

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZIANAGARAM**  
**II B. Tech II Semester Supplementary Examinations NOV-2025**  
**INDUCTION AND SYNCHRONOUS MACHINES**  
**(EEE )**

Time: 3 hours

Max. Marks: 70

**The Question paper consists of Part A & Part B.**

**Part A is compulsory, Answer all questions.**

**Part B Answers any one question from each unit.**

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|---|---|-----------|
| 1 | PART-A  | (20Marks) |
|   | a) Define the term Slip?  | [2]       |
|   | b) If the full load speed of a 3-phase, 50 Hz induction motor is 1460 rpm, what will be its synchronous speed?  | [2]       |
|   | c) What parameters determine the torque of an induction motor?  | [2]       |
|   | d) Draw simplified equivalent circuit of a 3-phase induction motor referred to stator side.   | [2]       |
|   | e) What is two-field revolving theory?  | [2]       |
|   | f) Why series motor are not operated at no-load?  | [2]       |
|   | g) State the working principle of a Synchronous motor   | [2]       |
|   | h) Define the terms Coil span factor and Distribution factor  | [2]       |
|   | i) What are the causes of hunting in synchronous machines?  | [2]       |
|   | j) Why the synchronous motor is not self-starting?  | [2]       |
|   | PART-B  | (50Marks) |
|   | Question from <b>Unit - I</b>   |           |
| 2 | a) Discuss how a rotating field is produced in a 3-phase induction motor. How does the rotating field help in the production of torque.   | [5]       |
|   | b) The resistance and stand-still reactance per phase of a 3-phase induction motor is 0.1 ohm and 0.4 ohm respectively. If 100 V per phase is induced in the rotor circuit at start then calculate rotor current and rotor power factor (i) when rotor is stationary and (ii) when running with a slip of 5%        | [5]       |
|   | (OR)  |           |
| 3 | a) Explain the principle of operation of a 3-phase induction motor.   | [5]       |
|   | b) A -3-phase induction motor is required to be operated at about 700 rpm. What will be the number of poles of the machine if supply frequency is (i) 60 Hz (ii) 25 Hz. Also determine its actual speed if slip is 5%.  | [5]       |
|   | Question from <b>Unit - II</b>  |           |
| 4 | a) Develop a relation between full-load torque and maximum torque of an induction motor   | [5]       |
|   | b) The rotor resistance and stand-still reactance per phase of a 3-phase, 8-pole, 50 Hz, phase-wound induction motor is 0.01 ohm and 0.1 ohm respectively. At full-load the machine is operating at 4% slip. Find the ratio of maximum torque to full load torque. Also find the speed at which this torque occurs. | [5]       |
|   | (OR)  |           |
| 5 | a) Draw and explain the torque-speed characteristic of a 3-phase induction motor.   | [5]       |
|   | b) What are the factors which determine the speed of a 3-phase induction motor? Name and explain in brief the various methods of speed control of 3-phase induction motor.  | [5]       |
|   | Question from <b>Unit - III</b>   |           |
| 6 | a) Explain the construction and working of a single-phase capacitor start induction motor.  | [5]       |
|   | b) Explain the working of AC Series motor with a neat circuit and corresponding phasor diagram  | [5]       |

(OR)

- 7 a) Explain the construction and working of a single-phase shaded pole induction motor [5]
- b) A single-phase induction motor draws a current of 0.5 A at 230 V and 0.6 lagging power factor. If it runs at a speed of 100 radian per second and develops an output torque of 0.3 Nm, find its output power and efficiency. [5]

Question from **Unit - IV**

- 8 A 3-phase, 20-pole, 50Hz alternator has single-layer winding with full-pitch coils. The coils are connected in  $60^\circ$  phase group and each coil is having six turns. If the flux per pole is 0.025 Wb, determine the rms value of emf induced per phase. [10]

(OR)

- 9 A three-phase star connected 1200 kVA, 3300 V, 50 Hz, alternator has armature resistance of 0.25 ohm per phase. A field current of 40 A produces a short circuit current of 200 A and an open circuit emf of 1100 V between lines. Calculate regulation on full load 0.8 power factor lagging. [10]

Question from **Unit - V**

- 10 a) Explain the working principle of a three-phase synchronous motor [5]
- b) A 6600 V, 3-phase, star-connected synchronous motor draws a full-load current of 80 A at 0.8 power factor leading. The armature resistance is 2.2 ohms and synchronous reactance 22 ohms per phase. If the stray losses of the machine are 3200 W, determine: (i) the emf induced; (ii) the output power; (iii) the efficiency. [5]

(OR)

- 11 a) Derive the commonly used expression for the power developed by a synchronous motor. [5]
- b) List the merits and demerits of Synchronous motor [5]

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