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Question Paper Code : X 20499

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
AND APRIL/MAY 2021

Seventh Semester

Electrical and Electronics Engineering

EE 6703 – SPECIAL ELECTRICAL MACHINES

(Regulations 2013)

(Common to PTEE 6703 – Special Electrical Machines for B.E. (Part-Time)

Sixth Semester – Electrical and Electronics Engineering – Regulations 2014)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. Draw the torque-angle characteristics of synchronous reluctance motor .
2. What is reluctance torque in synchronous reluctance motor ?
3. What are the different modes of excitation in a stepper motor ?
4. What is meant by Lead angle in stepper motors ?
5. Why the rotor position sensor is essential for the operation of SR Motor ?
6. Draw the torque speed characteristics of SR Motors.
7. What are the merits of the brushless dc motor drives ?
8. Write the difference between electronic and mechanical commutator.
9. What are the types of materials used in permanent magnet motor ?
10. What is self control in PMSM ?

PART – B

(5×13=65 Marks)

11. a) i) Draw and explain the steady state phasor diagram of synchronous reluctance motor. (7)
ii) Derive the expression for torque in a synchronous reluctance motor. (6)
- (OR)
- b) Explain the construction and operation of axial and radial flux machines. Discuss the advantages and disadvantages of each construction.



12. a) Describe construction and working of variable reluctance stepper motor with neat diagram.

(OR)

- b) i) Explain in detail the power driver circuits of stepper motor. (9)
ii) Write in detail the microprocessor based closed loop operation of stepper motor. (4)

13. a) Draw the cross sectional view of switched reluctance motor and explain the principle of operation. State the advantages of switched reluctance motor.

(OR)

- b) Draw and explain four converter topologies for a 3-phase SRM. Write the merits and demerits of each topology.

14. a) Sketch the structure of controller for PMBLDC motor and explain the functions of various blocks.

(OR)

- b) Derive EMF equation for PMBL square wave DC motor.

15. a) Derive the Torque equation of PMSM along with the phasor diagram.

(OR)

- b) i) Derive the EMF equation of PMSM. (9)
ii) Explain the torque speed characteristics of PMSM. (4)

PART – C

(1×15=15 Marks)

16. a) Discuss the applications areas of different special electrical machines. (15)

(OR)

- b) A stepper motor driven by a bipolar drive circuit has the following parameters :
Winding inductance = 30 mH, rated current = 3A, DC supply = 45 V, total resistance in each phase = 15Ω. When the transistors are turned off, determine (i) the time taken by the phase current to decay to zero and (ii) the proportion of the stored inductive energy returned to the supply. (7+8)