



SYED AMMAL ENGINEERING COLLEGE

Approved by the AICTE, New Delhi, and Affiliated to Anna University, Chennai, Govt. of Tamilnadu
Dr. E.M.Abdullah Campus, Ramanathapuram – 623 502.



Department of Electrical and Electronics Engineering

Question Bank (2016-2017ODD)

Programme : **B.E**

Subject : **EE 6703 SPECIAL ELECTRICAL MACHINES**

Semester / Branch : **VII-EEE**

UNIT - 1

PART A

1. List the applications of synchronous reluctance motors.
2. Draw the voltage and torque characteristics of synchronous reluctance motor.
3. Describe the principle of operation of synchronous reluctance motor.
4. Compare synchronous reluctance motor and induction motor
Express and explain the voltage and torque equation of synchronous reluctance
5. motor.
6. Write the different types of controllers used for synchronous reluctance motor.
7. Classify the different types of synchronous reluctance motor.
8. List the merits of 3-phase brushless permanent magnet synchronous motor.
9. List the types of synchronous reluctance motors.
Give the difference between synchronous reluctance motor and switched reluctance
10. motor.
11. Give some potential applications of synchronous reluctance machine.
12. Examine the various design parameters of synchronous reluctance motor.
13. Give the operating principle of radial flux motor.
14. List out any four properties of reluctance motors.
15. Define reluctance torque.
16. Define cogging.
17. Why the power factor of synchronous reluctance motor is much lower than permanent
magnet
motor?
18. Compare synchronous reluctance motor with conventional synchronous motor.



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19. Give the advantages and disadvantages of synchronous reluctance motor.
20. Draw the phasor diagram of synchronous reluctance motor.

PART B

1. (i) Generalize the expression for the torque equation for the synchronous reluctance motor. (8)

(ii) Investigate the performance of the synchronous reluctance motor with neat phasor diagram. (8)
2. (i) Draw the phasor diagram of synchronous reluctance motor. (4)
(ii) Explain the construction and operation of axial and radial flux machines. Discuss the advantages and disadvantages of each construction. (12)
3. (i) Discuss in detail about the construction and working of synchronous reluctance motor with neat diagrams. (8)
(ii) Draw and explain phasor diagram with characteristics of synchronous reluctance motor. (8)
4. (i) Discuss the various stator current modes in a synchronous reluctance motor in detail. (8)

(ii) Write a detailed technical note on the variable reluctance motor and the advantages. (8)
5. Derive the voltage and torque equations of synchronous reluctance motor. (16)
6. Describe the constructional features and operation of variable reluctance synchronous reluctance

Discuss in detail the principle of operation and constructional features of different types of synchronous
7. reluctance motor. (16)
8. Explain the torque speed characteristics of synchronous reluctance motor in detail. (16)
9. Derive the open circuit emf of synchronous reluctance motor. (16)



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10. (i) Explain the steady state phasor diagram of synchronous reluctance motor.
(ii) Derive the expression for d-axis synchronous reactance of a permanent magnet synchronous reluctance motor. (8)
11. Differentiate between axial and radial airgap synchronous reluctance motors compare the performance of synchronous reluctance motor with switched reluctance motor. (16)
Explain circle diagram and torque –speed characteristics of synchronous reluctance motor. (16)
- 12
(i) Discuss the main advantages and disadvantages of synchronous reluctance motor. (8)

(ii) Discuss the various applications of synchronous reluctance motor. (8)



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UNIT - 2

PART A

1. Analyze the various driver circuits used in stepped motor.
2. Define stepping angle.
3. Name the various modes of excitation in stepping motor.
4. Define the terms holding and detent torques as referred to stepper motor.
5. Distinguish the half step and full step operations of a stepping motor.
6. Summarize the principle of operation of a variable reluctance stepper motor.
7. Point out the difference between single and multistack stepping motors.
8. Write the principle of operation of stepping motors.
Explain the features of stepper motor which are responsible for its wide spread
9. use.
10. What is the function of drive circuit in stepping motor?
11. Define torque constant of a stepper motor.
Calculate the stepping angle for a 3phase, 24 pole permanent magnet stepper
12. motor.
13. List the different modes of excitations in stepping motors.
14. Analyze why stepper motor work in external logic circuits
15. Draw the block diagram of the drive systems of a stepping motor.
16. Illustrate the principle of hybrid stepping motors.
17. Express the equation for step angle of stepper motor.
18. Draw the equivalent circuit of a winding in stepper motor
19. Discuss the applications of micro stepping VR stepper motor.
20. Define slewing.



