CBCS SCHEME

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15EE554

Fifth Semester B.E. Degree Examination, June/July 2019
Special Electrical Machines

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the construction and working of a permanent magnet stepper motor. **(06 Marks)**

b. Explain static and dynamic characteristics of stepper motor. **(06 Marks)**

c. A stepper motor is wound for two phases and has four poles. It has 10 rotor poles. Find its revolution. **(04 Marks)**

OR

2 a. Explain the construction and working of a hybrid stepper motor. **(06 Marks)**

b. Explain the open loop control of stepper motor. **(05 Marks)**

c. A permanent magnet stepper motor is driven by a series of pulses of duration 20 ms. It has four stator poles and six rotor poles. How long will it take for the motor to make a complete rotation? **(05 Marks)**

Module-2

3 a. Derive the torque equation of an SRM. **(06 Marks)**

b. A BLDC motor has a no load speed of 6000 rpm when connected to 120V DC Source Armature resistance is 2.5Ω. Find the speed when it is supplied with 60V and developing a torque of 0.5N-m. Neglect constant losses. The no. load current is 1A. **(06 Marks)**

c. Compare BLDC motor and small conventional motors. **(04 Marks)**

OR

4 a. Describe L – θ profile of an SRM. **(06 Marks)**

b. With a block diagram , explain the DSP based control of BLDC motor. **(06 Marks)**

c. A four – phase eight pole switched reluctance motor has six rotor teeth. Find the step angle and commutation frequency for a speed of 6000 rpm. **(04 Marks)**

Module-3

5 a. Derive the EMF equation of permanent magnet synchronous motor (PMSM). **(08 Marks)**

b. A 3 ϕ, 4 pole, 60Hz, 230V star connected synchronous reluctance motor has direct axis and quadrature axis synchronous reactance's of 22.5Ω respectively. The load torque is 12.5N-m. The voltage of frequency ratio is maintained constant at rated value. Find i) Torque angle ii) Line current and iii) Power factor. **(08 Marks)**

OR

6 a. With a block diagram, explain micro processor based control of PMSM. **(08 Marks)**

b. Derive the torque equations of Synchronous Reluctance Motor (SyRM). **(08 Marks)**

Module-4

7 a. Explain the construction and working of a repulsion motor. **(06 Marks)**

b. Derive the transfer function of a field controlled DC servo motor. Draw the block diagram. **(06 Marks)**

c. A Universal motor takes 1A from 220V DC supply while running at 2000 rpm. Find the speed and power factor when it is connected to 230V, 50Hz supply drawing the same current. The total resistance and inductance are 20Ω and 0.4H respectively. **(04 Marks)**

OR

8 a. With necessary waveforms, explain the operation of a hysteresis motor. **(05 Marks)**

b. Explain the construction and working of Universal motor. **(06 Marks)**

c. A 50Hz, 32 pole hysteresis motor needs 0.8J to complete one revolution. Find i) Pull in and pull – out torque ii) Maximum output power before stalling iii) Rotor losses when the motor stalls. **(05 Marks)**

Module-5

9 a. Derive the thrust equation of DC linear motor. **(06 Marks)**

b. Explain the principle of working of linear variable reluctance motor. **(05 Marks)**

c. Discuss the various applications of Permanent Magnet Axial Flux (PMAF) machines. **(05 Marks)**

OR

10 a. Derive the output equation of Permanent Magnet Axial Flux (PMAF) motor. **(06 Marks)**

b. With a neat diagram and block diagram, explain the control of Linear Synchronous Motor (LSM). **(06 Marks)**

c. The thrust developed by a three phase linear induction motor is 100kW when running at 200 kmph. The supply frequency is 50Hz and the pole pitch is 0.5m. Find the power developed and copper loss in the secondary. **(04 Marks)**

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