



This exam measure the following ILOs (a15, b14, c13, c14, d1, d2)

Attempt all question, Assume any missing data

- Q1: (20 Mark)
- (i) Define the following: step angle, slewing, resolution, power factor of syrm, load angle of syrm. [10Mark]
- (ii) Find the pulse rate required to obtain a rotor speed of 2400 rpm for a stepper motor having a resolution of 200 steps/rev. [5 Mark]
- (iii) Explain the modes of operation of Switched reluctance motor. [5 Mark]

- Q2: (20 Mark)
- a) Derive the expressions for power input and torque of a brushless dc motor. Explain how its torque speed characteristics are obtained. [10 Mark]
- b) A universal series motor has resistance of 30 Ω and an inductance of 0.5 H. When connected to a 250 V d.c. supply and loaded to take 0.8 A, it runs at 2000 r.p.m. Estimate its speed and power factor, when connected to a 250-V, 50-Hz a.c. supply and loaded to take the same current. [10 Mark]

- Q3: (25 Mark)
- a) Why rotor position sensor is essential for the operation of switched reluctance motor? [7 Mark]
- b) What is the principle of operation of ac tacho-generator? [8 Mark]
- c) A 220 V, 50 Hz, 6-pole single phase induction motor has the following parameters, $R_1 = 3.04$, $X_1 = 4.2$, $X_m = 105.6$, $R'_2 = 6.26$, $X'_2 = 2.12$. It is operating at 5%. Find the forward, backward and net torque in synchronous watts. [10 Mark]

- Q4: (25 Mark)
- a- Use mathematical analysis to drive the force equation of linear induction motor. [9 Mark]
- b- Choose the correct answer with explain your choice. [14 Mark]
- One of the basic requirements of a servomotor is that it must produce high torque at all
(a) loads (b) frequencies (c) speeds (d) voltages
 - switched reluctance motor differs from a VR stepper motor in the sense that it
(a) has rotor poles of ferromagnetic material (b) rotates continuously (c) is designed for open-loop operation only (d) has lower efficiency.
 - A variable reluctance stepper motor is constructed of material with salient poles.
(a) paramagnetic (b) ferromagnetic (c) diamagnetic (d) non-magnetic



4. The rotor of a stepper motor has no
(a) windings (b) commutator (c) brushes (d) all of the above.
5. In a three-stack 12/8-pole VR motor, the rotor pole pitch is
a) 15° b) 30° c) 45° d) 60°
6. The most common two-phase ac servomotor differs from the standard ac induction motor because it has
a) higher rotor resistance b) higher power rating c) motor stator windings d) greater inertia.
7. The torque developed by a split phase motor is proportional to
a) Sine of angle between I_m and I_s b) Cosine of angle between I_m and I_s c) Main winding current, I_m d) Auxiliary winding current, I_s
8. The motor used in household refrigerators is
a) dc series motor b) dc shunt motor c) universal motor d) single phase induction motor.
9. The starting torque and power factor of shaded pole induction motor
a) High, low b) Low, high c) Low, low d) High, high
10. Linear induction motor is used in
a) conveyors. b) elevators. c) Accelerator. d) traction.
11. The thrust developed by a linear induction motor depends on
a) Synchronous speed b) Rotor input c) Number of poles d) both A and B
12. The synchronous speed of a linear induction motor does NOT depend on
a) width of pole pitch b) number of poles c) supply frequency d) any of the above

With my best wishes

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