KINGS
COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT CODE & NAME : EE 1001 – SPECIAL ELECTRICAL MACHINES

YEAR / SEM : IV / VII

UNIT – I

SYNCHRONOUS RELUCTANCE MOTOR

PART – A

1. What is synchronous reluctance motor? (2)
2. What are the advantages and disadvantages of synchronous reluctance motor? (2)
3. Mention some applications of synchronous reluctance motor. (2)
4. Define synchronous reluctance. (2)
5. Define reluctance torque. (2)
6. Distinguish between axial and radial air gap motors with relevant figures. (2)
7. Draw the steady state phasor diagram of synchronous reluctance motor. (2)
8. List out the primary design considerations of synchronous reluctance motor. (2)
9. State the advantages of synchronous reluctance motor over PM machines. (2)
10. What are factors to be considered while designing a vernier motor? (2)

PART – B

1. Explain the constructions and working principle of synchronous reluctance motor. (16)
2. Explain in detail about classification of synchronous reluctance motor. (16)
3. Draw the phasor diagram of synchronous reluctance motor. (16)
4. Derive the torque equation of synchronous reluctance motor. (16)

5. Draw and explain the characteristics of synchronous reluctance motor. (16)
6. Explain in detail about vernier motor. (16)

UNIT – II

STEPPER MOTOR

PART – A

1. What is stepper motor? (2)
2. Define step angle. (2)
3. Define slewing. (2)
4. Sketch the diagram of a VR Stepper motor. (2)
5. What are the different modes of excitation used in variable reluctance stepper motor? (2)
6. Mention some applications of stepper motor? (2)
7. Define resolution. (2)
8. What are the advantages and disadvantages of stepper motor? (2)
9. What is meant by micro stepping in stepper motor? (2)
10. Differential between VR, PM and hybrid stepper motor? (2)
11. Define holding torque. (2)
12. Define detent torque. (2)
13. Define pull-in torque and pull-out torque. (2)
14. Draw the typical dynamic characteristics of a stepper motor. (2)
15. What is slew range? (2)
16. What is synchronism in stepper motor? (2)
17. Draw the block diagram of the drive system of a stepper motor. (2)
18. What is the step angle of a four phase stepper motor with 12 stator teeth and 3 rotor teeth? (2)
19. A single stack, 3-phase VR motor has a step[angle of 15˚. Find the number of its rotor and stator poles. (2)
20. A stepper motor driven by a bipolar drive circuit has the following parameters: Winding resistance = 30 mH, rated current = 3 A, 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. (2)

PART – B

1. Explain the construction and various modes of excitation of VR stepper motor. (16)
2. Explain the construction and various modes of excitation of PM stepper motor. (16)
3. Explain the construction and working principle of Hybrid Stepper motor. (16)
4. State and explain the static and dynamic characteristics of a stepper motor. (16)
5. Explain in detail about different types of power drive circuits for stepper motor. (16)
6. Explain the mechanism of torque production in VR stepper motor. (16)
7. Draw any two drive circuits for stepper motor. (16)

UNIT – III

SWITCHED RELUCTANCE MOTOR

PART – A

1. What is switched reluctance motor? (2)
2. What are the essential differences between a stepper motor and SRM? (2)
3. Mention any four advantages of switched reluctance motor. (2)
4. Write about the disadvantages of SRM. (2)
5. Mention some applications of SRM. (2)
6. Draw the simple block diagram of SRM. (2)
7. What are the different power controllers used for the control of SRM? (2)
8. Why rotor position sensor is essential for the operation of SRM? (2)
9. What is meant by energy ratio? (2)
10. Draw the 'λ – i' curve for SRM. (2)
11. What is phase winding? (2)
12. What is the step angle of a 3Φ, SRM having 12 stator poles 8 rotor poles, also calculate commutation frequency at each phase and speed of 6000 rpm? (2)

PART – B

1. Explain the construction and working principle of switched reluctance motor. (16)
2. Describe the various power controller circuits applicable to switched reluctance motor and explain the operation of any one scheme with suitable circuit diagram. (16)

