

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

EE 2403 SPECIAL ELECTRICAL MACHINES

UNIT -1

PART A

1. State the properties of synchronous reluctance motor.
2. List the various types of synchronous reluctance motor.
3. Distinguish between axial and radial air gap rotors.
4. Write the torque equation of synchronous reluctance motor.
5. Define reluctance torque.
6. Draw the torque angle characteristics of synchronous reluctance motor.
7. Draw the speed – torque characteristics of synchronous reluctance motor.
8. Draw the phasor diagram of synchronous reluctance motor.
9. Give the advantages and disadvantages of synchronous reluctance motor.
10. What are the design considerations of synchronous reluctance motor?
11. What are the advantages of increasing L_d/L_q ratio in synchronous reluctance motor.
12. What are the applications of synchronous reluctance motor?
13. Define reluctance.
14. What is synchronous reactance?
15. What is hybrid motor?
16. What is SYNREL?
17. Synchronous reluctance motor is a self starting motor. True or False.
18. Power factor of synchronous reluctance motor is increased by increasing saliency ratio. True or False.
19. Efficiency of synchronous reluctance motor is high compared to doubly excited machine. True or False.
20. Compare synchronous reluctance motor with conventional synchronous motor.

PART B

1. With a neat sketch explain the constructional features and principle of operation of synchronous reluctance motor.
2. Draw the steady state phasor diagram synchronous reluctance motor and develop torque equation.
3. Compare the constructional features of axial and radial air gap synchronous reluctance motor.
4. Draw and explain speed – torque characteristics and torque angle characteristics of synchronous reluctance motor.
5. Explain circle diagram and torque –speed characteristics of synchronous reluctance motor.
6. Draw and explain typical speed -torque characteristics of reluctance motor. Compare a reluctance motor with an equivalent induction motor.
7. Distinguish between axial and radial air gap motors with relevant figures.
8. Discuss the main advantages and disadvantages of synchronous reluctance motor.
9. Enumerate the design considerations of synchronous reluctance motor.
10. Discuss the various applications of synchronous reluctance motor.

UNIT - 2

PART A

1. Define stepper motor.
2. Draw the basic block diagram of stepper motor.
3. Define the term step angle.
4. Define resolution.
5. List the various types of stepper motor.
6. List the applications of stepper motor.
7. What are the different modes of operation of VR stepper motor?
8. What are the different modes of excitation of VR stepper motor?
9. What do you mean by full step and half step operation?
10. What is meant by microstepping of stepper motor?
11. Define multi stack stepper motor.
12. What are the advantages and disadvantages of VR stepper motor/
13. What is hybrid stepper motor?
14. Define slewing.
15. Define holding torque and detent torque.
16. Define pull in torque and pull out torque.
17. Define pull in range.
18. What is response range of stepper motor?
19. What is slewing range of stepper motor?
20. Draw the typical static characteristics of stepper motor.
21. Draw the typical dynamic characteristics of stepper motor.
22. A stepper motor has a step angle of 1.8° and is driven at 400pps. Determine i) Resolution, ii) Motor speed and iii) number of pulses required to rotate the shaft through 54° .
23. Calculate the pulse rate required to obtain a rotor speed of 2400 rpm for a stepper motor having a resolution of 250 steps/rev.
24. A stepper motor has a resolution of 500 steps/rev in the single phase ON mode of operation. If it is operated in half step mode, determine i) resolution, ii) number of steps required to turn the rotor through 72° .
25. A four stack VR stepper motor has a step angle of 1.5° , find the number of its rotor and stator teeth.

PART B

1. Describe construction and principle of operation of a variable reluctance type stepper motor.
2. With a neat sketch explain the construction working principle of PM stepper motor.
3. With a neat sketch explain the construction working principle of hybrid stepper motor.
4. Explain the static and dynamic characteristics of a VR stepper motor with various specifications in them.
5. With a neat sketch explain the various modes of operation of VR stepper motor.
6. With a neat sketch explain the various drive circuits of VR stepper motor.
7. Explain open loop and closed loop control of stepper motor.
8. With a neat sketch explain the operation of two pole three stack VR stepper motor.
9. Derive the torque equation of VR stepper motor.
10. Explain torque Vs stepping rate characteristics of a stepper motor. Also explain about slew range, pull in range and pull out range.

UNIT – 3

PART – A

1. What are types of power controllers used for switched reluctance motor?
2. Why rotor position sensor is essential for the operation of switched reluctance motor?
3. List the disadvantages switched reluctance motor?
4. What are the advantages of switched reluctance motor?
5. What are the applications SRM?
6. What is the switched reluctance motor?
7. What are the two types of current control techniques?
8. What is meant by energy ratio?
9. What is the phase winding?
10. What are essential difference between SRM and Stepper motor?
11. Write down the torque equation for a switched reluctance motor drive.
12. What is hysteresis current control?
13. What are the basic requirements of power semiconductor circuits?
14. Draw the torque speed characteristics of SRM.
15. What are the effects of saturation in SRM.
16. What are the two modes of operation of SRM.
17. What are the merits and demerits of converter having phase winding with bifilar wires.
18. Draw the λ -I curve of SRM.
19. What is hysteresis type current control?
20. Define voltage pulse width modulation control.

