

FACULTY OF ENGINEERING**B.E. 4/4 (EEE/Inst.) I – Semester (Old) Examination, July 2014****Subject : Electric Drives and Static Control****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (25 Marks)**

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| 1 | Distinguish between active load torque and passive load torque. | 2 |
| 2 | Compare the DC drives with AC drives atleast in three aspects. | 3 |
| 3 | What do you understand by constant torque and constant power drive? | 2 |
| 4 | Give the principle behind closed loop control for DC drives. | 2 |
| 5 | List the disadvantages of induction motor operation with unbalanced supply voltages. | 3 |
| 6 | Write the limitations on maximum speeds of field controlled dc drive. | 3 |
| 7 | Differentiate between CSI and VSI fed induction motor. | 2 |
| 8 | Give the concept of switched reluctance motor in industrial application. | 3 |
| 9 | Draw the modified speed-torque characteristics of DC shunt motor. | 3 |
| 10 | What do you mean by four quadrant drive. | 2 |

PART – B (50 Marks)

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| 11 | a) Illustrate all the possible cases of the load torque and motor torque on X-axis and speed on Y-axis in order to determine the stability of each case. | 5 |
| | b) A drive has the following :
Parameters : $J = 20 \text{ kg} - \text{m}^2$;
$T = 25 + 0.05 N, \text{ N-m}$
$T_L = 15 + 0.06 N, \text{ N-m}$ where N is the speed in rpm.
Initially the drive is working in steady state. Now the drive is braked by electrical braking. Torque of the motor during braking is given by $T = -10 - 0.04N, \text{ N-m}$, calculate time taken by the drive to stop. | 5 |
| 12 | a) Describe all the five methods of modified speed torque characteristics of 3-ph Induction motor. | 5 |
| | b) A 10 KW, 440V, 3-ph 50 Hz speed control Induction motor operating at rated voltage and frequency has the rotor copper losses at maximum torque 8 times that at full load torque. The slip at full load torque is 0.04. Stator resistance and rotational losses may be neglected.
Determine i) the slip at max. torque ii) the ratio of maximum torque to full load torque iii) the ratio of starting torque to full load torque | 5 |
| 13 | a) What are the draw backs of rectifier fed DC drives. | 5 |
| | b) A 220V, 1500 rpm, 10A separately excited motor with armature resistance of 0.5Ω is fed from a 3-ph fully controlled rectifier available AC source has a line voltage of 440V, 50 Hz. A star/ delta connected transformer is used to feed the armature so that the motor terminal voltage equals rated voltage when converter firing angle is zero. | 5 |

- 2 -

- i) Calculate the transformer turns ratio
 ii) Determine the value of firing angle when a) motor is running at 1200 rpm and rated torque b) When motor is running at -800 rpm and twice the rated torque. Assume continuous conduction.
- 14 Describe in detail about dual converter drive (significance, block diagram, schematic diagram logic, merits and demerits, applications) 10
- 15 Explain about the following regarding synchronous motor. 5+5
 i) Self controlled ii) separately controlled
- 16 a) Define heating time constant and list the factors that it depend upon. 5
 b) A 220V, 20 KW DC shunt motor running at its rated speed of 1200 rpm is to be braked by reverse current braking. The armature resistance is 0.1Ω , and the rated efficiency of the motor is 30% calculate. 5
 i) The resistance to be connected in series with the armature to limit the limited braking current to twice the rated current. 5
 ii) The initial braking torque. 5
- 17 a) The temperature rise of a motor when operating for 25 min on full load is 25°C and becomes 40°C when the motor operates for another 25 min. On the same load. Determine heating time constant and the steady state temperature rise. 5
 b) What are the advantages of electrical drive? 5

FACULTY OF ENGINEERING
B.E. 4/4 (EEE) I-Semester (New) (Suppl.) Examination, July 2014

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Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

- 1 Write any four typical applications of Electric Drives. (2)
- 2 Draw the speed torque characteristics of induction motor drive for varying voltages. Also mention the disadvantages. (3)
- 3 Explain briefly about the methods used to reduce the starting losses incase of d.c. and induction motors. (3)
- 4 Explain about the dynamic braking of d.c. series motor briefly. (3)
- 5 Draw the speed torque characteristics of half controlled converter fed dc separately excited motor drive. (2)
- 6 Draw the speed torque characteristics rectifier fed dc series motor for varying firing angle. (2)
- 7 Draw the circuit diagram for cyclo converter fed induction motor drive. (3)
- 8 What is a static scherbius drive? (2)
- 9 List out the various applications of BLDC motor. (2)
- 10 Explain briefly about separating controlled synchronous motor. (3)

PART – B (50 Marks)

- 11 (a) Explain about the transient stability of an electric drive (synchronous motor) using equal area criteria. (4)
- (b) A 230V d.c. series motor used in lifts has a resistance of 0.2 ohms. At a speed of 1800 rpm it takes 50A. Determine resistance to be added in series with the motor
 - (i) to limit the speed to 3600 rpm when the current is 12.5 A. Assuming that magnetization curve is a straight line between zero and 50A.
 - (ii) to make the speed 900 rpm when the current is 70 Amps taking flux per pole at 70A is 20 percent greater than at 50amps (6)
- 12 (a) Derive the formula for energy lost during the starting of dc shunt motor under loaded condition. (5)
- (b) Write about various braking methods of induction motor. (5)
- 13 (a) Compare the circulating and non-circulating current modes of dual converters. (4)
- (b) Two quadrant operation a dc drive can be obtained using fully controlled rectifier. Justify. (6)
- 14 (a) Explain about the static rotor resistance control of induction motor with neat diagram. (5)
- (b) What are possible modes of VSI fed induction motor drive? Draw the circuits and explain. (5)

- 15 (a) Explain the principle of operation of switched reluctance motor. (6)
(b) Compare self and separately excited synchronous motor drives. (4)
- 16 A 440V, 50Hz, 6 pole, Y - connected squirrel cage induction motor has the following parameters.
 $R_s = 0.6\text{ohm}$, $R_r = 0.3\text{ ohm}$, $X_s = X_r = 1\text{ ohm}$
The normal full load slip is 0.05 ohm
The motor is fed from a voltage source inverter which maintains a constant v/f ratio.
For an operating frequency of 10Hz, calculate the breakdown torque as ratio of its value at the rated frequency.
What should be the v/f ratio at 10Hz so that the breakdown torque at the frequency remains same as at rated frequency? (10)
- 17 Write short notes on the following: (10)
(a) Chopper controlled drive for dynamic braking (5)
(b) Bipolar brush less DC motor (5)
