Ref No. : **Ex/ET/EE/T/216/2019**

BACHELOR OF ELECTRONICS AND TELE-COMMUNICATION ENGINEERING, 2ND YEAR
1ST SEMESTER EXAMINATION , 2019

SUBJECT: ELECTRICAL MACHINES

Time: Three Hours | Full Marks: 100 (50 each part)

Use a separate Answer-Script for each part

Question No.	PART - I	Marks
	Answer any three from the following. Question no. 3 carries maximum marks.	
1. i)	Draw the phasor diagram of a single phase transformer at no-load.	**4+6+6**
ii)	Explain the terms 'leakage reactance' and 'magnetizing reactance'.	
iii)	A 3 kVA, 110/220 V single phase transformer, when excited at rated voltage and 5 Hz on HV side draws a no-load current of 1 A at 0.5 lagging p.f. If it is excited from the lv side at rated voltage and 60 Hz determine the no-load current, power factor and power input.	
2. i)	Draw and explain the torque-speed characteristics of a three phase induction motor. Show how the stable operating points are determined.	**5+4+7**
ii)	Show how the rotating magnetic field determines the direction rotation of a squirrel-cage induction motor	
iii)	The stator of a 3-phase slip-ring induction motor is connected to 50Hz supply. At the rotor terminals a frequency of 30Hz is required. Find the possible speeds at which the rotor must be driven. What is the ratio of slip-ring emfs at these speeds at no load?	
3. i)	Why the no-load power factor of an induction motor is poorer than a transformer?	**3+6 +9**
ii)	Derive the condition for negative voltage regulation. Why it is not practically possible?	

[Turn over

PART - I **Marks**

Question No.

iii) A short-circuit test, when performed on the HV side of a 10 kVA, 2000/400V, single phase transformer gave the following data: 60 V, 4 A, 100W.
If the LV side is delivering full load current at 0.8 p.f. lag and at 400 V, find the voltage applied to the HV side.

4. i) Why transformers are connected in parallel in distribution systems? **4+4+8**

ii) Two transformers having same voltage ratio, per unit impedance, kVA rating but different r/x ratio are connected in parallel. What will happen if load is connected as per their kVA rating?

iii) Three transformers having their kVA rating and percentage impedance of i) 100 kVA, 25% ii) 75 kVA 30% and iii) 25 kVA, 20% respectively are connected in parallel to deliver 200 kVA load. Find out their load sharing.

5. i) What is air gap power? Show how the air gap power is related to electromechanical torque (T_e), generated in a 3-phase induction motor. **8+8**

ii) A 3-phase, 400V, 50Hz induction motor takes a power input of 35kW at its full-load speed of 890 r.p.m. The total stator losses are 1kW and the friction and windage losses are 1.5kW Calculate (a) slip, (b) rotor ohmic loss, (c) shaft power, (d) shaft torque and € efficiency.

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B.E. ETCE SECOND YEAR FIRST SEMESTER - 2019

ELECTRICAL MACHINES

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

Part – II

Use Separate Answer scripts for each Group.

No. of questions		Answer any *three* (3×16) questions *Two* (02) marks reserved for neat and well organized answers and answer scripts.	Marks
1.	(a)	Deduce and draw the torque-current, torque-speed characteristics of DC shunt motor. Mention the effect of armature reaction on these characteristics.	8
	(b)	Why should a DC series generator never be operated under no-load? Explain with proper circuit diagram and derivation.	8
2.	(a)	Discuss briefly the methods of speed control above rated speed for DC shunt and series motors.	8
	(c)	A DC shunt generator is not generating proper voltage even in no load condition. What can be the reasons? How can they be rectified?	8
3.	(a)	A DC series motor runs at 1000 rpm, drawing a current of 50A, when supplied by 220V DC. The armature resistance and the series field resistance of the motor are 0.3Ω and 0.2Ω respectively. Determine the resistance to be connected in series such that the speed becomes 600rpm, supplying same torque. Consider linear B-H characteristics for the motor.	8
	(b)	From the equivalent circuit of a three-phase alternator, derive and draw the power-angle characteristics. Mention motoring/generating regions of operation. Comment on the stable operating ranges.	8
4.	(a)	Using proper phasor diagrams, show that power factor of a synchronous motor can be controlled by controlling the excitation for given terminal voltage and power. Show that the motor can operate at any power factor.	8
	(b)	Discuss in brief the external characteristics of compound DC generators, showing its variation on different level of compounding. Compare this with similar characteristic of a DC shunt generator.	8
5.	(a)	What are the starting methods of three phase synchronous motors? Discuss the construction and advantage of damper bars in this relation.	8
	(b)	A three phase 50Hz star connected synchronous generator produces an open circuit voltage of 1.1kV when the field circuit is supplied by 25A DC. For the same field current, the short circuit current of the generator is 500A. The DC resistance measured between any two armature terminals is 0.1Ω. (i) Find the parameters of the equivalent circuit and draw the circuit. (ii) What will be the load current if a star connected impedance of (0.3+j0.4)Ω per-phase is connected across the generator terminals.	8