BACHELOR OF ELECTRICAL ENGINEERING (PART TIME) FIRST YEAR FIRST SEMESTER EXAMINATION, 2018

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 any three questions.** **Two marks are reserved for neat and well organized answers.**	**Marks**
1.a)	Derive expressions for electric field intensity and electric potential due to an isolated point charge.	6
1.b)	Derive an expression for potential energy in an electric field.	5
1.c)	It is required to hold four equal point charges +Q in equilibrium at the corners of a square of 2 m side. Find the point charge that will do this if placed at the centre of the square. The square is placed in air.	5
2.a)	State and prove Gauss's law.	5
2.b)	Deduce an expression for force of attraction between two oppositely charged plates.	5
2.c)	An air capacitor consisting of 2 parallel plates of 50-cm side is charged to p.d. of 250 V when the plates are 1 mm apart. Find the work done in separating the plates from 1 to 3 mm. Assume perfect insulation.	6
3.a)	State and explain Biot Savart's law.	3
3.b)	Deduce expressions for the magnetic field intensity and magnetic flux density on the axis of a square coil and hence show that the magnetic field intensity at the centre of a square coil is $\sqrt{2}I/\pi a$, where 'I' is the current flowing through the coil and 'a' is half the length of any side of the square coil.	8
3.c)	Two concentrated coils each of 20 cm in diameter and wound with 100 turns, are placed co-axially 10 cm. apart with their planes parallel. A direct current of 1 A is passed in the same direction through each coil. Determine the magnetic field intensity at a point on the axis and 30 cm. from one coil.	5
4.a)	Derive expressions for the following: I. Work done in moving a current carrying conductor in magnetic field. II. Dynamically induced e.m.f in a coil.	5
4.b)	Deduce an expression for the coefficient of coupling for two magnetically coupled coils.	5

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4.c)	Two coils, X of 12000 turns and Y of 15000 turns, lie in parallel planes so that 45% of the lux produced by coil X links coil Y. A current of 5 A in X produces 0.05 mWb while the same current in Y produces 0.075 mWb. Calculate (a) the mutual inductance, and (b) the coupling coefficient.	6
5.a)	Derive an expression for the energy stored in a magnetic field.	4
5.b)	Deduce an expression for the eddy current loss occurring in a magnetic material.	6
5.c)	A cast steel ring has a circular cross-section 3 cm in diameter and a mean circumference of 80 cm. The ring is uniformly wound with a coil of 600 turns. Determine (a) the current required to produce a flux of 0.5 mWb in the ring. (b)the flux produced by the current found in (a) if saw cut 2 mm wide is made in the ring, and (c) the current value which will give the sane flux as in (a). Assume the gap density to be the same as in iron and neglect fringing.	6

Ex/EE/5/T/111/2018

B.E. ELECTRICAL ENGG. (PART TIME) FIRST YEAR FIRST SEMESTER EXAM.-2018

Subject: PRINCIPLES OF ELECTRICAL ENGINEERING-I

Time: Three Hours Full Marks: 100

Use separate Answer script for each part
PART-II (50 marks)
Answer any Three Questions
(Q. No. 1 carry 18 marks)

1. a) Show that an ideal current source and an ideal voltage source have infinite and zero internal resistance respectively.

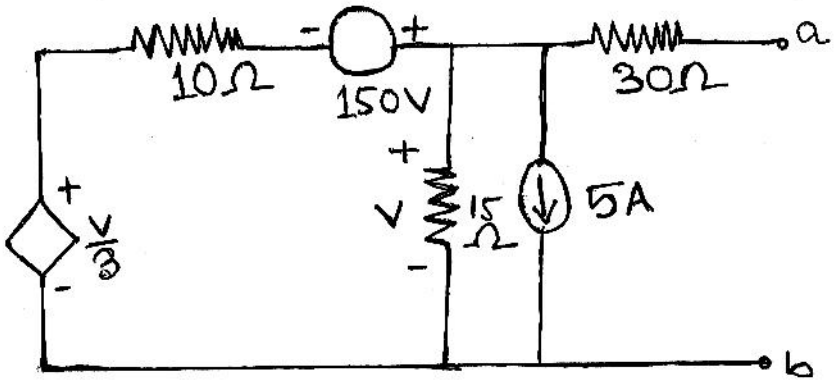
3+3=6

b) A circuit consists of resistance R, and capacitive reactance of 30Ω connected in series. Determine the value of R for which the power factor of the circuit is 0.8. Also draw the phasor diagram.

