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Roll No.

SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION

March 2006

PT-111 ELEMENTS OF ELECTRICAL ENGINEERING

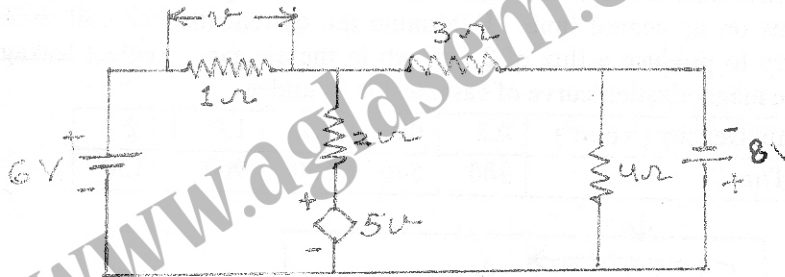
Time: 1 Hour 30 Minutes

Max. Marks : 20

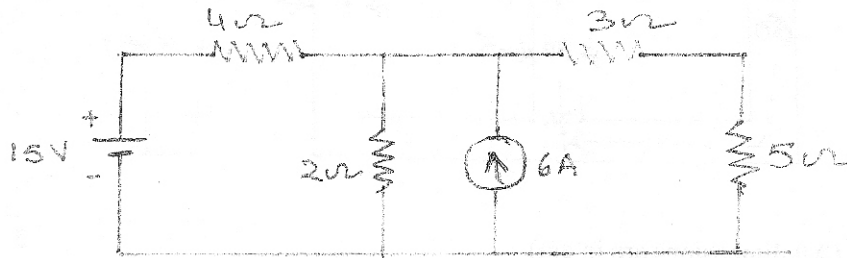
Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1 For the circuit shown, find (a) voltage, v (b) current through $2\ \Omega$ resistor, using nodal analysis method. 3

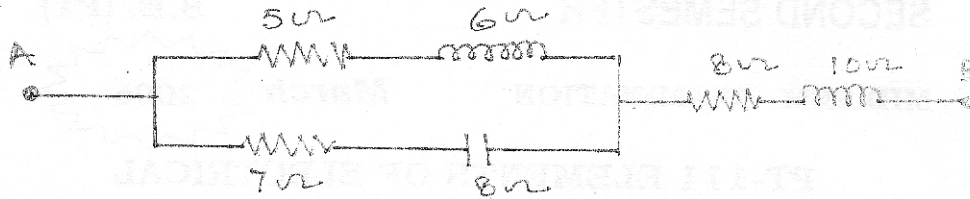


- 2 Determine the current through $5\ \Omega$ resistor using Thevenin's Theorem. 3



- 3 Explain the terms (i) RMS value (ii) Average value of an ac wave. Also, derive their expressions. 3

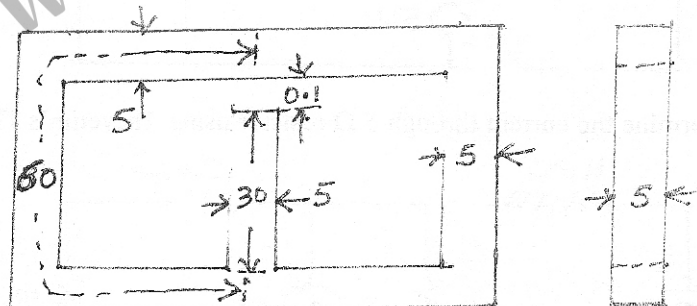
- 4 In the given circuit, determine what 50 Hz voltage must be applied across AB in order that a current of 10A may flow in the capacitor. 5



- 5 Three similar coils each of resistance 20 ohm and an inductance of 0.5 H are connected in star configuration across a three-phase supply of 400V, 50 Hz. Calculate the line currents and power absorbed by the circuit. 3

- 6 A cast steel d.c. electromagnet shown in the Fig. has a coil of 1000 turns on its central limb. Determine the current that the coil should carry to produce a flux of 2.5 m wb in the air gap. Neglect leakage. The magnetization curve of cast steel is as under.

Flux Density (wb/m ²)	0.2	0.5	0.7	1.0	1.2
AT/m	300	540	650	900	1150



(All dimensions are in cm)

SECOND SEMESTER**B.E. (PT)****MID SEM EXAMINATION****March.****2006****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 $Z = x^n f\left(\frac{y}{x}\right) + y^{-n} \phi\left(\frac{x}{y}\right)$ then Prove that

$$x^2 Z_{xx} + 2xyz_{xy} + y^2 Z_{yy} + xZ_x + yZ_y = n^2 Z$$

[b] Transform $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in to polar coordinates

[c] If $x^4 + y^4 = 4a^2 xy$, show that

$$(a^2 x - y^3)^3 \frac{d^2 y}{dx^2} = 2a^2 xy (3a^4 + x^2 y^2)$$

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2[a] Expand $x^2 y + 3y - 2$ in powers of $(x-1)$ and $(y+2)$ using Taylor's theorem.

[b] A rectangular box, open at the top, is to have a volume of 32 c.c. Find the dimension of the box requiring least material for its construction.

[c] Find the maximum and minimum distances of the point (3, 4, 12) from the sphere $x^2 + y^2 + z^2 = 1$.

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3[a] A pyramid is bounded by the three co-ordinate planes and the plane $x + 2y + 3z = 6$. Compute this volume by double integration.

