BTECH DEGREE EXAMINATION, NOVEMBER 2013

Seventh Semester

Branch- Electrical and Electronics Engineering

EE 010-706L06 : Special Electrical Machines

Model Question Paper -I

(Regular- New Scheme)

Time : Three Hours Maximum- 100 Marks

Part A

Answer all questions briefly

Each question carries 3 marks

1. Define step angle and what is meant by half step mode of operation of stepper motors.
2. Explain with block diagram the control scheme of switched reluctance stepper motor.
3. Explain the concept of torque production in synchronous reluctance motor
4. What is the requirement of position sensors in permanent magnet brushless DC motors (PMBLDC)? Mention any two types of position sensors used in permanent magnet BLDC.
5. Draw the phasor diagram of a permanent magnet synchronous motor

Part B

Each question carries 5 marks

6. With neat diagram explain the constructional features of variable reluctance stepper motors.
7. Define the hard chopping and soft chopping methods of control used in switched reluctance motors.
8. Explain the principle of operation of synchronous reluctance motor.
9. Explain in detail the constructional features of permanent magnet brushless DC motors (PMBLDC). Draw the schematic diagram of PMBLDC motor with control mechanism.
10. Explain how a sinusoidal rotating magnetic field is produced in the stator of a permanent magnet synchronous motor

Part C

Answer any one full question from each module

Each full question carries 12 marks

MODULE I

11. A 3 phase variable reluctance stepper motor is used of a particular application in which the step angle has to be varied in the following manner in anti clockwise

direction. 30^{o}-15^{o}-30^{o}-15^{o} and so on from the reference axis. With neat figures explain its operation.

Or

12. (a) Explain with neat figure the dynamic characteristics of stepper motors
    (b) What is meant by micro stepping mode of operation of stepper motors? What are its advantages?

MODULE II

13. Explain in detail any three characteristics curves of switched reluctance motor.

Or

14. (a) What is the requirement of chopping/hysterisis control of switched reluctance motor? What is meant by single pulse mode control of switched reluctance motor
    (b) Draw the block diagram of switched reluctance motor drive system. With neat figures of inductance profile explain the operation of switched reluctance motor

MODULE III

15. With neat figure explain the speed control of synchronous reluctance motor.

Or

16. Derive the expression for torque for a synchronous reluctance motor and explain its torque speed characteristics.

MODULE IV

17. Explain in detail the torque speed characteristics of permanent magnet brushless DC motors with torque expression.

Or

18. With the timing diagrams discuss the operation and characteristics of permanent magnet brushless DC motors. Draw the truth table for six step commutation including hall sensor status, phase current and power output.

MODULE V

19. Derive an equation for power developed in permanent magnet synchronous motor and analyze the effect of direct and quadrature axis reactance on developed power.

Or

20. Describe with neat sketches the construction details and operation of a permanent magnet synchronous motor with speed control.