5. A 220 V, 50 Hz, 6 pole single phase induction motor has the following parameters $V_1 = 3.04\ \Omega$, $X_1 = 4.2\ \Omega$, $X_m = 105.6\ \Omega$, $r_2 = 6.26\ \Omega$, $X'_2 = 2.12\ \Omega$. It is operating at 5 % slip. Determine the stator current and the power factor. **CO2 BL3**

6. A 230 V, 380 W, 50 Hz, 4-pole, single phase induction motor gave the following test results: **CO3 BL3**

No load test : 230 V, 84 W, 2.8 A.

Blocked rotor test: 110 V, 460 W, 6.2 A.

The stator winding resistance is 4.6 Ω and during the blocked rotor test, the auxiliary winding is open. Determine the equivalent circuit parameters.

7. A three-phase, 16 pole, 50 Hz star connected alternator has 144 slots and 10 conductors per slot. The flux per pole is 8 mWb and is sinusoidally distributed. The coil pitch is 2 slots short of full pitch. Find: **CO1 BL3**

(i) speed (ii) Phase emf (iii) line emf (iv) Coil Span factor Kc (v) Coil Distribution factor Kd.

8. Why is a synchronous motor not capable of starting by itself? Illustrate with a diagram and explain the starting procedure of a synchronous motor. **CO1 BL2**

9. Describe the V and inverted V characteristics of a synchronous motor. Also explain, with the aid of a vector diagram, the working of a synchronous motor as a synchronous condenser. **CO2 BL2**

10.a) A 3 phase 1500 kVA, star connected 50 Hz, 2300 V alternator has a resistance between each pair of terminals as measured by direct current is 0.16 Ω. Assume that the effective resistance is 1.6 times the ohmic resistance. A field current of 70 A produces a short circuit current equal to full load current of 376 A in each line. The same field current produces an emf of 700 V on open circuit. Determine the synchronous reactance of the machine and its regulation at half load when the p.f is i) 0.8 lag and ii) 0.8 lead **CO3 BL3**

OR

10.b) The open and short circuit test readings for a 3-ϕ, star-connected, 1000 kVA, 2000 V, 50 Hz, synchronous generator are: **CO3 BL3**

Field current (I_f) Amps	10	20	25	30	40	50
O.C. Terminal Voltage (L-L)	800	1500	1760	2000	2350	2600

A field current of 30A is required to circulate the rated current under short circuit condition. The armature effective resistance is 0.2Ω/phase. Draw the characteristics curves and estimate the full-load percentage regulation at 0.8 p.f. lagging by graphical method.

⇔⇔⇔ **Ca/D/TZ** ⇔⇔⇔

Ca/D/TZ

Reg. No:

Final Assessment Test – April 2026

VIT
Vellore Institute of Technology

Course: **BEEE312L - AC Machines**

Class NBR(s): **2256 / 4231**

Slot: **D1**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Identify the different types of construction and working of synchronous and asynchronous machines
CO2	Analyse the characteristics of synchronous machines and asynchronous machines
CO3	Perform various tests on synchronous machines and asynchronous machines to analyze its performance

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

1. A 1100-V, 50-Hz delta connected induction motor has a star-connected slip-ring rotor with a phase transformation ratio of 3.8. The rotor resistance and standstill leakage reactance are 0.012 Ω and 0.25 Ω per phase respectively. Neglecting stator impedance and magnetizing current determine — **CO2 BL3**
   i. The rotor current and power factor at start with slip-rings shorted
   ii. The rotor current and power factor at 4% slip with slip rings shorted
   iii. The external rotor resistance per phase required to obtain a starting current of 100 A in the stator supply lines.

2. List the various techniques for controlling the speed of a three-phase induction motor? Describe any three methods in detail. — **CO1 BL2**

3.a) A 10 kW, 400 V, 3-phase 4-pole 50 Hz delta connected induction motor is running at no load with a line current of 8A and an input power of 660 watts. At full load, the line current is 18A and the input power is 11.20 kW. Stator effective resistance per phase is 1.2 Ω and friction, windage loss is 420 watts. For negligible rotor ohmic losses at no load, calculate (i) stator core loss (ii) total rotor losses at full load (iii) total rotor ohmic losses at full load (iv) full load speed (v) internal torque, shaft torque and motor efficiency. — **CO2 BL3**

OR

3.b) A 50 hp, 3-phase, 6-pole induction motor delivers full load output at 960 rpm at 0·8 p.f. when supplied with 400 V, 50 Hz supply. Losses due to windage and friction come out to be 2 hp. and stator losses are 2 kW. Find (i) slip (ii) rotor power developed (iii) total rotor Cu loss (iv) efficiency and (v) line current. — **CO2 BL3**

4. i. A 6-pole, 50 Hz, 3-phase induction motor has a rotor resistance of 0.03 Ω per phase and standstill reactance of 0.5 Ω per phase. Determine the slip corresponding to maximum torque and speed of the motor at which maximum torque is developed. **[4] CO3 BL3**
   ii. Explain the procedure to construct circle diagram to find performance characteristics of three phase induction motor. **[6]**