B.E. (EE) Part-IV 8th Semester Final Examination, 2012

SPECIAL MACHINES AND DRIVES (EE-803)

Time : 3 hours   Full Marks : 70

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
Two marks are reserved for neatness in each half

FIRST HALF

1. a) Explain the torque versus stepping rate characteristics of a stepper motor. What is the slew range?
   b) Discuss the differences between reluctance and hysteresis motors. Sketch the typical torque-speed characteristic of a hysteresis motor and explain the characteristic. Mention some applications of hysteresis motors.   [(2+1)+ (3+3+2)]

2. a) Draw a sketch of a 4-phase 8/6 Switched Reluctance Motor. Draw a typical power circuit diagram showing how such a motor is excited through a Power Electronic Converter.
   b) Explain the angle control mode of operation of a switched reluctance motor.   [(3+4)+4]

3. a) What are the advantages and disadvantages of a brushless dc motor over a conventional dc motor? Draw the waveforms of flux-linkage, back-emf, current and torque in a BLDC motor. Explain the advantage of having trapezoidal back emf distribution.
   b) Mention some applications of BLDC motors.   [(3+3+3)+2]

4. a) Name some commonly used Permanent Magnet materials. What are the important technical specifications of a Permanent Magnet?
   b) Explain the significance of the second quadrant of the B-H characteristics of permanent magnet materials.
   c) Explain "Minor Hysteresis Loop" and "Recoil line" of a permanent magnet.   [4+3+4]

5. a) What is a multiple stack variable reluctance stepper motor? Explain its working principle with sketches.
   b) Design and explain a typical control circuit and the power circuit for rotating a 3-stack variable reluctance stepper motor in forward as well as reverse direction.   [5+6]

SECOND HALF

6. (a) Prepare a brief write up on group drive, multi-motor drive and direct drive.
   (b) With suitable examples, explain the four quadrant operation of drive.
   (c) Mention limitations of electric drive.

                                                                                        [4 + 5 + 2]

7. (a) Derive the expressions for total torque and inertia of a crank shaft driven load referred to motor shaft. Assume any other parameters, if required.

(b) Why the gears are used in drives? Derive the expression for optimum gear ratio of a drive system for fastest response.

[6 + 5]

8. (a) Derive the expression for speed torque characteristics of a separately excited dc motor during reversing and draw the nature. With the help of this diagram explain how speed of motor will reverse when the external resistance is reduced in four steps.

(b) Explain and compare between S3 and S6 duty of motors

[7 + 4]

9. (a) Derive the expression for time to stop a three phase induction motor by dynamic braking method and the minimum value of this time.

(b) Derive the expression for total energy taken from the supply during the starting of a separately excited dc motor with load.

[6+5]

10.(a) What do you mean by ingress protection of electric motors? What are the classifications?

(b) Prepare a write-up on soft starter.

[8+ 3]