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PART B

1. (i) Explain microprocessor based control of stepper motor with an example. (12)
(ii) What are the advantages of closed loop control of stepper motor? (4)

Describe the operation of variable reluctance type stepper motor with different modes of operation. (16)

Construct and evaluate the operation of single stack and multi-stack stepper motor with a neat diagram. (16)

4. (i) Compare the static and dynamic characteristics of stepper motor with necessary diagrams.

(ii) Explain closed loop control of stepper motor. (8)

5. Discuss the construction and working principle of hybrid stepper motor with neat diagrams.

6. Draw and explain the drive circuits and their performance characteristics for stepper motor.

7. Discuss the following :

(i) Modes of excitations of stepping motors. (8)

(ii) Characteristics of stepping motors. (8)

8. (i) Derive the reluctance torque of a stepper motor. (8)

(ii) Calculate the stepping angle for a 3 phase 24 pole permanent magnet type stepper motor. (8)

9. With a neat block diagram explain microprocessor control of stepping motor. (16)

10. (i) Discuss in detail, about the construction and working principle of Variable reluctance stepper motors. (8)

(ii) A single stack 3 phase variable reluctance motor has a step angle of 15° . Find the number of stator and rotor poles. (8)



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(i) What is the motor torque T_m required to accelerate an initial load of $2 \times 10^{-4} \text{ kgm}^2$ from 500Hz to 11. 1500Hz in 50ms. The frictional torque is 0.03Nm and step angle is 1.18° . (8)

(ii) Write a detailed technical note on the bipolar drives for stepper motors. (8)

12. (i) Explain with a neat diagram the multistack configuration in stepper motors. (8)

(ii) Explain the working of hybrid motor. (8)

Discuss the principle of operations of permanent magnet stepper motor with torque Vs angle characteristics. (16)

14. Discuss dual voltage driver circuit for two phase on drive of a four phase stepper motor and explain the nature of current build up in dual voltage drive. (16)

UNIT – 3

PART A

1. What is the significance of closed loop control in switched reluctance motor?

2. List out the advantages of switched reluctance motors.

3. Point out the different power controllers used for the control of switched reluctance motor.

4. Illustrate the different modes of operation of switched reluctance motor.

5. Compare the advantages and disadvantages of the converter circuit with two power semiconductor devices and two diodes per phase

6. Give the advantages of sensorless operation of switched reluctance motor.

7. Discuss the principle of operation of switched reluctance motor.

8. Generalize the voltage and torque equation of switched reluctance motor.

9. Mention some position sensors in switched reluctance motor.

10. Analyze why SR machines popular in adjustable speed drives.

11. Give the significance of rotor position sensor essential for the operation of SR Motors

12. List the methods of rotor position sensing in switched reluctance motor.



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13. Illustrate the applications of switched reluctance motor.
14. Define energy ratio.
Differentiate switched reluctance motor with variable reluctance stepper
15. motor.
16. Draw the torque speed characteristics of SRM
17. Define voltage pulse width modulation control.
18. What is hysteresis current control?
19. Summarize the disadvantages switched reluctance motor.
Differentiate the merits & demerits of converter having phase winding with bifilar
20. wires.

PART – B

1. (i) Explain with a neat circuit any two configuration of power converters used for the control of switched reluctance motor. (12)
(ii) State the advantages of sensorless operation. (4)

Explain with a neat diagram the constructional details and working of rotary switched

2. reluctance motor(16)

- (i) Along with circuit diagrams explain the hysteresis type and PWM current regulator for
3. one phase of a switched reluctance motor. (10)
4. (i) Discuss the microprocessor based control of switched reluctance motor. (8)
(ii) Derive the torque equations of the variable reluctance motor and illustrate the various dependent parameters. (8)
5. Summarize the steady state performance analysis of switched reluctance motor. (16)
6. Explain the closed loop control analysis of switched reluctance motor. (16)
7. (i) Compare and contrast the performances of SR motor and VR stepper motors. (6)
(ii) Explain the importance of closed loop control in SR motor. (10)
8. Discuss the following in switched reluctance motor
(i) Methods of rotor position sensing (8)



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- (ii) Sensorless operation. (8)
- 9. Explain the construction and working of switched reluctance motor with neat sketches. (16)
- 10. (i) Explain the torque -speed characteristics of switched reluctance motors. (8)
(ii) Derive the expressions for voltage and torque of SR machines. (8)
- 11. Discuss the necessity of power electronic circuit in SR motor. Explain the different types of converter circuits in details. (16)
- 12. (i) Explain the shaft position sensing of SR motor. (8)
(ii) Explain the nonlinear analysis of SRM. (8)
- 13. Discuss the various converter topologies for a 3 phase switched reluctance motor with merits and demerits of each. Explain any two of them. (16)

UNIT – 4

PART A

1. List the permanent magnet materials used in PMBLDC motors.
2. Compare conventional DC motor and PMBLDC motor.
3. Compare PMBLDC motor with PMSM.
4. Define Permeance coefficient.
5. Comment on demagnetization in PMBLDC motor.
6. Describe the principle of operation of PMBLDC motor.
7. List out the different classifications of BLPM DC motor?
8. Draw the magnetic equivalent circuit of 2 pole PMBLDC motor.
9. How the permanent magnet motors are named based on the wave shape of emf?
10. Express the torque and Emf equation of square wave brushless motor.
11. Justify the statement: PMBLDC motor is called electronically commutated motor.
12. Compare and contrast mechanical and electronic commutator.