PART – B

1. Draw and explain four converter topologies for three phase Switched Reluctance. Write the merits and demerits of each. **(Apr/May 2010)**
2. With neat block diagram describe in detail the microprocessor based controller in SRM. **(Apr/May 2010) and (Nov /Dec 2009)**
3. Explain the construction and working principle of SRM. **(Nov /Dec 2007)**
4. Draw and explain torque/ speed characteristic of SRM. **(Apr/May 2010)**
5. Explain in detail about torque prediction in SRM. **(Nov /Dec 2007)**
6. Explain in detail the control circuits used in switched reluctance motor.
7. Discuss the various modes of operation of SRM.
8. Derive the torque equation and develop the mechanical characteristics of SRM.
9. Explain the importance of closed loop control in switched reluctance motor.
10. Sketch the general torque speed curve of SR motor and discuss the type of control strategy used for different regions of the curve.

UNIT – 4

PART – A

1. What are the advantage and disadvantages of brush less dc motor drives?
2. List the permanent magnet materials.
3. What are differences between mechanical and electronic commutator.
4. Write the torque and Emf equation of square wave brushless motor.
5. Mention some applications of PMBLDC Motor.
6. Compare conventional dc motor and PMBLDC motor.
7. What is the difference classification BLPM dc motor?
8. What are the two types of BLPMSQWDC motor?
9. Compare PMBLDC motor and switched reluctance motor.
10. What is the permanent magnet DC Commutator motor?
11. Why the PMBLDC motor is called electronically commutated motor?
12. What are the relative merits of the brushless dc motor drives?
13. What is hall sensor?
14. What is optical sensor?
15. Sketch the ideal phase voltage and current waveform of PMBLDC machine.
16. What are materials used for making Hall IC pallet?
17. How the permanent magnet motors are named based on the wave shape of emf?
18. Draw the magnetic equivalent circuit of 2 pole PMBLDC motor.
19. Name the position sensors that are used for PMBLDC motor.
20. Define intrinsic coercivity.

PART – B

1. Derive the expression for Emf and torque of a PMBLDC motor. Draw the relevant waveforms. **(Nov/Dec 2007)**
2. Explain torque/ speed characteristic of PMBLDC motor. **(Apr/May 2010)**
3. Write a note on power controllers used in PMBLDC motor. **(Nov/Dec 2007)**
4. Explain the construction and working principle of PMBLDC motor. **(Nov/Dec 2009)**
5. Explain the closed loop control scheme of a PMBLDC motor drive with a suitable schematic diagram. **(Apr/May 2010)**
6. What are the types of materials used in PMDC motors?
7. Why the PMBLDC motor is called electronically commutated motor?
8. Derive an expression for permeance coefficient for PMBLDC motor.
9. Discuss the use of Hall sensors for position sensing in PMBLDC motor.
10. Draw the B-H hysteresis loop of permanent magnet material.

UNIT – 5

PART – A

1. What are features of permanent magnet synchronous motor?
2. What are advantages of load commutation?
3. What are the applications of PMSM?
4. What are features of closed loop speed control of loaded commuted Inverter fed synchronous motor drive?
5. What are the merits and demerits of PMSM?
6. Write the emf equation of PMSM.
7. What are assumptions made in derivation of emf for PMSM?
8. What is pulsated mode?
9. What is load commutation?
10. Clearly explain the difference between synchronous reluctance motor and PM synchronous motor.
11. What is meant by self motor?
12. How are PMBLDC motor and PMSM different? PMBLDC motor
13. What is meant by slot less motor?
14. State the two classifications of PM synchronous machines and the types in each.
15. Distinguish between self control and vector control PMSM.
16. State the differences between synchronous reluctance motor and PMSM.
17. What is meant by vector control?
18. What is meant by synchronous reactance?
19. What is meant by field oriented control of PMSM?
20. Compare electromagnetic excitation with permanent magnet of PMSM.

PART – B

1. Explain the construction and working principle of operation of PMSM. Explain the microprocessor based control of PMSM (**Nov/Dec 2007**)
2. Draw and explain the phasor diagram of PMSM (**Apr/May 2010**)
3. Derive torque and EMF equation of PMSM. (**Nov/Dec 2007**)
4. Compare BLPMDC motor and PMSM.
5. Derive the expression for synchronous reactance of PM synchronous motor.
6. Discuss about power controllers of PMSM.
7. With necessary phasor diagram and circle diagram, describe torque speed characteristics of PMSM.
8. Discuss PMBLDC and PMSM with respect to torque/ampere and KVA of converter/ kw of power to motor for 4 pole, 3 phase motor system.
9. Show the power output of PMBLDC motor is more than PMSM for the same size.
10. State the application of PMSM.