BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING EXAMINATION, 2018

(1st Year, 1st Semester)

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 any *TWO* from the rest

1. Correct or justify any five of the following 5x4=20

a) An ideal current source and an ideal voltage source have internal resistances of infinite and zero value, respectively.

b) A pure capacitor operates at a zero power factor lagging.

c) By dimensional analysis, CR^2 has the unit of inductance, C being the capacitance and R the resistance of a circuit.

d) In any R-L-C circuit, power is dissipated in resistance (R) only.

e) According to the maximum power transfer theorem, a load will draw maximum power when the load impedance is equal to the Thevenin's equivalent impedance of the network.

f) A voltage of $e = 10\sin(50\pi t)V$ has been applied to a circuit to deliver a current of $i = 3\sin(50\pi t - 60^0)A$. The reactive power drawn by the circuit is 15 VAR.

2. a) Calculate the rms and average values of current i in ampere as shown in Fig.1

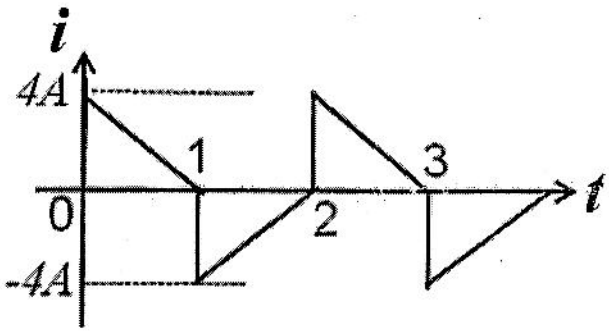


Fig.1 6

b) Prove that the energy consumed by a pure inductor over full cycle of applied sinusoidal voltage is zero. 4

c) A circuit takes a current $i = 20\sin\left(314t - \frac{\pi}{3}\right)$ when the supply voltage is $v = 240\sin\left(314t - \frac{\pi}{4}\right)$. Find the value of impedance along with its components as well as power factor of the circuit. 5

3.a) A coil of 1.5 kΩ resistance and 0.2 H inductance is connected in parallel with a variable capacitor across a 1.5 V, 15 kHz AC supply. Calculate
i) the value of the capacitor when the supply current is minimum,
ii) the effective impedance and the current for the condition (i) 8

b) A circuit takes a current of 4A at a power factorof 0.8 lagging when connected to 110V, 50 Hz supply. Another circuit takes a current of 5A at a pf of 0.6 leading when connected across the same supply. If the two circuits are connected in series across a 230V, 50 Hz supply, calculate:
i) the current
ii) the power consumed in the entire circuit
iii) the power factor of the combined circuit. 7

4. a) Determine the dimension of capacitance and magnetic flux. Show equations used to determine the dimensions. 5

b) Obtain current I_o in Fig.2 using Norton's theorem 5

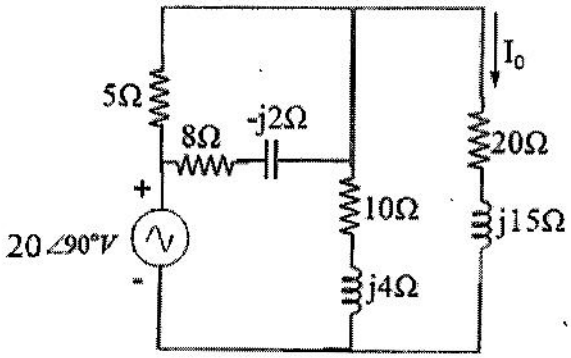


Fig. 2

c) Find the resistance between the terminal A and B of the circuit given in Fig.3.

