A.C. Machines Performance (315333)

MSBTE Diploma · K-Scheme · Model Question Paper — Set A

Time: 3 Hours **Max. Marks: 70**

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. Mobile phone, pager and any other electronic communication devices are not permissible in the examination hall.

Q.1 Attempt any FIVE of the following: **10**

a) Define slip and synchronous speed of a three phase induction motor.

b) State the function of the following parts of a 3-φ induction motor: (i) Stator core (ii) Slip rings.

c) State any two advantages of a soft starter over a star–delta starter.

d) List the types of single phase induction motors.

e) Define pull-in torque and pull-out torque of a synchronous motor.

f) Define pitch factor and distribution factor of an alternator winding.

g) State any four applications of stepper motor.

Q.2 Attempt any THREE of the following: **12**

a) Draw a neat diagram of a manual star–delta starter for a 3-φ induction motor and explain its working.

b) Explain the working of a soft starter with a neat diagram.

c) A 400 V, 50 Hz, delta-connected cage induction motor takes a starting current of 90 A per phase when switched directly on line. Calculate: (i) line current with DOL starting, (ii) line and phase starting currents with star–delta starter, (iii) motor and supply line currents with an auto-transformer starter set at 65 % tapping.

d) Explain with neat circuit and phasor diagram the working of a capacitor start capacitor run single phase induction motor.

Q.3 Attempt any THREE of the following: **12**

a) Explain double field revolving theory and show why a single phase induction motor is not self-starting.

b) Explain the shaded pole self-starting technique of a single phase induction motor with a neat sketch.

c) Compare capacitor start induction run motor with capacitor start capacitor run motor (any four points).

d) Suggest a suitable single phase induction motor for the following applications with reason: (i) Ceiling fan (ii) Air-conditioner compressor (iii) Small exhaust fan (iv) Washing machine

Q.4 Attempt any THREE of the following: **12**

a) Explain the production of rotating magnetic field in a three phase induction motor with suitable diagrams.

b) The power input to a 4 pole, 3-φ, 50 Hz induction motor is 25 kW and it runs at 1440 rpm. The stator losses are 0.8 kW and the friction and windage losses are 0.6 kW. Find: (i) slip (ii) rotor input (iii) rotor copper loss (iv) shaft output and efficiency.

c) Draw and explain the torque–slip characteristics of a three phase induction motor.

d) Explain the construction of a universal motor and draw its torque–speed characteristics.

e) Describe the stepwise procedure of the stroboscopic method of slip measurement.

Q.5 Attempt any TWO of the following: **12**

a) (i) Derive the e.m.f. equation of an alternator. (ii) A 3-φ, 4 pole, 50 Hz, star-connected alternator has 48 slots with 10 conductors per slot. The flux per pole is 0.03 Wb, sinusoidally distributed, and the coils are short-pitched by 2 slots. Find the phase and line e.m.f.

b) A 4 pole, 50 Hz, 3-φ induction motor has rotor resistance 0.03 Ω and standstill rotor reactance 0.18 Ω per phase. The rotor induced e.m.f. per phase at standstill is 110 V. At full load the motor runs at 1440 rpm. Calculate: (i) starting torque (ii) full-load torque (iii) maximum torque and the speed at which it occurs.

c) What is armature reaction? Explain the effect of armature reaction on the main field flux of an alternator at unity, zero lagging and zero leading power factor loads with phasor diagrams.

Q.6 Attempt any TWO of the following: **12**

a) A 500 kVA, 3300 V, 3-φ, star-connected alternator has armature resistance of 0.3 Ω and synchronous reactance of 4 Ω per phase. Calculate the percentage voltage regulation at full load at (i) 0.8 p.f. lagging (ii) 0.8 p.f. leading.

b) (i) Draw and label the power stages of a three phase induction motor. (ii) The power input to the rotor of a 4 pole, 50 Hz induction motor is 50 kW. The rotor e.m.f. makes 90 complete cycles per minute. Calculate the slip, rotor speed, rotor copper loss and gross mechanical power.

c) Draw the V-curves of a synchronous motor and explain how a synchronous motor is used for power factor improvement.

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in