

## BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) EXAMINATION, 2024

(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 is shaded pole motor? With the help of neat sketch discuss the construction and working principle of shaded pole motor. Mention some application of shaded pole motor.	8
	b) In a single phase capacitor induction motor, it is required that the auxiliary winding current should lead the main winding current by $90^\circ$ , 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.	6
	b) What is Compensated single phase series motor?	

[ Turn over

5.	a) The following data relates to tests on a 110 volt, 150 watt, 50 Hz, 6 pole single-phase induction motor. 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 $2.5 \Omega$ and during the blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters. Also find the core, friction and windage losses.	8
	b) Write a note on Repulsion Motor.	8

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)  
FOURTH YEAR  
FIRST SEMESTER EXAM**

**SUBJECT: - ELECTRICAL MACHINES-III**

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/~~Six hours~~

Full Marks 100  
(50 marks for each part)

Use a separate Answer-Script for each part

**PART II**

6. Justify the following (any four) (CO1) 4X2½
- a) Hydro alternator rotors are fitted with damper bars where as turbo alternators have solid rotor structure.
  - b) Liquid Hydrogen is used as coolant for the armature winding of an alternator.
  - c) Salient pole machines are low speed machines.
  - d) The armature reaction of an alternator is demagnetizing for lagging load.
  - e) The short circuit ratio of a cylindrical rotor alternator is inversely proportional to its synchronous reactance.
  - f) A turbo alternator is designed with larger value of L/D ratio compared to hydro alternator of same rating.
7. 10
- a) Explain two reaction theory and develop the phasor diagram of a salient pole rotor alternator under leading load. (CO2)
- or**
- b) Draw the phasor diagram of a cylindrical rotor alternator both under lagging and leading power factor condition. (CO2) 10
8. 10
- a) Derive the power angle characteristics of a salient pole alternator and sketch the same. (CO2)
- or**
- b) Explain V-curve of alternator with the help of phasor diagram and sketch the same for no load condition. Also indicate the operating power factors on different parts of the curve. (CO3) 10
9. Answer any two: (CO3) 5x2
- a) Why slip test is performed for an alternator? Explain the test procedure and the sources of errors for this test.

[ Turn over

**BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)  
FOURTH YEAR  
FIRST SEMESTER EXAM**

**SUBJECT: - ELECTRICAL MACHINES-III**

Time: ~~Two hours~~/Three hours/~~Four hours~~/~~Six hours~~

Full Marks 100  
(50 marks for each part)

Use a separate Answer-Script for each part

- b) Why do synchronous motors have no starting torque? Explain different starting methods of synchronous motors.
- c) Sketch and explain the operating chart of an alternator.
10. CO4
- a) A 3-phase star connected alternator has a synchronous impedance of  $(0.2+j2.5)$  ohm per phase and is delivering power of 8000kW to grid. It is operating at a constant terminal voltage of 6.6 kV with excitation voltage of 7.2 kV. Find the load angle, armature current, and p.f. corresponding to this operating condition. 10
- or
- b) A 50 MVA, 3 phase, star connected, 11kV, 12 pole 50 Hz, salient pole synchronous motor has the following parameters per phase.  
 $X_d = 4.0$  ohm,  $X_q = 2.5$  ohm  
Compute the excitation voltage and load angle at full load 0.8 power factor lag with rated operating voltage.