

Code No: RT42022C

**R13**

**Set No. 1**

IV B.Tech II Semester Regular Examinations, April/May - 2017

**SPECIAL ELECTRICAL MACHINES**

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Define reluctance. Deduce the relation between reluctance and inductance. [4]
- b) What is a stepper motor? What are its applications? [4]
- c) Compare between permanent magnets and electromagnets. [4]
- d) Is BLDC motor a DC motor or an AC motor? Justify your answer. [3]
- e) What are different types of linear motors? [3]
- f) What are main characteristics of traction drives? [4]

**PART-B (3x16 = 48 Marks)**

2. a) Discuss the design of stator and rotor pole arc of SR motors. [8]
- b) What is co-energy? Explain the torque production mechanism in SR motors. Also derive the expression for torque produced in SR motors. [8]
3. a) Define step angle. Explain the operation of a variable reluctance stepper motor. [8]
- b) With a block diagram, explain the closed loop control of a stepper motor. [8]
4. a) Explain the working of a PM DC motor and derive its torque equation. [8]
- b) Compare between PMDC motors and DC motors. [8]
5. a) With the help of model waveforms for back emf, gate pulses of converter, stator currents and voltages, explain the operation of a BLDC motor. [8]
- b) Compare between sensorless control and sensor based control of BLDC motors. [8]
6. a) What are linear motors? How the linear motors are useful in manufacturing industry? [8]
- b) Discuss the operating principle and applications of linear synchronous motors. [8]
7. What are the advantages of using linear motors for electric traction? Discuss the application of single sided linear induction motor for traction drives. [16]



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**Set No. 2**

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**(Electrical and Electronics Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Explain the basic principle of operation of switched reluctance motor. [4]
- b) Differential between stepper motors and switched reluctance motors. [4]
- c) List the disadvantages of permanent magnets over electromagnets. [3]
- d) Draw the waveform of back-emf of a PM BLDC motor. [4]
- e) Mention any four applications of linear motors. [4]
- f) What type of motor is mainly used in traction? Why? [3]

**PART-B (3x16 = 48 Marks)**

2. a) What is the need for position sensor in SRM control? Explain. [8]
- b) With the help of a neat schematic diagram, explain the closed loop control of an SRM. [8]
3. a) List and explain different types of stepper motors. [8]
- b) Discuss the theory of torque production in stepper motors. [8]
4. a) Compare the performance characteristics of DC motors with PM DC motors. [8]
- b) What are moving coil motors? Explain its operating principle and applications. [8]
5. a) What are the main advantages of BLDC motors? What are its drawbacks? List the application areas of BLDC motors. [8]
- b) What is the cause for torque ripples in BLDC motors? How to reduce torque ripples in BLDC motors? [8]
6. Explain the constructional details of a linear synchronous motor? Also mention its applications. [16]
7. a) What are the advantages and disadvantages of using linear induction motor for electric traction? [8]
- b) Distinguish between AC motors and DC motors for traction. [8]



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**PART-A (22 Marks)**

1. a) List the merits of SRM over conventional motors. [4]
- b) What are different types of stepper motors? [4]
- c) Give the applications of PM DC motors. [4]
- d) What are the main advantages of BLDC motors? [4]
- e) How does a linear induction motor works? [3]
- f) Why DC series motors were preferred for traction drives? [3]

**PART-B (3x16 = 48 Marks)**

2. a) Draw the constructional details of an SRM and explain its operating principle. [8]
- b) Explain the reasons for ripples in torque produced by the SRM. Also list various applications of SRM. [8]
3. a) What is a hybrid stepper motor? Explain its operation and applications. [8]
- b) Compare between open loop control and closed loop control of stepper motors. [8]
4. a) Discuss the principle of operation of permanent magnet DC motors. Also mention their applications. [8]
- b) Draw the B-H curve of a magnetic material and explain the significance of hysteresis loop. [8]
5. a) Differentiate between permanent magnet BLDC motor and permanent magnet synchronous motor. Also list few applications of BLDC motors. [8]
- b) What is the need for position sensor in BLDC motor control? How is sensorless control of BLDC motor achieved? [8]
6. a) With neat diagrams, explain the constructional details of linear induction motors. [10]
- b) Discuss the applications of linear induction motors. [6]
7. a) Discuss the role and potential for linear motors in traction systems. [8]
- b) What are various ac motors used in traction systems? Explain. [8]



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**Set No. 4**

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**SPECIAL ELECTRICAL MACHINES**

**(Electrical and Electronics Engineering)**

**Time: 3 hours**

**Max. Marks: 70**

*Question paper consists of Part-A and Part-B*

*Answer ALL sub questions from Part-A*

*Answer any THREE questions from Part-B*

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**PART-A (22 Marks)**

1. a) Enlist various applications of Switched Reluctance Motors. [4]
- b) Explain the principle of operation of a stepper motor. [4]
- c) Compare between soft and hard ferromagnetic materials. [4]
- d) What is the need for position sensor in the control of BLDC motors? [4]
- e) Compare between linear DC motor and linear induction motors. [3]
- f) What are the different motors used in traction system. [3]

**PART-B (3x16 = 48 Marks)**

2. a) With a neat circuit diagram, explain the operation of an asymmetric power converter topology for a three-phase 6/4 SRM. [8]
- b) Discuss the torque production mechanism in switched reluctance motors. Derive the expression for torque produced by the switched reluctance motor. [8]
3. a) With neat diagrams, explain in detail the constructional details of a stepper motor. [8]
- b) Discuss the open loop control of a stepper motor. [8]
4. a) What are the advantages and disadvantages of permanent magnet machines? Mention the applications of PM DC motors. [8]
- b) Draw and explain the constructional details of a permanent magnet DC motor. [8]
5. a) Explain the constructional details of a PM BLDC motor. [8]
- b) What are various components that are required for the control of BLDC motors? Explain. [8]
6. a) What are linear motors? How are they different from rotary motors? Explain the application areas of linear motors. [8]
- b) Explain the principle of operation of linear induction motor. [8]
7. a) What are the main characteristics of traction motors? Which motor is mainly used in traction drives? [8]
- b) Compare between AC and DC traction systems. [8]

