| Reg. No. | | | | | | | | | | | | | | | |
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| Question Paper Code | 13903 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Seventh Semester

**Electrical and Electronics Engineering**

**20EEEL713 - SPECIAL ELECTRICAL MACHINES**

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | What is the purpose of the rotor position detection in a stepper motor system?<br>a) To determine the step angle b) To Synchronize the motors rotation<br>c) To provide feedback for closed-loop control d) To regulate the motor's speed | 1 | K1 | CO1 |
| 2. | Which type of motor is most suitable for computer printer device?<br>a) Reluctance motor b) Hysteresis motor<br>c) shaded pole motor d) Stepper motor | 1 | K1 | CO1 |
| 3. | What is a key disadvantage of a switched reluctance motor?<br>a) High cost b) Need for a rotor position sensor c) Low reliability d) Large size | 1 | K1 | CO2 |
| 4. | Switched reluctance motors are also known as<br>a) synchronous reluctance motors b) DC motors<br>c) Stepper motors d) Induction motors | 1 | K1 | CO2 |
| 5. | What replaces the mechanical brush-commutator assembly in a BLDC motor?<br>a) A DC voltage supply b) A mechanical switch<br>b) c) Electronic circuitry with sensors (like Hall effect sensors) d) An AC voltage supply | 1 | K1 | CO3 |
| 6. | Which component provides the feedback for electronic commutation in a BLDC motor?<br>a) The armature b) The stator windings<br>c) The permanent magnets d) A Hall sensor or encoder | 1 | K1 | CO3 |
| 7. | What is the primary advantage of using permanent magnets in the rotor of a PMSM?<br>a) Lower efficiency b) Increased weight<br>c) Higher power density and efficiency d) No need for a power source | 1 | K1 | CO4 |
| 8. | A PMSM is a type of:<br>a) Asynchronous motor b) DC motor c) Synchronous motor d) Reluctance motor | 1 | K1 | CO4 |
| 9. | How is torque produced in a synchronous reluctance motor?<br>a) By the tendency of the rotor to align itself in the minimum reluctance position.<br>b) By the attraction of the rotor to the stator poles.<br>c) By magnetic repulsion between the stator and rotor poles.<br>d) By a rotating magnetic field acting on a permanent magnet. | 1 | K1 | CO5 |
| 10. | The secondary of a linear induction motor can be made of:<br>a) A squirrel cage rotor b) A conductive plate or a short-circuited coil<br>c) A slip-ring rotor d) A wound rotor | 1 | K1 | CO5 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | Define lead angle. | 2 | K1 | CO1 |
| 12. | Define the terms holding and detent torques as referred to stepper motor. | 2 | K1 | CO1 |
| 13. | State the principle of operation of switched reluctance motor. | 2 | K1 | CO2 |
| 14. | List out the different power controllers used for the control of switched reluctance motor. | 2 | K1 | CO2 |
| 15. | Compare conventional DC Motor and PMBLDC motor. | 2 | K2 | CO3 |
| 16. | Give the torque equation of square wave brush less motor. | 2 | K1 | CO3 |

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|---|---|---|---|---|---|
| 17. | Classify the different types of PMSM. | 2 | K2 | CO4 |
| 18. | Draw the torque - speed characteristics of PMSM motor. | 2 | K1 | CO4 |
| 19. | State the applications of repulsion motor. | 2 | K1 | CO5 |
| 20. | List the properties of linear induction motor. | 2 | K1 | CO5 |
| 21. | Give EMF equation of square wave brush less motor. | 2 | K1 | CO3 |
| 22. | List the applications of switched reluctance motor. | 2 | K1 | CO2 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

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|---|---|---|---|---|---|---|
| 23. | a) | Illustrate the static and dynamic characteristics of stepper motor with neat sketch. | 11 | K2 | CO1 |
| | | **OR** | | | |
| | b) | Explain the construction and principle of operation of variable reluctance stepping motor. | 11 | K2 | CO1 |
| 24. | a) | Draw a schematic diagram and explain the operation of a "C" dump converter used for the control of SRM. | 11 | K2 | CO2 |
| | | **OR** | | | |
| | b) | Explain in detail about microprocessor based control of switched reluctance motor. | 11 | K2 | CO2 |
| 25. | a) | Derive the torque and EMF equations of the permanent magnet brushless DC motor. | 11 | K2 | CO3 |
| | | **OR** | | | |
| | b) | Sketch the structure of controller for permanent magnet brushless DC motor and explain the functions of various blocks. | 11 | K2 | CO3 |
| 26. | a) | Discuss the principle of operation and characteristics of PMSM in brief with neat sketch. | 11 | K2 | CO4 |
| | | **OR** | | | |
| | b) | Explain the current and speed controllers of PMSM. | 11 | K2 | CO4 |
| 27. | a) | Discuss the principle of operation and characteristics of hysteresis motor. | 11 | K2 | CO5 |
| | | **OR** | | | |
| | b) | With relevant diagrams, discuss the characteristics of synchronous reluctance motor. | 11 | K2 | CO5 |
| 28. | a) i) | Explain the Volt-Ampere requirements of PMSM Motor. | 5 | K2 | CO4 |
| | ii) | Identify the merits and demerits of synchronous reluctance motor with its application. | 6 | K3 | CO5 |
| | | **OR** | | | |
| | b) i) | Illustrate the expression for synchronous reactance of PMSM. | 5 | K2 | CO4 |
| | ii) | Build the constructional features of repulsion motor with neat diagrams. | 6 | K3 | CO5 |