B.E ELECTRICAL ENGINEERING (EVENING) EXAMINATION, 2017

(1^{st} Year, 1st Semester Supplementary)

PRINCIPLES OF ELECTRICAL ENGINEERING-I

Time: Three Hours Full Marks: 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART-I

Answer Question no 1 *and* ***any two*** from the rest

1. a) Derive an expression for capacitance per unit length of a co-axial cylinder having internal radius r_1 and external radius r_2. 8

   b) Derive an expression for energy stored in a electro-static field. 6

   c) A parallel plate capacitor, with each plate having cross sectional area of 12 cm^2, is separated by a mica sheet of 0.2 mm thick. If the dielectric constant for mica is 5, calculate the capacitance. Derive necessary relations. 6

2. a) Draw a comparison between magnetic circuit with electrical circuit. 5

   b) An iron-ring of mean length 30 cm is made of three pieces of cast iron, each has the same length but their respective diameters are 4, 3 and 2.5 cm. An air-gap of length 0.5 mm is cut in the 2.5 cm piece. If a coil of 1,000 turns is wound on the ring, find the value of the current it has to carry to produce a flux density of 0.5 Wb/m^2 in the air- gap. B/H characteristic of cast-iron may be drawn from the following:

   B (Wb/m^2): 0.1 0.2 0.3 0.4 0.5 0.6

   H (AT/m): 280 620 990 1400 2000 28000 10

3. a) Using Biot-Savart's Law, derive an expression for magnetic field intensity at any point due to an infinite current carrying conductor 8

   b) Derive an expression for lifting power of an electromagnet. 7

4. a) Draw the hysteresis curve for a ferromagnetic material subjected to sinusoidal excitation and hence define retentivity and coercivity. 7

   b) The hysteresis loop for a certain magnetic material is drawn to the following scales:

   1 cm = 200 AT/m and 1 cm = 0.1 Wb/m^2

   The area of the loop is 48 cm^2. Assuming the density of the material to be 7.8×10^3 kg/m^3, calculate the hysteresis loss in watt/kg at 50 Hz. 8

5. Write short notes on *any two* of the following: 7.5×2=15
   (i) Expression for capacitance of a co-axial cylinder for a multi dielectric system
   (ii) Self inductance, Mutual inductance and coefficient of coupling
   (iii) Energy stored in an inductor and Ampere's Circuital law.

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B. ELECTRICAL ENGG. (EVENING) 1ST YEAR 1ST SEM. SUPPLE EXAM.-2017

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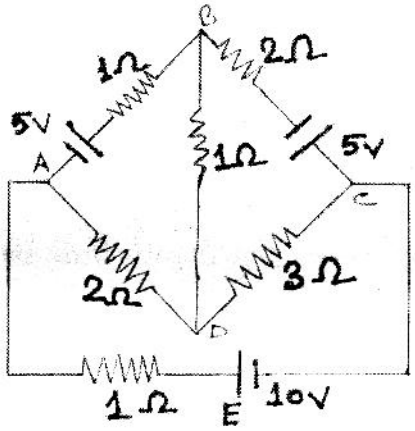
PART-II (50 marks)
Answer any Three Questions
(Q. No. 1 carry 18 marks)

1. a) State the Norton's theorem and explain the procedure to Nortonize a given network.

8

b) Determine the branch currents of the given network using Maxwell's loop current method.

10



2. a) State the superposition theorem. Derive the expressions to convert the star and delta connected resistances from one to another.

2+8=10

b) Find the dimensions of Electric Potential (V) and Magnetic Flux (Φ) in MKS unit system.

6

3. a) Show that the power consumed by a pure capacitor over a full cycle of applied sinusoidal voltage is zero.

4

b) Show that current lags the voltage by 90° in case of a pure inductor connected across sinusoidal voltage. 4

c) The half cycle of an alternating signal is as follows- it increases uniformly from zero at 0° to $230V$ at α°, remain constant at $230V$ upto$(180-\alpha)^{\circ}$, then

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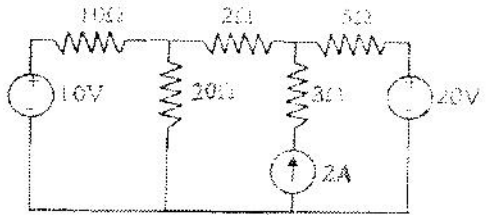
decreases uniformly from $230V$ to zero at 180°. Calculate the average and r.m.s. values of the signal. 8

4. a) Find the dimensions of Electric Field intensity (E) in esu and emu unit system. 4

b) Find the Thevenin's equivalent network of the given network across 2Ω resistance. Hence determine the current. 6



c) Calculate the active and reactive power when a voltage represented by $v = 325sin100\pi t$ volts is applied across a coil of 100Ω resistance and $0.22\mu F$ capacitance. 6

5. a) State and prove the maximum power transfer theorem. 6

b) Determine the current supplied by the battery E. 10