17511

14115

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) State why three phase induction motor never run on synchronous speed ?

   ii) State the effect of rotor resistance on torque of an induction motor.

   iii) Draw a neat diagram for Autotransformer starter used in 3 phase induction motor.

   iv) State the necessity of AC generator. State any two parts of AC generator with material used for them.

   B) Attempt **any one** of the following : **6**

   i) Explain voltage frequency method of speed control of 3 phase induction motor.

   ii) Draw a schematic diagram of an a.c. series motor. How to change its speed and direction of rotation ? Give two applications of a.c. series motors.

MARKS

2. Attempt **any four** of the following : **16**

   a) Explain with neat sketches, the production of rotating magnetic field in three phase induction motor.

   b) A 3ϕ, 50 Hz, 4 pole, I.M. has a slip of 4%

      Calculate :

      1) Speed of motor

      2) Frequency of rotor emf if the rotor has a resistance of 1Ω and standstill reactance of 4Ω. Calculate the rotor power factor at
         i) standstill
         ii) a speed of 1440 rpm.

   c) Explain the factors which affect the terminal voltage of alternator.

   d) A 12 pole, 3ϕ, alternator is coupled to an engine running at 500 rpm. It supplies an induction motor which has full load speed of 1440 rpm. Find the slip and the no. of poles of the induction motor.

   e) What is an universal motor ? Comment briefly on its constructional features and speed-torque characteristics. Mention its any two applications.

   f) Explain the working principle of permanent magnet stepper motor.

3. Attempt **any four** of the following : **16**

   a) Derive torque equation of 3 phase induction motor.

   b) A 12 pole, 50 Hz, 3 phase induction motor has rotor resistance of 0.15Ω and standstill reactance of 0.25Ω per phase. On full load, it is running at a speed of 480 rpm. The rotor induced emf per phase at standstill is observed to be 32 V. Calculate

      1) Starting torque

      2) Full load torque

      3) Maximum torque

      4) Speed at maximum torque.

MARKS

c) A 16 pole, 3 phase star connected alternator armature has 12 slots with 24 conductors per slot and the flux per pole is 0.1 Wb. sinusoidally distributed. Calculate the line emf generated at 50 Hz.

d) Derive the emf equation of alternator.

e) Why a single phase induction motor doesn't have a self starting torque ? Explain the double revolving field theory.

4. A) Attempt **any three** of the following : **12**

a) A 500 V, 3 ph, 50 Hz induction motor develops an output of 15 kW at 950 rpm. If the input power factor is 0.86 lagging. Mechanical losses are 730 W and the stator losses 1500 W. Find

1) The slip
2) The rotor copper loss
3) The motor input
4) The line current.

b) Compare DC motor and induction motor on the basis of construction, size, speed control and applications.

c) Explain the procedure to calculate voltage regulation of a 3 phase alternator by synchronous impedance method with necessary graphs and phasor diagram.

d) Why is it necessary to run the alternators in parallel ?

B) Attempt **any one** of the following : **6**

a) Define voltage regulation of alternator ? On what factors regulation depends ? Explain in brief.

b) O.C. and S.C. test were performed on a 3 phase 0.5 MVA, 3.6 kV, star connected alternator. The results are given below :

O.C. : I_f = 10 A, V_{SC} = 3000 volt

S.C. : I_f = 10 A, I_{SC} = 150 A

Ra/ph = 1 Ω

Calculate the percentage, regulation for full load condition at 0.8 p.f. lagging.

MARKS

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

   a) A 20 HP, three phase, 50 Hz, 4 pole induction motor has a full load slip of 4%. The friction and windage losses are 500 watts ; calculate the rotor copper loss and rotor speed.

   b) Describe with the help of curves the effect of variation of a rotor circuit resistance on the torque-slip characteristics of an induction motor.

   c) Explain the concept of load sharing.

   d) A total load of 1200 kW is shared equally by two identical alternator at 6000 volts and 0.866 lagging p.f. The current of one alternator is 70 A at lagging p.f. Find the p.f. of both the alternators. Both alternators are 3 phase star connected.

   e) Explain the principle of operation of linear induction motor.

   f) What is an induction generator ? State its principle of operation.

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

   a) State two applications each for the single phase capacitor start capacitor run and shaded pole induction motors.

   b) State the four applications of induction generators.

   c) What is armature reaction ? Discuss the effect of lagging p.f. on armature reaction.

   d) Explain the role of capacitor in a single phase capacitor start capacitor run induction motor.

   e) With neat schematic diagram, briefly explain the principle of operation of a shaded pole single phase induction motor.
