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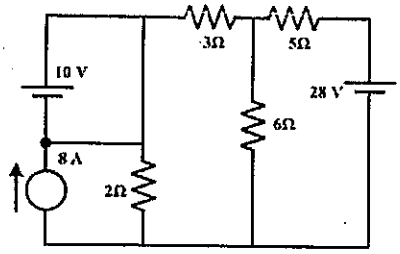
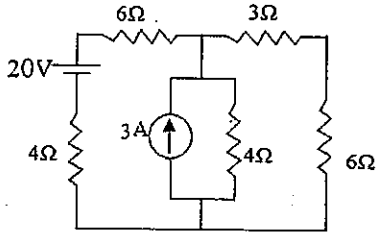
Ref. No. **EX/MET/ETech/EE/T/A/213/2017(S)**

B.MET. ENGINEERING 2ND YEAR 1ST SEM SUPPLEMENTARY EXAMINATION, 2017

SUBJECT: ELECTRICAL TECHNOLOGY-A

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

Use Separate Answer-Scripts for each part

No. of question	**Part I** **Answer any three questions.** **Two marks reserved for neatness and well organized answer.**	**Marks**
1.a)	State Norton's Theorem.	2
b)	Find the current through 6Ω resistor for the given circuit using 'mesh current' method and also calculate the voltage across it. 	10
c)	"In maximum power transfer condition, the efficiency of any electrical circuit is 50%"----Correct and/or justify the following statement.	4
2.a)	A symmetrical 3-phase, 415 V system supplies a balanced delta-connected load. The inductive load consumes 10 kW and the line current is 20 A. calculate the resistance and inductance per phase of the load and the power factor of the circuit.	8
b)	Determine the current through 3Ω resistor in the following circuit. (Apply Thevenin's theorem). 	8
3.a)	Draw and label a pure sinusoidal waveform of current. Deduce the relation between R.M.S. and average value(s) of the current waveform in terms of its maximum value.	4

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b)	A resistance(R), inductance (L) of 0.10 H and capacitance(C) are connected in series. When a voltage $415\cos(3000t-15^0)$V is applied to the series combination, the current flowing through the circuit is $14.14\cos(3000t+45^0)$A. Draw the phasor diagram and find the values of resistance & capacitance in the circuit.	6
c)	Deduce the expression for equivalent delta resistances of a star-connected network of resistances.	6
4.a)	A single phase transformer has 500 primary and 1000 secondary turns. The net cross sectional area of the core is 60 cm^2. The primary winding is connected to a 500V supply. Find the i) peak value of the core flux density and the ii) emf induced in the secondary winding.	8
b)	Derive the condition for maximum efficiency of a single phase transformer.	6
c)	"Superposition theorem is valid for linear circuit only" --- Correct and/or Justify the statement.	2
5.a)	Draw the connection diagram of two wattmeters intended to measure total power consumption by a balanced 3-phase delta - connected load. Express the readings of the wattmeters in terms of the line voltage, line current and the power factor angle of the load. Assume balanced source. Draw necessary vector diagram.	8
b)	Write short note on open circuit & short circuit test of a single phase transformer.	8

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Subject: ELECTRICAL TECHNOLOGY-A **Time: Three Hours** **Full Marks: 100**

Use a separate Answer-Script for each Part

Part II: (50 marks)

Question 1 is compulsory

Answer ***Any Two*** questions from the rest (2×20)

Question No.			Marks
Q1	Answer any ***Two*** of the following:		
	(a)	What do you understand by Hysteresis loss and Eddy current loss?	5
	(b)	What is commutation in a d.c. machine? Explain why it is necessary for (i) d.c. generator and (ii) d.c. motor.	5
	(c)	What are the difficulties in starting a d.c. motor with full voltage applied across its terminals? How to overcome such situations?	5
	(d)	Why the starting torque in a synchronous motor is zero? What are the methods employed to start a synchronous motor?	5
Q2	(a)	What are Leakage flux and Fringing flux?	2+2
	(b)	Determine the current required to establish a flux density of 0.5T in the air gap for the magnetic circuit shown in Fig. P-2(b). Assume $\mu_{core}=5000\ \mu_0$.	6
	(c)	Derive the expression for eddy current loss in a thin plate.	10
Q3	(a)	Derive the emf equation for d.c. generators.	4
	(b)	Explain how voltage builds up in a d.c. shunt generator. What are the conditions that are to be satisfied to ensure that voltage build-up takes place?	6+4
	(c)	A 4-pole, 12 kW, 240 volt d.c. generator has its armature coils wave connected. If the same machine is lap connected, with all other parameters remaining unchanged, then calculate voltage, current and power rating of the generator.	6

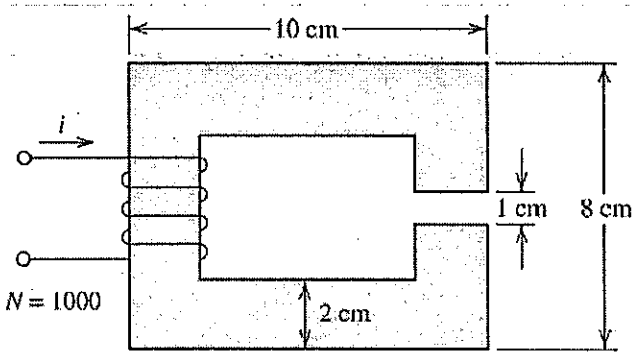

Fig. P-2(b)

Q4	(a)	Derive the torque equation for d.c. motors.	4
	(b)	Describe the speed control methods for d.c. shunt motor (i) below base speed, and, (ii) above base speed.	4+4
	(c)	A 200 volt d.c. shunt motor takes 22 Amp at rated voltage and runs at 1000 rpm. Its field resistance is 100 ohm and armature circuit resistance is 0.1ohm. Compute the value of additional resistance required in the armature circuit to reduce the speed to 800 rpm. Assume the load torque to be proportional to the speed.	8
Q5	(a)	Derive the expressions for real and reactive power for a 3-phase alternator.	6
	(b)	A 3-phase, 50 Hz, star connected salient pole alternator has 216 slots with 5 conductors per slot. All the conductors of each phase are connected in series; the winding is distributed and full pitched. The flux per pole is 30 mWb and the alternator runs at 250 rpm. Determine the phase and line voltages of emf induced.	8
	(c)	What is the physical significance of slip of an induction motor? Explain the speed torque characteristics of an induction motor.	2+4