of friction. 1
- [b] Figure 2 shows the block B, weighing 1.2 kN. A force P, applied to the wedge C, is used to just raise the block. Assuming the wedge to be weightless, obtain the force P. Take $\mu = 0.3$ for all surfaces of contact.

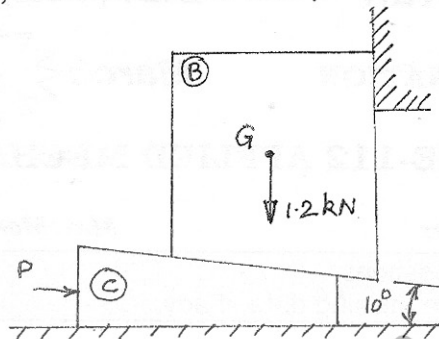


Figure 2.

- 4 Dimensions of a cross-section are shown in Figure 3. Calculate the distance of centroid of the section from line A-A and its area moment of inertia about the line A-A. 4

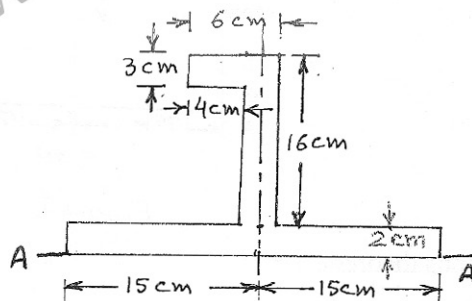


Figure 3

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SECOND SEMESTER

B.E. (COE/EC/EE)

MID SEM EXAMINATION

March

2006

COE/EC/EE-113 MATHEMATICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

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

Assume suitable missing data, if any.

1[a] Find $\frac{dy}{dx}$ if $y^x + x^y = C$.

[b] If $x = r\cos\theta$, $y = r\sin\theta$, prove that

$$\frac{\partial^2 \theta}{\partial x^2} + \frac{\partial^2 \theta}{\partial y^2} = 0$$

[c] If $\frac{3}{x} + \frac{4}{y} + \frac{5}{z} = 6$ find the values of x, y, z which make $x + y + z$ minimum.

2[a] Evaluate the integral by changing the order of integration

$$\int_0^1 \int_{2y}^2 e^{x^2} dx dy$$

[b] Evaluate the value bounded above by the sphere $x^2 + y^2 + z^2 = 2a^2$ and below by the paraboloid $az = x^2 + y^2$

[c] Integrate $r \sin\theta$ over the area of the cardioid $r = a(1 + \cos\theta)$ above the initial line.

3[a] Find the inverse of the following matrix

$$\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$$

[b] Determine the rank of the matrix.

$$\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$$

[c] If consistent then solve the system of equations

$$2x_1 + x_2 + x_3 + x_4 = 2$$

$$3x_1 - x_2 + x_3 - x_4 = 2$$

$$x_1 + 2x_2 - x_3 + x_4 = 1$$

$$6x_1 + 2x_2 + x_3 + x_4 = 5$$

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SECOND SEMESTER

B.E. (EE/EC)

MID SEM EXAMINATION

March

2006

EE/EC-114 PHYSICS-II

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1[a] Two straight conducting wires lying on the x axis separated by a gap of 4 nanometer. The potential energy U in the gap is about 3 eV higher than the energy of conduction electrons in either wire. What is the probability that a conduction electron in one wire arriving at the gap will pass through the gap into the other wire. 2
- [b] A quantum mechanical system having mass 'm' is described by the wave function

$$\psi(r) = \frac{1}{r} e^{iKr}$$

Calculate the probability current density. 2

- [c] Sketch wave functions for first three excited states for a particle confined in one dimensional (i) infinite and (ii) finite potential well of width. 2
- [d] A particle is confined to one dimensional infinite potential well of width of 0.2 nanometer. It is found that the wave function has 5 antinodes, when the energy of the particle is 230 eV. Find the mass of particle. 2
- [e] Calculate the expectation value of position $\langle x \rangle$, and expectation value of momentum $\langle p \rangle$ for a particle described by the wave function

$$\psi(x) = \begin{cases} \sqrt{\frac{2}{L}} \sin \frac{\pi x}{L} & 0 < x < L \\ 0 & \text{for } x > L \text{ \& } x < 0 \end{cases} \quad 2$$

