Model Question Paper-I with effect from 2017-18

USN | | | | | | | | | | | **15EE554**

Fifth Semester B.E.(CBCS) Examination
Special Electrical Machines

(Professional Elective, E&EE)

Time: 3 Hrs Max.Marks: 80

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

Module-1

1. **(a)** Draw and explain the structure of multi-stack variable reluctance stepper motor. **(05 Marks)**
   (b) Derive the torque equation of stepper motor. **(06 Marks)**
   (c) Explain the open-loop control of stepper motor. **(05 Marks)**

OR

2. **(a)** A five-phase stepper motor has 40 rotor teeth. It drives a lead screw having a pitch of 10 threads per cm. The lead screw in turn produces a linear motion of a cutting tool. The input pulse is applied 10 times. Find the distance covered by the cutting tool. **(06 Marks)**
   (b) Explain the dynamic characteristics of stepper motor. **(04 Marks)**
   (c) With a block diagram and flow chart, explain the microprocessor-based control of stepper motor. **(06 Marks)**

Module-2

3. **(a)** Explain L-θ profile of Switched reluctance motor (SRM). **(06 Marks)**
   (b) With a neat block diagram, explain the microprocessor-based control of Switched reluctance motor (SRM). **(05 Marks)**
   (c) A BLDC motor has a no load speed of 6000 rpm when connected to 120 V DC source. Armature resistance is 2.5 **Ω**. Find the speed when it is supplied with 60V and developing a torque of 0.5 Nm. Neglect constant losses. The no load current is 1A. **(05 Marks)**

OR

4. **(a)** Explain the constraints on Pole Arc and Tooth Arc of Switched reluctance motor (SRM). **(05 Marks)**
   (b) With a neat sketch, explain the current regulators used for Switched reluctance motor (SRM). **(06 Marks)**
   (c) With a neat sketch, explain the microprocessor-based control of BLDC motor. **(05 Marks)**

Module-3

5. **(a)** Derive the EMF equation of permanent magnet synchronous motor (PMSM). **(09 Marks)**
   (b) List any seven applications of Synchronous reluctance motor (SyRM). **(07 Marks)**

OR

6. **(a)** Derive the torque equation of permanent magnet synchronous motor (PMSM). **(09 Marks)**

   (b) A 3 phase, 4pole, 60 Hz, 230V star connected synchronous reluctance motor has direct axis and quadrature axis synchronous reactances of 22.5 Ω and 3.5 Ω respectively. The load torque of 12.5 Nm. The voltage to frequency ratio is maintained constant at rated value. Find (a) torque angle, (b) line current and (c) power factor. Neglect rotational losses and armature resistance. **(07 Marks)**

Module-4

7. **(a)** With a neat sketch, explain the various characteristics of repulsion motor. **(05 Marks)**
   (b) With necessary waveforms, explain the operation of hysteresis motor. **(05 Marks)**
   (c) Derive the transfer function of a field controlled DC servomotor. Draw the block diagram. **(06 Marks)**

OR

8. **(a)**A 5kW, 4-pole, 230V, 50 Hz reluctance motor has a torque angle of 30^o when running with rated load. Find the load torque. Find the torque angle if the voltage is decreased by 10V. Does the motor works with this torque angle? **(05 Marks)**
   (b) Explain the various speed control schemes for universal motor. **(06 Marks)**
   (c) With a neat sketch, explain the torque-speed characteristics of AC servomotor. **(05 Marks)**

Module-5

9. **(a)** A vehicle is propelled by a linear induction motor. The motor has 100 poles with a pole pitch of 0.5 m. Find the vehicle speed in kmph when the vehicle is running with a slip of 0.25 at a frequency of 50 Hz. **(05 Marks)**
   (b) Derive the thrust equation of DC Linear motor (DCLM). **(05 Marks)**
   (c) Draw and explain the phasor diagram of a Permanent magnet axial flux motor (PMAF motor). **(06 Marks)**

OR

10. **(a)**With a neat circuit diagram and block diagram, explain the control of Linear Synchronous motor (LSM). **(06 Marks)**
    (b) Derive the output equation of a Permanent magnet axial flux (PMAF) motor. **(05 Marks)**
    (c) Explain the various applications of permanent magnet axial flux (PMAF) motor. **(05 Marks)**

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