

CBCS SCHEME

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BANGALORE - 560 037

15EE554

Fifth Semester B.E. Degree Examination, June/July 2018 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 working of four phase, eight pole variable reluctance stepper motor in 2 – 1 – 2 – 1 phase of half step mode. (06 Marks)
- b. Explain with block diagram, the closed loop control of stepper motor. (05 Marks)
- c. A stepper motor has a step angle of 2.5° . Find i) Resolution ii) Number of steps required for 25 revolutions iii) Shaft speed. The stepping frequency is 3600 pulses/sec. (05 Marks)

OR

- 2 a. Explain the construction and working of hybrid stepper motor. (06 Marks)
- b. Derive the torque equation of stepper motor. (06 Marks)
- c. For a four phase variable reluctance motor, give the logic sequence for i) 1 – 2 – 1 – 2 phase ON mode ii) 2 – 3 – 2 – 3 phase ON mode. (04 Marks)

Module-2

- 3 a. Explain the working principle of switched reluctance motor. (06 Marks)
- b. Derive the torque equations of permanent magnet DC motor. (04 Marks)
- c. A Brushless DC motor has a no load speed of 6000 rpm when connected to 120V DC source. Armature resistance is 2.5 Ohm. 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 1 ampere. (06 Marks)

OR

- 4 a. Give a comparison of conventional DC motor and Brushless DC motor. (04 Marks)
- b. List the constraints on pole arc and tooth arc in case of switched reluctance motor. (05 Marks)
- c. A permanent magnet DC motor has an armature resistance of 1.03 ohm. It draws a current of 1.25A at no load with 50V supply and running at 2100 rpm. Find i) Speed – voltage constant ii) Rotational losses iii) Output power when it runs at 1700 rpm at 48V supply. (07 Marks)

Module-3

- 5 a. Draw the phasor diagram of permanent magnet synchronous motor and obtain its circle diagram. Neglect armature resistance. (07 Marks)
- b. Explain the principle of self control in case of permanent magnet synchronous motor. (05 Marks)
- c. A three phase, four pole, 50Hz, 400V, star connected synchronous reluctance motor has direct axis and quadrature axis reactance's of 8 Ohm and 2 Ohm respectively. For a load torque of 80 N-m, find the load angle. If the line current is 37.53A, calculate the power factor. Neglect armature resistance and mechanical losses. (04 Marks)

OR

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- 6 a. Draw the phasor diagram of Synchronous reluctance motor, neglecting armature resistance using it derive the torque equations. (07 Marks)
- b. Compare permanent magnet Synchronous motor to conventional Synchronous motor. (04 Marks)
- c. A three phase, four – pole, star – connected Synchronous motor has 72 slots with 20 conductors per slot. The flux per pole is 0.05wb and speed is 1500 rpm. Assuming the full pitch coil, find the line and phase voltage. (05 Marks)

Module-4

- 7 a. With neat sketch, explain the principle of working of AC series motor. (05 Marks)
- b. Draw the phasor diagram of Repulsion motor and explain. (05 Marks)
- c. With the help of a block diagram, explain closed loop control scheme for a chopper fed DC motor. (06 Marks)

OR

- 8 a. Obtain the transfer function of field controlled DC servo motor. Give its block diagram. Is the control open loop or closed loop? Explain. Take angular displacement θ of the rotor as output. (08 Marks)
- b. A 230V, 50Hz, 2 pole , 100 W single phase series motor has a mutual reactance of 120 Ohm. Its total armature and field resistance and reactance are 20 Ohm and 250 Ohm, respectively. Find the current , power factor and output when running at 9000 rpm. The stray loss is 20W. (08 Marks)

Module-5

- 9 a. Discuss the factors to be considered in selecting specific magnetic loading and specific electric loading for linear induction motor. (08 Marks)
- b. With the help of a block diagram, explain the control of linear synchronous motor. (08 Marks)

OR

- 10 a. With neat sketches, explain the construction and working of Axial field linear induction motor. (08 Marks)
- b. Draw the phasor diagram of permanent magnet axial flux machine and derive the equation for power developed. (08 Marks)