B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fourth Semester

Electrical and Electronics Engineering

20EEPC401 - SYNCHRONOUS AND INDUCTION MACHINES

Regulations - 2020

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

| | | Marks | K–Level | CO |

1. Why the m.m.f. method is considered optimistic when used for calculating the voltage regulation of an alternator?   *(1, K1, CO1)*
   (a) Because it provides the highest voltage regulation value
   (b) Because it guarantees 100% accuracy in calculation
   (c) Because it includes saturation of the synchronous machine
   (d) Because it will always show a lower voltage regulation than actual

2. Depending upon the reluctances offered along the direct axis and quadrature axis, the armature reaction flux will _____.   *(1, K1, CO1)*
   (a) Lead the armature current
   (b) Lags behind the armature current
   (c) In phase with the armature current
   (d) Either In phase with the armature current or Lags behind the armature current

3. The synchronous motors are not self-starting because _____.   *(1, K1, CO2)*
   (a) stator is not used
   (b) starting winding is not provided
   (c) the direction of instantaneous torque on the rotor reverses after half cycle
   (d) there is no slip

4. A synchronous motor is running on a load with normal excitation. Now if the load on the motor is increased _____.   *(1, K1, CO2)*
   (a) Power factor as well as armature current will decrease
   (b) Power factor as well as armature current will increase
   (c) Power factor will increase but armature current will decrease
   (d) Power factor will decrease but armature current will increase

5. A 500 kW, 3-phase, 440 volts, 50 Hz, induction motor has a speed of 960 r.p.m. on full load. The machine has 6-poles. The slip of the machine will be _____.   *(1, K1, CO3)*
   (a) 1%   (b) 2%   (c) 3%   (d) 4%

6. In a 3-phase induction motor, the variable mechanical load is represented electrically by a variable _____ only.   *(1, K1, CO3)*
   (a) inductance   (b) capacitance   (c) resistance   (d) capacitance-resistance

7. The speed of a slip-ring three phase induction motor can be controlled from the rotor side by _____.   *(1, K1, CO4)*
   (a) changing the supply voltage   (b) changing the supply frequency
   (c) rheostatic control.   (d) changing the number of poles

8. The external resistance in a rotor resistance starter is commonly implemented using _____ resistors.   *(1, K1, CO4)*
   (a) Wire-wound   (b) Film   (c) Ceramic   (d) Variable

9. Capacitor-start capacitor-run induction motor is basically a _____ motor.   *(1, K1, CO5)*
   (a) two phase   (b) ac series   (c) commutator   (d) synchronous

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

10. Which one of the following statements is correct? When a single phase induction motor is excited with single phase ac voltage, the magnetic field set up is equivalent to   *1   K1   CO5*
    (a) Two fields, rotating in opposite directions with different speeds
    (b) Two field, rotating at synchronous speed in opposite directions
    (c) Two fields, rotating at synchronous speed
    (d) Two fields, rotating in the same direction but at different speeds

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Infer why short-pitch winding is preferred over full pitch winding.   *2   K2   CO1*
12. Define load angle of an alternator.   *2   K1   CO1*
13. Outline the need of parallel operation of alternators.   *2   K2   CO1*
14. List the Merits of Three phase synchronous motor over three phase induction motor.   *2   K1   CO2*
15. Name the functions of damper windings which are provided in synchronous machines.   *2   K1   CO2*
16. Outline the synchronous motors are not self starting motor.   *2   K2   CO2*
17. A 3 phase induction motor is supplied at 50 Hz and is wound for 4 poles. Calculate (i)Synchronous Speed (ii) speed when slip is 3% (iii) Frequency of the rotor EMF when it runs at 2000 RPM.   *2   K2   CO3*
18. Compare squirrel cage induction motor and phase wound induction motor.   *2   K2   CO3*
19. What are the main disadvantages of rotor rheostatic control?   *2   K1   CO4*
20. Classify the different types of starters used for 3 phase IM.   *2   K2   CO4*
21. Draw the equivalent circuit of a single phase induction motor without core loss.   *2   K1   CO5*
22. Infer the function of capacitor in a single phase induction motor.   *2   K2   CO5*

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) A 3 phase star connected alternator is rated at 1500kVA, 12000V. The armature effective resistance and synchronous reactance are 2 ohm and 5 ohm respectively/phase. Calculate the % regulation for a load of 1200kW at pf of 0.8 lag.   *11   K2   CO1*

OR

   b) Outline the EMF method used to predetermine the voltage regulation of synchronous machines.   *11   K2   CO1*

24. a) A three phase 500 V, star connected synchronous motor gives net output of 17kW on full load operating at 0.9 lagging power factor. Its armature resistance is 0.8 Ω per phase The mechanical losses are 1300 W. Estimate the current drawn by the motor and full load efficiency.   *11   K2   CO2*

OR

   b) Explain V and inverted V curves of a synchronous motor with necessary diagram.   *11   K2   CO2*

25. a) Derive the torque equation of the three-phase induction motor and deduce the condition for maximum torque.   *11   K2   CO3*

OR

   b) Deduce and develop the equivalent circuit for 3-phase induction motor.   *11   K2   CO3*

26. a) Classify the different methods of starting and explain any two methods of starting of three phase IM.   *11   K2   CO4*

OR

   b) Outline with neat sketches, the working of star-delta starter and rotor resistance starter.   *11   K2   CO4*

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14228**

27. a) Explain double field revolving theory and mention the merits and demerits of shaded pole induction motor.   *11*   *K2*   *CO5*

OR

    b) Draw the equivalent circuit of single-phase induction motor and discuss the experimental procedure to obtain its parameter.   *11*   *K2*   *CO5*

28. a) (i) Describe the Scherbius System of conventional methods of slip power recovery scheme of three phase induction motor with its advantages and disadvantages.   *6*   *K2*   *CO4*

     (ii) Outline any two types of single-phase induction motors.   *5*   *K2*   *CO5*

OR

    b) (i) Illustrate the cascade operation of induction motors to obtain variable speed.   *6*   *K2*   *CO4*

     (ii) Explain the no load test and blocked rotor test on a single-phase induction motor.   *5*   *K2*   *CO5*