B.E. CHEMICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION, 2018

SUBJECT : ELECTRICAL TECHNOLOGY

Time : Three hours

Full Marks –100

Use a separate Answer-Script for each part

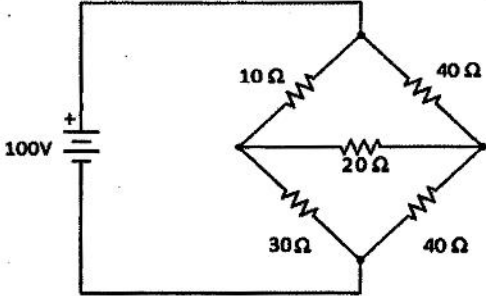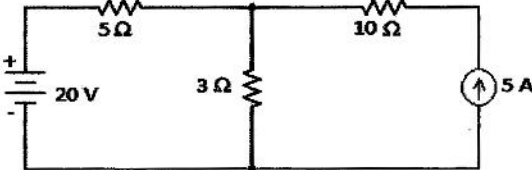| No. of question	**Part I (60 Marks)** **Answer any three questions.**	Marks
1. a)	State Thevenin's theorem. Use Thevenin's theorem to find the current through 20Ω resistor in figure below. 	10
b)	Deduce the RMS value of a sinusoidal voltage waveform.	4
c)	Derive the relationship between the alternating voltage and current for purely inductive circuit. Also show the average power consumed by the circuit under alternating excitation is zero. Draw the phasor diagram of the circuit.	6
2. a)	Using superposition theorem, find the current through 3 Ω resistor in the figure below. 	8
b)	State and prove maximum power transfer theorem.	6
c)	For an ac signal define cycle, time period, frequency and phase difference.	6
3.a)	Explain the phenomenon of resonance in any series R-L-C circuit and parallel R-L-C circuit.	6

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b)	A series RLC circuit containing a resistance of 8 Ω, an inductance of 0.0531 henry and a capacitor of 189.7 µF are connected in series across a 100 V, 50 Hz Supply. Calculate the total circuit impedance, circuit current, power factor and draw the phasor diagram.	9
c)	Deduce the expression for equivalent delta resistances of a star- connected network of resistances.	5
4. a)	"For a given electrical network, Thevenin's equivalent resistance and Norton's equivalent resistance are numerically equal."---Correct and/or justify the statement.	3
b)	Establish the relationship between line and phase quantities of currents and voltages of balanced three phase star connected system.	7
c)	A balanced load of 8Ω per phase is connected to a three-phase, 230V supply. Find the line current, power-factor, power, reactive VA and total VA when the load is i) star connected and ii) delta connected.	10
5. a)	A cast steel d.c electromagnet shown below has a coil of 1000 turns on central limb. Determine the current that the coil should carry to produce a flux of 2.5 mWb in the air-gap. Neglect leakage. Dimensions are given in cm. The magnetic curve for cast steel is as under: *Flux density(Wb/m²): 0.2 0.5 0.7 1.0 1.2* *Amp-turn/m : 300 540 650 900 1150* 	12
b)	Draw the hysteresis loop for a ferromagnetic material subjected to sinusoidal excitation. What is the significance of the area enclosed by B-H loop.	5
c)	Explain eddy current loss. How it can be minimized.	3

Ref. No.   Ex/ChE/ETech/EE/T/B/2018

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No. of question	Part II (40 Marks) **Answer any two questions.**	Marks
1. a)	Discuss the load characteristics of DC separately excited, shunt and series generator	10
b)	What is the concept of back e.m.f in dc motor?	5
c)	Discuss Speed-Torque characteristics of DC series motor.	5
2. a)	A 220 V DC series motor has armature and field resistances of 0.15 Ω and 0.10 Ω respectively. It takes a current of 30 A from the supply while running at 1000 rpm. If an external resistance of 1 Ω is inserted in series with the motor, calculate the new steady state armature current and the speed. Assume the load torque remains constant.	10
b)	What is the concept of slip in an induction motor?	5
c)	"In induction motor, rotor can never rotate at synchronous speed"- Explain this statement.	5
3.a)	Discuss the torque-armature current characteristics of DC series and shunt motor.	10
b)	Derive the e.m.f equation of a single phase transformer.	5
c)	A four pole generator having wave-wound armature winding has 51 slots, each slot containing 20 conductors. What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 7.0 mWb ?	5

4.	Write short notes on the following (Any Two) :
	    (i) Core type and Shell type transformers
	    (ii) Construction of DC Machines
	    (iii) Commutation in DC machines
	    (iv) Speed-Torque characteristics of DC shunt motor
		2x10