Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20944

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 3009 — SPECIAL ELECTRICAL MACHINES

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the various driver circuits used in the operation of stepper motors.

2. A stepper motor has a step angle of 1.8° and is driven at 4000 RPS. Determine the resolution and rotor speed.

3. Give the expression for torque of a switched reluctance motor.

4. Write the principle of hysteresis type current control of switched reluctance motor.

5. List the magnetic materials used in the construction of permanent magnet motor.

6. How is the direction of rotation of a Permanent Magnet Brushless DC motor is reversed?

7. List the four general types of rotor in Permanent Magnet Synchronous Machine.

8. List at least two speed controllers applicable for Permanent Magnet Synchronous Motor.

9. List the applications of Hysteresis motor.

10. How is the power factor of AC series motor improved?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the working principle of variable reluctance type stepper motor. Bring out their advantages and applications.

Or

(b) Explain With the help of block diagram, the closed loop control of stepper motor.

12. (a) Draw the circuit diagram of a C-dump converter used for the control of a switched reluctance motor and explain its operation. Also state the advantages and disadvantages of this method.

Or

(b) Draw the block diagram of a sensor less rotor position estimation method applicable to switched reluctance motor and explain the theory of the method.

13. (a) Draw the cross-sectional view of 2 pole PMBLDC motor showing the complete magnetic path of the flux flow. Obtain the magnetic equivalent circuit and do the analysis.

Or

(b) Obtain the transfer function of the PMBLDC motor under loaded condition.

14. (a) Explain the emfs influencing on the armature winding of Permanent Magnet Synchronous Motor and draw the phasor diagram of the machine.

Or

(b) Explain the working principle and Torque-speed characteristic of Synchronous Reluctance motor.

15. (a) Explain the working principle and important characteristics of a hysteresis motor.

Or

(b) Explain the construction, working principle and applications of Linear Induction motor.

PART C — (1 × 15 = 15 marks)

16. (a) A stepper motor driven by bipolar drive circuits and has the following parameters:

Winding Inductance = 30mH, rated current=3A and Winding resistance = 2 Ω.

Determine the supply voltage (V_s), and external resistance (R_{ext})to be connected in series with the phase winding such that rated current flows when the transistor is ON and phase current decays to zero in 1.0 m sec when the transistor is OFF.

Or

(b) Describe the significance of Skew factor, Chording factor and Distribution factor on the fundamental component of ampere turn distribution of PMSM. Obtain the expression for electromagnetic torque developed applicable for vector control of PMSM.

———————