- 2[a] State Gauss's law in electrostatics and write down its integral and differential form. State how Gauss's law is modified in the presence of dielectrics? 2

- [b] Draw lines of force for
- An infinite sheet of positive charges
 - An isolated positive charge
 - Two equal but opposite charges. 2
- [c] Four charges $+q$, $+q$, $-q$ and $-q$ are placed respectively at the corners A, B, C and D of a square of side "L". Calculate the electric field intensity at 'O', the center of a square. 2
- [d] Prove $\nabla \cdot \mathbf{B} = 0$ and comment on its physical significance. 2
- [e] A long cylindrical conductor of radius 'a' carries a current along its length. The current density at a distance r from the axis of the conductor is given by $\mathbf{J}(r) = J_0 \cdot r/a$ where J_0 is a constant. Calculate the magnetic induction a function of r for $r \leq a$ and also $r > a$. 2
- Mass of electron $m_e = 9.1 \times 10^{-31}$ kg
 Planck's constant $h = 6.62 \times 10^{-34}$ Js.
 Charge of electron $e = 1.6 \times 10^{-19}$ C.

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SECOND SEMESTER

B.E. (EE/EC)

MID SEM EXAMINATION

March

2006

EE/EC-115 ELECTRICAL ENGINEERING MATERIALS

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions from PART A and **TEN** from PART B.
Use separate answer sheets for PART-A and PART-B.
Assume suitable missing data, if any.

PART-A

- 1[a] Define (i) Critical temperature, (ii) Critical current and (iii) Critical magnetic field for a superconductor. 1½
- [b] A tin wire of diameter 2 mm is superconducting at 2K. Given, $T_c = 3.722$ K and critical magnetic field at 0K is 0.0305 T. What current should be passed through it at 2K so that it becomes non-superconducting? ($\mu_0 = 4\pi \times 10^{-7} \text{ NA}^{-2}$) 2
- [c] What do you mean by free electron Fermi gas? Define Fermi level and Fermi energy. 1½
- 2[a] Determine the Miller indices of a plane in a cubic crystal of edge 0.424 nm which is parallel to y-axis and cuts intercepts 2 and 1 along the x- and z-axes respectively. Also calculate the interplanar spacing. 2
- [b] Define (i) basis and (ii) atomic packing factor. ½+½
- [c] Sketch the (110) plane. 1
- [d] Mention the most important feature of Kronig-Penney model and what is the range of the first Brillouin zone. ½+½

PART-B

- 1 What is the hardness of potable water as per WHO? 1
- 2 Write down the main characteristics of industrial water. 1
- 3 What are the various units used to describe the hardness? 1

- 4 What is the equivalent of 10 ampere current passed for 2 hrs 40 minutes and 50 seconds in term of equivalent weight of copper? 1
- 5 What is the size of double layer around electrodes? 1
- 6 Write down anode reactions for electrolysis of acidic copper sulfate with copper electrodes. 1
- 7 What are the functions of soda in softening of water through lime soda process? 1
- 8 If $M > 2P$, which alkaline ions may be present in water? 1
- 9 Write down the chemical formula of disodium salt of EDTA. 1
- 10 Describe the types of direct current used in electroplating. 1
- 11 What should be characteristics of a good material for fabrication of an electroplating tank? 1
- 12 What are the advantages of air agitation? 1
13. How many types of addition agents are used during electroplating? 1
- 14 What do you understand by throwing power of electroplating bath? 1
- 15 On what basis a salt must be chosen for an electroplating bath? 1