21718

3 Hours / 100 Marks   Seat No.

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) **Attempt any THREE of the following:** 12

(i) Explain why 3 phase induction motor can never run on synchronous speed.

(ii) Give the comparison between squirrel cage induction motor and slip ring induction motor on any four parameters.

(iii) State the necessity of starter in 3 phase induction motor. Draw a neat diagram of auto transformer starter.

(iv) Give any four advantages of having a stationary Armature in case of Alternator.

Marks

b) **Attempt any <u>ONE</u> of the following:**   **6**

   (i) Explain speed control of 3 phase induction motor by the following methods:

      1) Pole changing method

      2) Stator voltage control method

      3) Rotor resistance control method.

   (ii) With the help of neat labelled diagram, explain the construction and working of variable reluctance stepper motor (VRSM). Also give any two applications of this motor.

2.   **Attempt any <u>FOUR</u> of the following:**   **16**

  a) Draw the necessary flow diagram showing power stages of 3φ Induction motor.

  b) Draw and explain torque slip characteristics of 3φ induction motor.

  c) Derive emf equation of an Alternator.

  d) State any 3 advantages and any one disadvantages of short pitched coil in case of alternator.

  e) In AC series motor, explain how the construction is modified in order to

    (i) Reduce eddy current losses

    (ii) Improve power factor.

  f) With the help of necessary phasor diagram, explain how starting torque is produced in capacitor start induction run = 1φ Induction motor.

Marks

3 **Attempt any <u>FOUR</u> of the following:** **16**

a) Derive the condition for maximum torque under running condition for 3 phase induction motor.

b) A 4 pole, 50 Hz, 7.46 kW motor has at rated voltage and frequency, a starting torque of 160% and maximum torque of 200% of full load. Determine:

   (i) Full load speed

   (ii) Speed at maximum torque.

c) From the following test results, determine the voltage regulation of a 2000 V, 1-phase alternator delivering a current of 100 Amp at:

   (i) Unity pf

   (ii) 0.8 leading pf

      Test Results:

      1) Full load current of 100 Amp is produced on short circuit by a field excitation of 2.5A.

      2) An emf of 500 V is produced on open circuit by the same excitation.

      Armature resistance in 0.8 ohm.

c) The stator of a 3 phase, 16 pole alternator has 144 slots and there are 4 conductor per slot connected in two layers and the conductors of each phase are connected in series. If the speed of the alternator is 375 rpm, calculate the emf induced per phase. Resultant flux in the air gap is 5×10^{-2} wb per pole sinusoidally distributed. Assume the coil span as 150° electrical.

e) Discuss the construction and working principle of Linear Induction motor.

Marks

4. a) **Attempt any <u>THREE</u> of the following:** **12**

    (i) The power input to a 500V, 50Hz, 6pole, 3phase induction motor running at 975 rpm is 40 KW. The stator losses are 1 KW and the friction and windage losses are 2KW calculate:

        1) Slip

        2) Rotor copper loss

        3) Shaft power

        4) Efficiency

    (ii) Explain how each of the following can reduce starting current of a 3 phase induction motor:

        1) By star-delta starter.

        2) By inserting resistance in rotor winding

    (iii) Discuss the different factor affecting the terminal voltage of an Alternator.

    (iv) State the need of parallel operation of Alternators. Also give the three essential conditions which must be satisfied for proper synchronization of alternators.

  b) **Attempt any <u>ONE</u> of the following** **6**

    (i) Draw the vector diagram of a loaded alternator when load is :

        1) Unity pf

        2) 0.8 pf logging

        3) 0.8 pf leading

    (ii) With the help of necessary graphs and vector diagram, describe in details the Ampere turn method of determining regulation of a 3 ϕ Alternator.

Marks

5. **Attempt any FOUR of the following:** **16**

a) Discuss the stroboscopic method of measurement of slip in 3ϕ induction motor.

b) Describe the production of rotating magnetic field in case of 3ϕ induction motor with aid of vector diagram.

c) Explain the lamp method of synchronizing alternator to the bus bar.

d) Discuss how will the change in excitation effect load sharing between two alternators connected in parallel.

e) Describe the construction and working principle of A.C. servomotor.

f) Give any two application each of the following:

   (i) Universal motor

   (ii) Linear induction motor

   (iii) DC/AC servomotor

   (iv) Permanent magnet stepper motor (PMSM)

6. **Attempt any FOUR of the following:** **16**

a) Describe the construction and working of shaded pole induction motor.

b) Explain the construction of universal motor and draw its torque-speed characteristics.

c) Enlist two types of rotor used in alternator. Give any three differences between them.

d) Why single phase IM is not self starting? Justify with the help of double field revolving theory.

e) For capacitor start, capacitor run 1-ϕ IM:

   (i) Explain construction   2

   (ii) Draw torque speed characteristic   1

   (iii) Any two applications   1

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