

Ref. No. : Ex/EE/5/T/512C/2019 (Old)

BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING) FIFTH YEAR FIRST SEMESTER (Old) - 2019

SUBJECT: - SPECIAL ELECTRICAL MACHINES AND DRIVES

Time: ~~Two hours~~/Three hours/ ~~Four hours~~/~~Six hours~~

Full Marks 100
(50 marks for each part)

Use a separate Answer-Script for each part

Answer any three Questions

Two marks reserved for brief and to the point answer

- | | | | |
|----|-------|---|-----|
| 1. | a) | What is co-energy? Indicate the torque zone and mention its relations with stroke angle of S R M . | 8 |
| | b) | How the rate of change of co-energy decides the rate of mechanical power developed in a SRM? | 8 |
| 2. | a) | How the permanent magnet materials are selected for rotating machines? | 8 |
| | b) | Explain with proper reasons why the operating point is selected at maximum energy density point of a PM material for any rotating machine. | 8 |
| 3. | a) | Describe the construction and principle of operation of a single phase reluctance motor. (Assume that the magnetic flux and reluctance variations are sinusoidal) | 8 |
| | b) | Explain the operating principle of a BLDC motor. Why it is preferred in electrical cars? | 8 |
| 4 | a) | Describe construction and operating principle of a Hybrid Stepper motor. | 8 |
| | b) | Describe construction and operating principle of a Hysteresis motor. | 8 |
| 5. | | Write short notes (any two) | 8X2 |
| | (i) | Linear induction motor. | |
| | (ii) | PMDC motor | |
| | (iii) | Servo motor | |

[Turn over

PART-II.

Answer *any three* questions from this part.

Two marks are reserved for neat and well organised answer

6. Justify the following (any four) 8
- a) Develop the PLC based ladder diagram for DC shunt motor starter system having the starting resistances divided in three steps. Assume START, STOP and OVERLOAD as the available commands/input in the system. Show the inputs and outputs to the system.
- b) A 1.0 kW, 110V, 1200 rpm DC shunt motor with $r_a=1.0$ ohm is operating at rated condition when fed from a half controlled rectifier with single phase input voltage of 230V. Find the triggering angle for the converter. 8

7.	a) Develop the ladder diagram of a DOL starter for three phase induction motor. Consider START, STOP and OVERLOAD as available commands for the system.	8
	b) Discuss with relevant diagrams the different current sensing techniques in a DC motor drive system along with their merits and demerits.	8
8.	a) Discuss with Ladder diagram the method of PLC based plug braking scheme of a DC separately excited motor.	8
	b) Explain how regenerative braking can be achieved in an induction machine. Discuss the same with relevant circuit diagrams.	8
9	a) Discuss the methods to maintain constant braking torque during dynamic braking of a DC separately excited machines. Show how PLC based control can be useful for these schemes.	8
	b) What is scalar control of induction machines? Discuss with relevant block diagram a suitable scheme for the same.	8