

EE8005 SPECIAL ELECTRICAL MACHINES

IMPORTANT QUESTIONS AND QUESTION BANK

UNIT I - STEPPER MOTORS

2-Marks

1. What is stepper motor?
2. Define step angle?
3. Define slewing?
4. Classify the different types of stepping motor?
5. Summarize the principle of operation of available reluctance stepper motor?
6. Define the terms holding and detent torques as referred to stepper motor?
7. Define torque constant of a stepper motor?
8. Calculate the stepping angle for a 3phase,24 pole permanent magnet stepper motor.?
9. Draw the block diagram of the drive system of a stepping motor?
10. What is the function of drive circuit in stepping motor?

Part-B

1. Describe in detail the construction and working of variable reluctance stepper motor?
2. Explain the construction and working principle of hybrid stepper motor with neat diagrams?
3. Explain the operation of single stack and multi-stack stepper motor with a neat diagram?
4. Discuss the principles of operation of permanent magnet stepper motor torque angle characteristics?
5. Draw and explain in detail the static and dynamic characteristics of stepper motor?
6. Explain the mechanism of static torque production in a variable reluctance stepping motor?
7. Describe the dynamic characteristics of available reluctance stepper motor?
8. Explain in detail linear analysis of stepper motor?
9. Draw and explain drive circuits and their performance characteristics for stepper motor?
10. Explain in detail the concept of lead angle in stepper motor?
11. Enumerate the various applications of stepper motor?

12. Develop single and multi-stack configured stepping motors for mechanical clock application?
13. A Variable Reluctance stepper motor has a step angle of 3° , Determine the following: i) Resolution. ii) Number of steps per shaft to make 10 revolutions iii) Shaft speed if stepping frequency is 2400 pulse/sec?
14. Recommend suitable types of stepper motor for mill and explain the reason with their characteristics?
15. Design a suitable driver circuit which employs unipolar and bipolar wiring arrangements of stepping motor and explain?

UNIT II - SWITCHED RELUCTANCE MOTORS (SRM)

2-Marks

1. State the principle of operation of switched reluctance motor?
2. Illustrate the different modes of operation of switched reluctance motor?
3. Give basic features or characteristics of Switched Reluctance motor?
4. What are the disadvantages of a switched reluctance motor?
5. Give the expression for torque of a switched reluctance motor?
6. Write the relations between the speed and fundamental switching frequency?
7. Determine the step angle of a three phase switched reluctance motor having 12 stator poles and 8 rotor poles. What is the commutation frequency in each phase of 6000 rpm?
8. Evaluate the speed-torque characteristics of SRM?
9. Point out the different power controllers used for the control of switched reluctance motor?
10. Give the advantages of sensor less operation of switched reluctance motor?

Part-B

1. Draw the cross sectional view of switched reluctance motor and explain the principle of operation. State the advantages of switched reluctance motor?
2. Explain the torque-speed characteristics of switched reluctance motors?
3. Explain the steady state performance of its switched reluctance motor?
4. Draw and explain the characteristics of switched reluctance motor in detail?
5. Prepare the necessity of power electronic circuit in SR motor. Explain its different types of converter circuits?
6. Draw and explain four converter topologies for a three phase SRM. Write the merits and demerits of each topology
7. Draw a schematic diagram and explain the operation of a "C"-dump converter used for the control of SRM?
8. Describe the various converter topologies for a 3 phase switched reluctance motor with merits and demerits of each. Explain any two of them?

9. Describe with a neat circuit any two configuration of power converters used for the control of switched reluctance motor?
10. Describe the closed loop control analysis of switched reluctance motor?
11. Role of microprocessors in control of switched reluctance motor?
12. Assess the features of rotary and linear switched reluctance motors and suggest suitable motor for bottling plant?
13. Summarize the various stages in sensor less control of SRM?
14. Plot the mechanical characteristics of SR motor and discuss the type of control strategy used for different regions of the curve. Also, draw the typical phase current waveforms?

UNIT III - PERMANENT MAGNET BRUSHLESS D.C. MOTORS

2-Marks

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 BLPMDC motor?
8. Plot the magnetic equivalent circuit of PMBLDC motor?
9. What are the differences between mechanical and electronic commutator?
10. Give the torque and emf equation of square wave brushless motor?

Part-B

1. Derive an expression for permeance coefficient of PMBLDC motor?
State the advantages of BLPM DC motor over conventional DC motor?
2. Derive the torque equation and torque ratio of permanent magnet brushless DC motor?
3. Explain the construction PMBLDC also compare conventional DC motor and PMBLDC motor?
4. Elucidate in detail about the operation of PMBLDC motor with 180° magnet arcs and 120° square-wave phase currents?
5. Discuss in detail about magnetic circuit analysis of PMBLDC motor.
Also draw its characteristics?
6. Derive the expression for emf and torque of a PMBLDC motor. Draw the relevant characteristics?

