Bachelor ofEngineering (Electrical Engineering) Examination, 2019

(4th Year, **1st** Semester)

ELECTRICAL MACHINES - III

Time: Three Hours **Full Marks:** 100

(50 marks for each part)
Use a separate Answer-Script for each Part

PART - I

Answer ***any three*** questions from this part.
Two marks are for neat and well organised answer.

1. a) Explain the double revolving field theory for single phase induction motor and also prove that a single phase induction motor cannot produce starting torque. Show that this motor can be forced to run in either direction. 12

   b) What are the various methods of starting of single phase induction motor? 4

2. a) Derive the equivalent circuit of a single phase induction motor with the help of double revolving field theory. 10

   b) Explain how the equivalent circuit parameters of a single phase induction motor can be determined experimentally. State various assumptions made. 6

3. a) What are the two kinds of emfs induced in the armature of ac commutator machines? Derive expressions for these emfs in case field flux is pulsating. 8

   b) In a single phase capacitor induction motor, it is required that the auxiliary winding current should lead the main winding current by 90^{o}, at the time of starting. Find the value of capacitive reactance in series with the auxiliary winding in terms of two winding constants. 8

4. a) What is single phase series motor? Explain its working principle. Draw and explain the phasor diagram of a single phase series motor. 12

   b) What is Compensated single phase series motor? 4

5. a) The following data relates to tests on a 110 volt, 150 watt, 50 Hz, 6 pole single-phase induction motor. 8

No-load test : 110 volts, 63 watts, 2.7 amps.

Blocked rotor test : 55 volts, 212 watts, 5.8 amps.

The stator winding resistance is 2.5 Ω and during the blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters. Also find the core, friction and windage losses.

b) With a neat diagram describe the construction and principle of operation of a Shaded Pole motor. 8

PART-II

Answer ***any three*** questions from this part.
Two marks are reserved for neat and well organised answer

6. Justify the following (any four) 4X4

a) The short circuit characteristic of an alternator is linear.

b) Slip test is not performed at rated voltage.

c) Synchronous motors have no starting torque.

d) The armature reaction of an alternator is demagnetizing for lagging load.

e) Alternators have demagnetizing armature reaction under lagging load.

f) A turbo alternator is designed with small value of D/L ratio compared to hydro alternator of same rating.

7.	a) Explain with the help of suitable phasor diagrams the effect of armature reaction on the terminal voltage of an alternator.	8
	b) A 10.0 MVA, 6.6 kV, 3 phase, star connected, alternator has the following data: Xs=1.0 ohm/phase and Ra=0.3 ohm/phase. Calculate the voltage regulation and load angle at upf, when it is operating under (i) half load (ii) full load.	8
8.	a) Develop the power angle characteristics of a cylindrical rotor alternator. Also sketch the same showing maximum power.	8
	b) Develop the phasor diagram of a salient pole alternator both under lagging and leading power factor condition.	8
9	a) With the help of phasor diagram discuss the operation of a synchronous condenser. Also indicate the application areas for the same.	8
	b) A 5.0 MVA , 3-phase star connected 6.6 kV, 50 Hz synchronous motor has reactance of X_d=1.5 Ω and X_q= 1.0 Ω. Compute its excitation voltage and load angle at half load, unity	8

	power factor and rated voltage.	
10	Write short notes on any Two: a) Starting techniques of synchronous motor. b) Synchronization of alternator to infinite bus. c) V- curve of a synchronous machine.	8 + 8