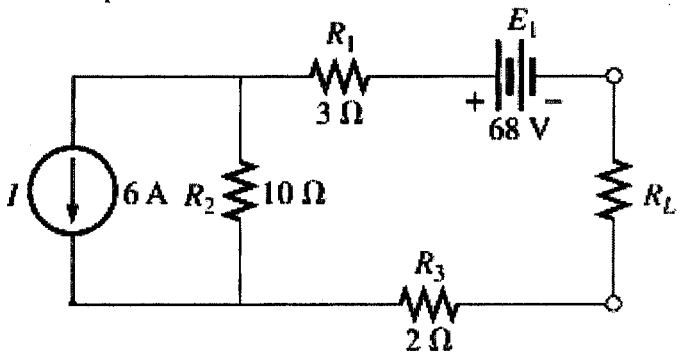
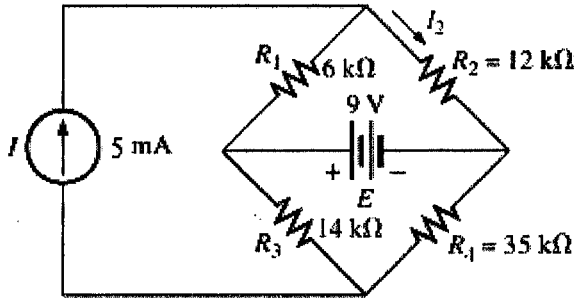
B.E. METALLURGICAL AND MATERIAL ENGINEERING SECOND YEAR FIRST SEMESTER EXAMINATION, 2019

SUBJECT: ELECTRICAL TECHNOLOGY-A

Time :Three hours **Full Marks: 100**
(50 marks for each part)

Use a separate Answer-Script for each part

No. of Question	**Part I** **Answer any three questions.** **Two marks reserved for neatness and well organized answers**	Marks
1.a)	State and explain Maximum Power Transfer Theorem.	6
b)	Find the value of R_L for maximum power transferred to the load as shown in the figure. Also calculate maximum power to the load. 	8
c)	What do you mean by resonance in any ac circuit?	2
2.a)	Deduce the relationship for converting any three terminal star-connected resistances into an equivalent delta connection.	6
b)	Using the principle of superposition, find the current I_2 through the 12 kΩ resistor in Fig. 	8
c)	Distinguish between Apparent Power & 'True Power'.	2

Ref. No. **Ex/Met/ETech/EE/T/A/213/2019**

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3.a)	A resistance R, an inductance L=0.05 H and a capacitance C are connected in series. When an alternating voltage v=500sin(3000t-10°)V is applied to the series combination, the current flowing is 30 sin(3000t-55°)A. Find the values of R and C.	8
b)	Two wattmeter method is used to measure the power absorbed by a 3Φ induction motor. The wattmeter readings are 15 kW and 5 kW. Find (i) the power absorbed by the machine (ii) load power factor (iii) reactive power taken by the load.	8
4.a)	A 3Φ star connected supply with a phase voltage of 230V is supplying a balanced delta connected load. The load draws 15kW at 0.8pf lagging. Find the line currents and the current in each phase of the load. Also calculate the load impedance.	8
b)	Describe the method of measurement of total power consumption of a three phase balanced load using two wattmeters. Draw necessary circuit and phasor diagrams.	8
5. a)	Define magnetic hysteresis and explain hysteresis loop. Explain the terms 'retentivity' and 'coercive force' in this context.	8
b)	An iron ring of mean circumference 85 cm is made from round iron of area 8 cm^2. It has a saw cut of 2 mm wide and is wound with 700 turns. Find the current required to produce a flux of 1 mWb across the air gap and 1.25 through iron path. Assume a relative permeability for iron as 625.	6
c)	What are the different methods to reduce hysteresis losses?	2

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No. of question	**Part II** **Answer any three questions.** **Two marks reserved for neatness and well organized answer.**	Marks
1.a)	Derive the emf equation of a DC motor.	3
b)	Explain with proper circuit diagrams the different methods of excitation of DC machines.	4
c)	A 4 pole wave connected DC machine has 200 conductors and runs at 1000 rpm. The useful flux per pole is 0.015 Wb. The current through the armature is 100A. Find the emf and torque developed.	5
d)	Draw No-Load, external, armature and load characteristics of a separately excited DC generator.	4
2.a)	Define Transformer. Explain the working principle of transformer.	2+2
b)	Draw the phasor diagram for a single phase practical transformer on leading load.	4
c)	A 5 kVA, 500/200 V, 50 Hz single phase transformer gave the following test results: OC test: 200V, 1.2A, 90W SC test: 50V, 10A, 150 W Determine the equivalent circuit parameters of the transformer as referred to the high voltage side.	8
3.a)	Derive the relation: $$\frac{T_e}{T_{em}} = \frac{2}{\frac{S_{mT}}{S} + \frac{S}{S_{mT}}}$$ T_e is the torque T_{em} is the maximum torque S_{mT} is the slip at which maximum torque occurs S is the slip	6
b)	Explain the principle of operation of three phase induction motor.	3
c)	Can a three phase induction machine attain synchronous speed? Give proper reasons for your answer.	2
d)	The rotor copper loss of three phase induction machine is 0.5kW. Find the rotor output power at 4% slip.	3
e)	Draw the torque slip characteristics of three phase induction machine.	2

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4.a)	Compare cylindrical pole rotor and salient pole rotor alternator.	2
b)	Draw the phasor diagram of an alternator on lagging load. From this phasor diagram find out the expression for excitation emf.	2+2
c)	Prove that $$P = \frac{V_t E_f \sin\delta}{X_s}$$ Where symbols have their usual meanings.	2
d)	A 2200 V, 50 Hz, three phase, star connected alternator has an effective resistance of 0.5 Ohm per phase. A field current of 30 A produced the full load current of 200 A on short circuit and a line to line emf of 1100 V on open circuit. Determine (i) the power angle of the alternator when it delivers full load at 0.8 pf (lag), (ii) the SCR of the alternator.	8
5.a)	Draw the torque current characteristics of DC shunt and DC series motor.	2
b)	Explain the field resistance method of speed control of DC motors.	3
c)	What are the electrical parameters that remain constant in the primary winding and secondary winding of an ideal 2 winding single phase transformer?	2
d)	Define voltage regulation in an ideal 2 winding single phase transformer.	2
e)	Explain the term "slip" in relation to three phase induction machine.	2
f)	A 6 pole three phase induction motor is running at 5% slip at full load. If the speed of motor is 1140 rpm, find the supply frequency.	3
g)	Is synchronous motor self starting? Give proper reasons for your answer.	2