6

c) Find the Thevenin's equivalent network for given the network.

6

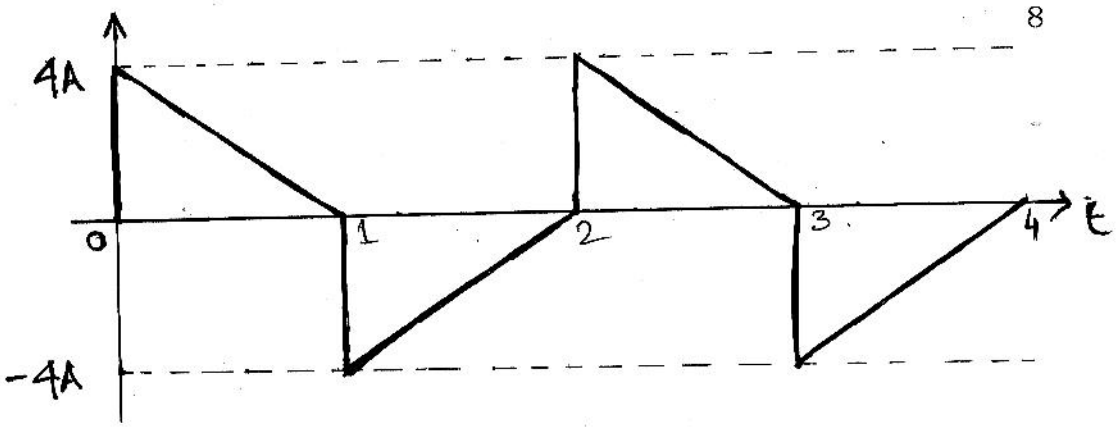


2. a) State and explain the Kirchoff's laws. Find the dimensions of Electric Potential (V) and Magnetic Flux (Φ) in MKS unit system.

4+4=8

b) Find the r.m.s. and average value of current wave as shown below-

8



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B.E. ELECTRICAL ENGG. (PART TIME) FIRST YEAR FIRST SEMESTER EXAM.-2018

Subject: PRINCIPLES OF ELECTRICAL ENGINEERING-I

Time: Three Hours Full Marks: 100

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

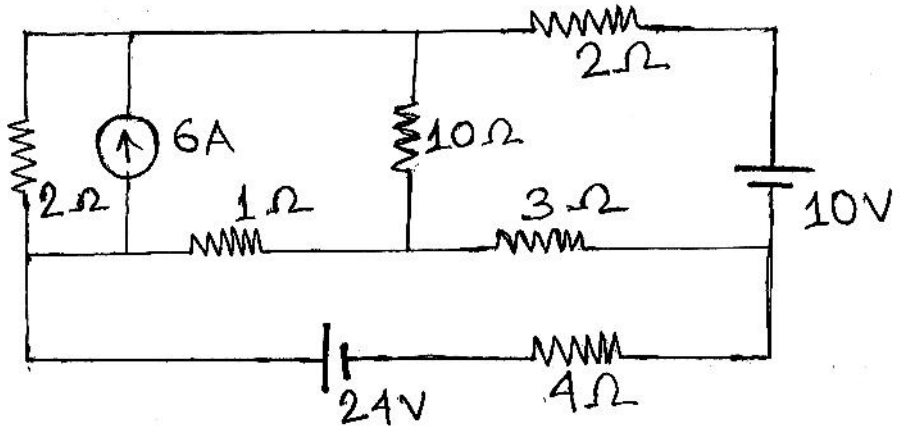
4

b) Show that current leads the voltage by 90° in case of a pure capacitor connected across sinusoidal voltage.

4

c) Determine the current through each branch of the given network.

8



4. a) Derive the expressions to convert the star and delta connected resistances from one to another.

8

b) A coil of resistance 20Ω and inductance 0.07H is connected in parallel with a series combination of 50Ω resistance and 60μF capacitance. Calculate the total current, when the parallel combination is connected across 230V, 50Hz supply. Also draw the phasor diagram.

8

5. a) Deduce the condition for maximum power transfer to the resistive load.

4

b) A series circuit consists of a resistance of 12Ω, a capacitance of 320μF and an inductance of 0.08H. A supply of 230V, 50Hz is connected across it. Calculate i) the current in the circuit, ii) the potential differences across each element and iii) the frequency at which the current would have unity power factor.

8

c) For a R-L-C series circuit, discuss the nature of power factor for i) $X_L > X_C$ ii) $X_L < X_C$ with suitable phasor diagram.

4