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13. Define permanent magnet DC Commutator motor. How it is different from MBLDC motor?
14. List out the power controllers used in permanent magnet brushless DC motor.
15. Give short note on hall & optical sensors and its uses?
16. Name the position sensors that are used for PMBLDC motor.
17. How are the directions of rotations reversed in PMBLDC motor?
18. Sketch the ideal phase voltage and current waveform of PMBLDC machine.
19. A permanent magnet DC commutator motor has a stalling torque of 2 Nm. The stall current is 5 A. Compute the motor's no-load speed if it is fed with 28 V DC Supply.
20. Mention some of the applications of PMBLDC Motor.

PART – B

1. (i) Derive an expression for permeance coefficient for PMBLDC motor. (12)
(ii) State the advantages of BLPM DC motor over conventional DC motor. (4)
2. Illustrate B-H hysteresis loop of permanent magnet material. (16)
3. Explain in detail about the construction and working principle of PMBLDC motor. (16)
4. (i) Elucidate in detail about the operation of PMBLDC motor with 180° magnet arcs and 120° square-wave phase currents. (8)

(ii) Describe the constructional aspects of mechanical and electronic commutators of PMBLDC motors. (8)
5. Discuss in detail about magnetic circuit analysis of PMBLDC motor. Also draw its characteristics. (16)
6. Derive the expression for Emf and torque of a PMBLDC motor. Draw the relevant characteristics. (16)
7. Analyze the operation of electronic commutator in PMBLDC motor with necessary diagrams. Explain the operation of the same. (16)



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8. Write a note on power controllers used for PMBLDC motor and explain the each blocks associated in it. (16)
9. Discuss the hysteresis type current regulation of PMBLDC motor with neat diagram? (16)
- Discuss the use of Hall sensors for position sensing in PMBLDC motor with necessary
10. block diagram. (16)
11. (i) Explain the speed-torque characteristics of PMBLDC motor. (8)
- (ii) Differentiate between Mechanical and Electronic Commutators. (8)
12. (i) A permanent magnet DC commutator motor has a no-load speed of 600 rpm when connected to a 120 V supply. The armature resistance is 2.5Ω and rotational and iron losses may be neglected. Determine the speed when the supply voltage is 60 V and the torque is 0.5 Nm.
- ii) Prove that the torque equation in BLDC motor is similar to that of conventional motor.
13. (i) Explain in detail about various types of PMBLDC motor with necessary diagrams. (8)
14. A PMBLDC motor has torque constant of 0.12 Nm/A referred to DC supply. Find the motor's no-load speed when connected to 48 V DC supply. Find the stall current and stall torque if armature resistance is $0.15 \Omega/\text{phase}$ & drop in controller transistor is 2 V. (8)
- Explain the closed loop control scheme of a PMBLDC motor drive with a suitable schematic diagram. (16)



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PART – B

1. Explain the construction and working principle of operation of PMSM. (16)
2. Derive the torque and EMF equations of PMSM. (16)
3. Deduce the expression for synchronous reactance of PM synchronous motor. (16)
4. Draw and explain the phasor diagram of PMSM. (16)
5. With necessary phasor diagram and circle diagram, describe the torque speed characteristics of PMSM. (16)
6. Derive the expression for power input and torque of a PMSM. Explain how its torque speed characteristics are obtained. (16)
7. 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. (16)
8. Analyze and Justify, the power output of PMBLDC motor is more than PMSM for the same size.
9. (i) Discuss the current control scheme of permanent magnet synchronous motor in detail. (8)
(ii) Derive Self and Mutual Inductance of Permanent magnet Synchronous motor. (8)
- 10 (i) What is armature reaction. Discuss its effects on PMSM. (4)
(ii) Explain the concept of vector control and how it achieved in PMSM. (12)
With a neat sketch, explain the microprocessor based speed control of PMSM. (16)
- 11 i) Discuss in detail about various rotor configurations of Permanent Magnet Synchronous machines (8)
(ii) With necessary block diagram explain in detail about FOC for PMSM. (8)
12. (i) State the applications of PMSM. (6)
(ii) Discuss in detail about Volt-ampere requirements of PMSM. (10)