[b] Find the volume cut off from the paraboloid $x^2 + \frac{y^2}{4} + z^2 = 1$ by the plane $z=0$.

[c] Find the surface area of the section of the cylinder $x^2 + y^2 = a^2$ made by the plane $x + y + z = a$

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SECOND SEMESTER

B.E. (PT)

MID SEM EXAMINATION March

2006

PT-113 MECHANICAL SCIENCES

Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer ALL questions.

Assume suitable missing data, if any.

- 1[a] Why is direct heating of a room thermodynamically wasteful? Explain. 1
- [b] Why is the second law of thermodynamics called a directional law of nature? Explain. 1
- [c] Why does free expansion have zero work transfer? Explain. 1
- [d] The kinetic energy of a fluid increases as it is accelerated in an adiabatic nozzle. Where does this energy come from? 1
- [e] In the absence of any friction and other irreversibilities, can a heat engine have an efficiency of 100%? Explain. 1
- 2[a] For the same compression ratio and heat rejection, which cycle is most efficient; Otto, Diesel or Dual. Explain with PV diagram. 2
- [b] Show that efficiency of a Brayton cycle depends only on pressure ratio. 2
- [c] Is it possible to develop an actual (irreversible) heat engine that is more efficient than Carnot cycle, operating between the same temperature limits? Explain. 2
- 3 A stream of gases at 750 kN/m², 800°C and 150 mts/sec is passed through a turbine of a jet engine. The stream comes out of the turbine at 200 kN/m², 600°C, and 300 mts/sec. The process may be assumed adiabatic. Determine the power output of the turbine if the gas flow rate is 4 kg/sec. The enthalpies of gas at the entry and exit of a turbine are 960 kJ/kg and 700 kJ/kg of gas respectively. 3
- 4 A heat pump is used to maintain an auditorium hall at 25°C when the atmospheric temperature is -5°C. The heat load of hall is 2400 kJ/min. Calculate the power required to run the actual heat pump if the COP of the actual heat pump is 25% of the Carnot heat pump working between the same temperature limits. 2
- 5 In a gas turbine plant, working on the Brayton cycle, the air at the inlet to the compressor is at 0.1 MPa, 40°C, pressure ratio 6 and maximum temp is 850°C. If the turbine and compressor have efficiencies 75% and 80% respectively, find the cycle efficiency. Take $C_p = 1.005 \text{ KJ/kgK}$. 4

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SECOND SEMESTER

Roll No.

B.E. (E)

MID SEM EXAMINATION

March

2006

PT-114 SCIENCE OF MATERIALS

Time: 1 Hour 30 Minutes

Max. Marks : 20

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

Use separate answer sheets for **PART-A** and **PART-B**.

Assume suitable missing data, if any.

PART-A

- 1 For bcc iron, compute (a) the inter-planer spacing, (b) the first order diffraction angle for (220) set of planes. The lattice parameter for Fe is 0.2866 nm and the wavelength of the monochromatic radiation is 0.1790 nm. 2
- 2 The Fermi-Dirac distribution function is written as $f(E) = \frac{1}{1 + \exp \frac{E - E_F}{k_B T}}$, where the symbols have their usual meaning.
(i) Draw the variation $f(E)$ as a function of E at $T = 0K$ and hence define the Fermi energy E_F .
(ii) Draw the curve at $T > 0$ and also mention its significance. 2
- 3 What are van-der-Waal's bonds? Which group of materials in the periodic table has this bond. Give examples. 2
- 4 The forbidden energy gap of germanium and diamond are 0.69 eV and 6.0eV. Relate these values to the transparency/opacity of the crystals to visible radiation. 2
- 5 Define Schottky defects in ionic crystal. How does the density of Schottky defects in an ionic crystal vary with temperature. 2

PART-B

- 1[a] What are composites? Give names of two natural composites. What are the advantageous characteristics of composites? 3
- [b] Write an informative note on particulate composites. 2
- 2 Describe the method of preparation, properties and uses of any TWO of the following
- (i) PVA (ii) KEVLAR
- (iii) PMMA (iv) POLYURETHANES
- 2½x2=5
- 3[a] What are carbon-fibres? Write important applications of carbon fibre reinforced composites.
- [b] Explain the important function of matrix phase in a composite. 2½x2

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SECOND SEMESTER

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B.E. (PT)

MID SEM EXAMINATION March

2006

PT-115 MECHANICS OF SOLIDS

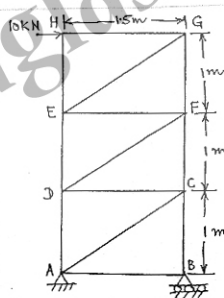
Time: 1 Hour 30 Minutes

Max. Marks : 20

Note : Answer **ALL** questions.

Assume suitable missing data, if any.

- 1 The top of an electric pole is connected with a stay wire which makes an angle of 60° with the horizontal. If a horizontal force of 100 N is essential for keeping the pole vertical, determine the tension induced in the stay wire. Also calculate the vertical component of this tension and state the purpose served by it. 6
- 2 Calculate the forces in members ED, DF and FC of the plane truss loaded and supported as shown in Fig.1. 7



- 3 For the shaded area shown in Fig.2, determine
[a] coordinates of the centroid, and
[b] moment of inertia about the centroidal axes.
The removed area is semicircular and all the given dimension are in mm. 7

