

**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 stepper motor and its step angle
2. Distinguish between switched reluctance motor and variable reluctance stepper motor
3. List down any three comparisons between switched reluctance and synchronous reluctance motor
4. Compare brushless DC motor with conventional DC motor
5. Explain the principle of operation of permanent magnet synchronous motor with its basic constructional features

**Part B**

Each question carries 5 marks

6. What is meant by two phase excitation of stepper motors? Mention its advantages.
7. Explain with neat figure the inductance profile of switched reluctance motor. Explain each region in its profile.
8. Explain the principle of operation of synchronous reluctance motor.
9. Define commutation in DC motors. Explain in detail the electronic commutation used in BLDC motors
10. Derive the emf equation 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. State the principle of operation of a variable reluctance (VR) stepper motor. Draw the cross sectional view with phase windings of a 3-phase VR stepper motor operating at  $30^\circ$ . Explain in detail how this motor can operate at  $15^\circ$ .

Or

12. (a) Explain the constructional features of hybrid stepper motor. With neat figures explain its operation  
(b) With neat figure explain the operation of single phase stepper motors. What are its applications?

### **MODULE II**

13. Derive the expression for torque for a switched reluctance motor.

Or

14. Which are the three inverter topologies used in switched reluctance motor? Explain in detail any two inverter topologies.

### **MODULE III**

15. Derive the torque equation of synchronous reluctance motor and explain its torque speed characteristics.

Or

16. With neat sketches explain the speed control of synchronous reluctance motor.

### **MODULE IV**

17. Derive the expression for torques for a square wave BLDC motor with neat figures.

Or

18. Explain the operation of a six step switching of star connected permanent magnet BLDC motor with Hall Effect sensors. Draw the schematic diagram of the controller of a permanent magnet BLDC which can control both commutation and speed.

### **MODULE V**

19. Explain how a rotating magnetic field is created in permanent magnet synchronous magnet motor (PMSM). Derive the torque expression of a PMSM.

Or

20. Explain with block diagram the control strategies used in permanent magnet synchronous motor