7. Explain the operation of electronic commutator in PMBLDC motor with necessary diagrams. Explain the operation of the same?
8. Write a note on power controllers used for PMBLDC motor and explain the each blocks associated in it?
9. Discuss the hysteresis type current regulation of PMBLDC motor with neat diagram?
10. Discuss the use of Hall sensors for position sensing in PMBLDC motor with necessary block diagram?
11. A permanent magnet DC commutator motor has a no-load speed of 6000 rpm when connected to a 120 V supply. The armature resistance is 2Ω and rotational and iron losses may be neglected. Determine the speed when the supply voltage is 60 V and the torque is 0.5Nm?
12. Explain the closed loop control scheme of a PMBLDC motor drive with a suitable schematic diagram?
13. Identify appropriate power controllers for PMBLDC motor and explain with neat diagram?
14. Develop a power semiconductor base inverter circuit for star connected PMBLDC Motor and sketch the firing sequence and phase current waveform for any mode?
15. Prepare the relationship between magnetizing force and flux density by performing the magnetic circuit analysis of a brushless dc motor on open circuit?

UNIT IV - PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)

2-Marks

1. Distinguish PM synchronous motor from BLPM DC motor?
2. List out the merits and demerits of PMSM?
3. Classify the different types of PMSM?
4. Express the torque and EMF equation of PMSM?
5. Briefly explain about synchronous reactance. Also write the expression for self and synchronous reactance of PMSM?
6. Define load angle?
7. Describe the features of closed loop speed control of loaded commuted inverter fed synchronous motor drive?
8. Draw the output phasor diagram of PMSM?
9. Define synchronous reactance in PMSM?
10. Explain the difference between SYNREL motor and PM synchronous motor?

Part-B

1. Explain the construction and working principle of operation of PMSM?
2. For an ideal sinewave permanent magnet motor derive the torque and EMF equations?
3. Enumerate the design considerations of permanent magnet synchronous motor?
4. Describe the construction of phasor diagram of surface magnet sinewave motor?
5. With necessary phasor diagram and circle diagram, describe the torque speed characteristics of PMSM?
6. Derive the expression for power input and torque of a PMSM. Explain how its torque speed characteristics are obtained?
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?
8. Analyze and justify, the power output of PMBLDC motor is more than PMSM for the same size?
9. With necessary diagrams, discuss about various power controllers used for PMSM?
10. Integrate a suitable microprocessor for the control of permanent magnet synchronous motor?
11. A 3 ϕ , 4 pole, brushless PM rotor has 36 stators lots. Each phase winding is made up of three coils per pole with 10 turns per coil. The coils pan = 7 slots. If the fundamental component of magnet flux is 1.8mWb. Estimate the open circuit phase emf (E_q) at 3000 rpm?
12. Clarify in detail the field oriented control of permanent magnet synchronous motor?
13. Discuss in detail about various rotor configurations of permanent magnet synchronous machines?
14. What is armature reaction? Discuss its effects on PMSM?
15. Discuss the current control scheme of permanent magnet synchronous motor in detail?

UNIT V - OTHER SPECIAL MACHINES

2-Marks

1. List the applications of synchronous reluctance motors?

2. Develop the voltage and torque characteristics of synchronous reluctance motor?
3. Describe in short about SYNREL motors?
4. Define cogging?
5. Point out any two advantages of synchronous reluctance motor?
6. Tabulate the types of rotor available in synchronous reluctance motor?
7. Define reluctance torque with reference to synchronous reluctance motor?
8. What is linear synchronous speed?
9. Quote the properties of linear induction motor?
10. Describe the principle of operation of hysteresis motor?

Part-B

1. Give a detailed technical note on the variable reluctance motor and the advantages?
2. Investigate the performance of the synchronous reluctance motor with neat phasor diagram?
3. Explain the construction and operation of axial and radial flux machines. Discuss the advantages and disadvantages of each construction?
4. Differentiate between axial and radial airgap synchronous reluctance motors. Compare the performance of synchronous reluctance motor with switched reluctance motor?
5. Describe the constructional features and operation of variable reluctance synchronous reluctance motor?
6. Explain with neat diagram, the construction working principle and types of synchronous reluctance motor?
7. Discuss the main advantages and disadvantages of synchronous reluctance motor?
8. Discuss the various applications of synchronous reluctance motor?
9. Describe circle diagram and torque–speed characteristics of synchronous reluctance motor?
10. Explain the working of linear induction motor and also write its applications?
11. Describe briefly about the repulsion motor?
12. Summarize the constructional details principle of operation and the application Hysteresis motor?
13. Recommend a suitable type of synchronous reluctance motor for rewinding mill?

14. Summarize applications of linear induction motor and repulsion motor?
15. Formulate a suitable saliency ratio of synchronous reluctance motor and how it can be improved?
16. Substitute a suitable reluctance motor for placing induction motor and synchronous motor and explain?

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