3. Draw a schematic diagram and explain the operation of a 'C' dump converter used for the control of SRM. (16)
4. Derive the torque equation of SRM. (16)
5. Draw and explain the general torque-speed characteristics of SRM and discuss the type of control strategy used for different regions of the curve. Sketch the typical phase current waveforms of low speed operation. (16)
6. Describe the hysterisis type and PWM type current regulator for one phase of a SRM. (16)

UNIT – IV

PERMANENT MAGNET BRSHLESS DC MOTOR

PART – A

1. What are the advantages dc brushless dc motor drives? (2)
2. What are the disadvantages dc brushless dc motor drives? (2)
3. List out the various permanent magnet materials. (2)
4. Draw the magnetic equivalent circuit of 2 pole permanent magnet brushless dc motor. (2)
5. Why a PMBLDC motor is called an electronically commutated motor? (2)
6. Write the torque and emf equation of square wave brushless motor. (2)
7. Mention some applications of PMBLDC motor. (2)
8. What are the differences between the mechanical and electronic Commutator? (2)
9. What are the difference between the conventional dc motor and PMBLDC motor? (2)
10. What are the classifications of PMBLDC motor? (2)
11. What are the two types of rotor position sensors? (2)
12. What are the materials used for making Hall IC pallet? (2)
13. A permanent magnet dc Commutator motor has a stall torque of 1 N-m with a stall current of 5A. Estimate it's no load speed in rpm when fed from a 28 V dc voltage supply. (2)
14. A PMBLDC motor has torque constant 0.12 Nm/A referred to DC supply. Find no load speed when connected to 48V DC supply. Find stall current and stall torque if armature resistance = 0.15 Ω/phase and drop in controller transistors is 2V. (2)
15. A permanent magnet dc Commutator motor has a no-load speed of 6000 rpm when connected to a 120V supply. The armature resistance is 2.5Ω and rotational and iron losses may be neglected. Determine the speed when the supply voltage is 60V and the torque is 0.5Nm. (2)

PART – B

1. Sketch the structure of controller for PMBLDC motor and explain the functions of various blocks. (16)
2. Explain the closed loop control scheme of a permanent magnet brushless dc motor drive with a suitable schematic diagram. (16)
3. Drive the expressions for the emf and torque of a PMBLDC motor. (16)
4. Draw the diagram of electronic Commutator. Explain the operation of electronic Commutator. (16)
5. Discuss the use of Hall sensors for position sensing in PMBLDC motor. (16)
6. Sketch the torque-speed characteristics of a PMBLDC motor. (16)

UNIT – V

PERMANENT MAGNET SYNCHRONOUS MOTOR

PART – A

1. What is permanent magnet synchronous motor? (2)
2. What are the advantages and disadvantages of PMSM? (2)
3. What are the applications of PMSM? (2)
4. What are the different types of PMSM? (2)
5. Compare electromagnetic excitation with permanent magnet of PMSM. (2)
6. Clearly explain the differences between the synchronous reluctance motor and PMSM. (2)
7. What are the differences in the constructional features of PMBLDC motor and PMSM? (2)
8. Write the emf equation of PMSM. (2)
9. What is meant by self control? (2)
10. What is ‘pulsed mode’? (2)
11. What is load commutation? (2)
12. A three phase, four pole, brushless PM rotor has 36 stator slots. Each phase winding is made up of three coils per pole with 20 turns per coil. The coil span is seven slots. If the fundamental component of magnet flux is 1.8 Mwb. Calculate the open circuit phase emf (E_q) at 3000 rpm. (2)

PART – B

1. Explain the construction and operation of PMSM. (16)
2. Explain the principle of operation of a sine wave PM synchronous machine in detail. Draw its phasor diagram and derive its torque equation. (16)
3. Derive the emf equation of PMSM. (16)
4. Write about Self control of PMSM. (16)
5. Derive the expressions for power input and torque of a PMSM. Explain how its torque speed characteristics are obtained. (16)
6. Explain in detail the vector control of permanent magnet synchronous motor. (16)