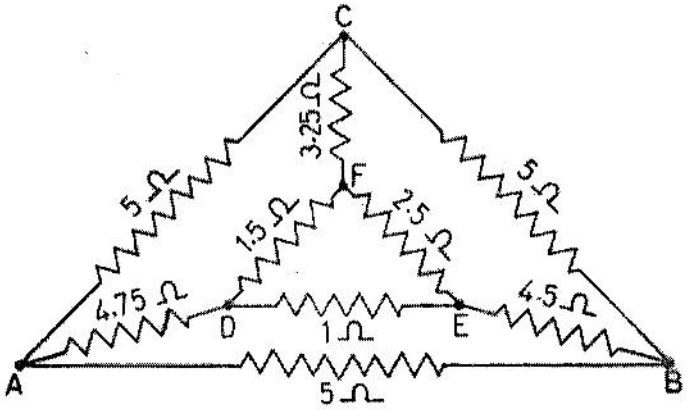
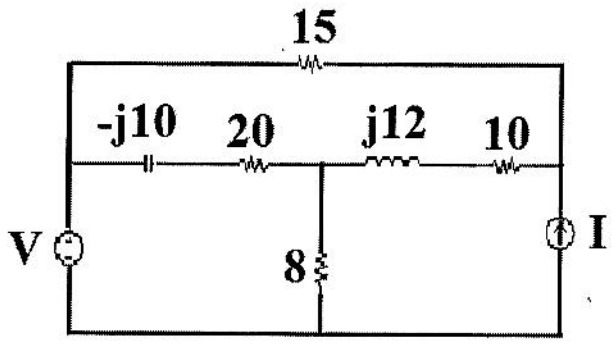


Fig. 3

5

5. a) A single phase induction motor absorbs 7 KW at a lagging power factor of 0.65 from a 230V, 50 Hz power supply. Find the value of capacitance necessary to raise the power factor to 0.9 lagging. Draw the relevant phasor diagram. 7

b) Using superposition theorem, find the power consumed by 10 ohm resistor as shown in the following figure. 8



Here, V= $120/\underline{30^0}$ V and I= $20/\underline{0^0}$ A.

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Ex/EE/T/111/2018

B.E. ELECTRICAL ENGINEERING EXAMINATION 2018
(1st Year, 1st Semester)

PRINCIPLES OF ELECTRICAL ENGINEERING-I

Time: Three hours Full Marks: 100

(50 marks for each part)

Use separate answer script for each part.

PART II

Answer **any three** questions.

Figures in the margin indicate full marks

Two marks allotted for neat and to the point answer

6. (a)	Explain what do you mean by the terms (i) flux-linkage, (ii) leakage flux (iii) mmf (iv) permeability.	(8)
(b)	Compare electric circuit and magnetic circuit.	(8)
7 (a)	What is meant by normal magnetization curve? How is it drawn? Explain the significance of different sections of the magnetization curve. What is the difference between hysteresis loop and normal magnetization curve?	(6)
(b)	Discuss the hysteresis and eddy current losses that occur in a magnetic core when it is energized by an alternating current.	(10)
8(a)	Derive the expressions of energy stored in a magnetic field and lifting power of an electromagnet.	(8)
(b)	A wrought iron ring of mean iron path of 0.9m and cross sectional area of 20 sq.cm has an air gap of 2mm length. A permanent magnet of mmf 100AT is inserted in the ring so that it aids the air gap flux. Calculate the current required to produce a flux of 1 mWb across an air gap with a magnetizing coil of 180 turns. Assume a leakage co-efficient of 1.5. Neglect fringing. The magnetization curve of the wrought iron is given below:	(8)
9. (a)	Calculate the energy stored in a 10μF, 100V capacitor. Derive the formula used.	(6)
(b)	Derive the expression for the capacitance between two concentric cylinders with three dielectric layers between them.	(10)
10. (a)	What do you understand by the terms 1) electric potential 2) electric field intensity (3) electric charge density ? Derive a generalized relationship between electric potential and electric field intensity.	
(b)	State and explain Gauss's theorem. Apply it to derive an expression for the electric field at distance d from the axis of long straight conductor with a certain charge density.	(8+8)

B (wb/m^2)	0.6	0.75	0.8	1.25	1.4	1.5
H (AT/m)	75	100	125	250	500	1000