17511

15162

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

Marks

1. Attempt **any five** : **(4×5=20)**

a) State the working principle of 3 ϕ induction motor. **4**

b) Draw a block diagram showing power stages of 3 ϕ induction motor. **4**

c) State the necessity of starter in 3 ϕ induction motor. Enlist any four types of starters used in 3 ϕ induction motor. **4**

d) List out the advantages of having a stationary armature and rotating field of 3 ϕ alternator. **4**

e) State the necessity conditions of parallel operation of 3 ϕ alternator. **4**

f) Give the reason why single phase induction motors are not self starting. **4**

g) Give any two advantages and two disadvantages of single phase induction generator. **4**

2. Attempt **any four** : **(4×4=16)**

a) Derive the condition for maximum torque at running condition of a 3 ϕ induction motor. **4**

b) How speed of 3 ϕ induction motor is controlled by using pole changing method ? **4**

c) Define each of the following term of alternator :
i) Leakage reactance ii) Synchronous impedance
iii) Distribution factor iv) Pitch factor. **4**

d) State the need of parallel operation of 3 ϕ alternator. **4**

e) Give the two applications of each motor :
i) A.C. series motor ii) Universal motor
iii) Linear induction motor iv) Stepper motor. **4**

f) State construction and working of shaded pole single phase induction motor. **4**

3. Attempt **any four** of the following : **(4×4=16)**

a) The power input to a 500 V, 50 Hz, 6-pole, 3 ϕ induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and the friction and windage losses total 2 kW. Calculate
i) The slip ii) The rotor cu-loss
iii) Shaft power and iv) The efficiency. **4**

b) With neat sketch state the working principle of star-delta starter. **4**

c) State any four points of comparison of salient pole type rotor and smooth cylindrical rotor of 3 ϕ alternator. **4**

P.T.O.

Marks

d) State the effect of change in excitation in case of parallel operation of two, 3 ϕ alternators. **4**

e) How the direction of rotation of capacitor start capacitor run motor can be reversed ? **4**

f) What is the working principle of linear induction motor ? **4**

4. Attempt **any four** : **(4×4=16)**

a) State why three phase induction motor never runs on synchronous speed. **4**

b) State how each of the following can reduce starting current of 3 ϕ induction motor :

i) By inserting resistance in rotor winding.

ii) By connecting autotransformer in stator winding. **4**

c) Derive the emf equation of an alternator. **4**

d) State the double field revolving theory of single phase induction motor. **4**

e) Compare resistance split phase and capacitance split phase induction motor (any four points). **4**

f) State the working principle of permanent magnet stepper motor. **4**

5. Attempt **any two** : **(2×8=16)**

a) An 18.65 kW, 4 pole, 50 Hz, 3-phase induction motor has friction and windage losses of 2.5 percent of the output. The full load slip is 4%. Compute for full load

a) The rotor cu loss b) The rotor input

c) The shaft torque d) The gross torque. **8**

b) A certain 3 ϕ, star connected, 100 kVA, 11000 V alternator has rated current of 52.5 A. The a.c. resistance of the winding per phase is 0.45 Ω. The test results are given below :
O.C. Test – Field current = 12.5 A; Voltage between lines = 422 V
S.C. Test – Field current = 12.5 A, line current is equal to 52.5 A.
Determine the full load voltage regulation of the alternator at p.f. 0.8 lagging and 0.8 p.f. leading. **8**

c) i) Draw a schematic diagram of an A.C. series motor.

ii) Draw speed torque characteristics of A.C. series motor. **8**

6. Attempt **any two** : **(2×8=16)**

a) A 6-pole, 50 Hz, 3 ϕ, induction motor running on full load with 4% slip develops a torque of 149.3 N-m at its pulley rim. The friction and windage losses are 200 W and the stator copper and iron losses equal to 1620 W. Calculate

a) Output power

b) The rotor copper loss and

c) The efficiency at full-load. **8**

b) Describe the factors affecting the regulation of three phase alternator and draw the phasor diagrams of loaded alternator when operating power factor is lagging and leading. **8**

c) A certain 3 ϕ alternator is rated at 5 kVA, 110 V, 26.3 A, 50 Hz and 1200 rpm. The stator resistance between terminals as measured with d.c. is 0.2 Ω. With no load and rated speed, the stator line voltage is 160 V for a field current of 4 A. At rated speed, the short circuit stator current per terminal is 60 A for a field current of 4 A.

Calculate :

i) Synchronous impedance per phase

ii) The voltage regulation of alternator at 0.8 p.f. lagging.

The alternator is star connected. **8**
