FACULTY OF ENGINEERING

B.E. 4/4 (EEE) I - Semester (Main & BL) Examination, December 2017
Subject: Electric Drives and static Control

Time: 3 Hours   Max. Marks: 75

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

PART-A (25 Marks)

1. Draw speed-torque characteristics of dc shunt motor in third and fourth quadrants with and without external resistance connected to armature. (3)

2. What is the difference between active load and passive load? Give examples. (3)

3. Derive an expression for energy loss during starting of a dc shunt motor at no-load. (3)

4. Why a 3-phase induction motor draws high current at the instant of counter current braking? (2)

5. What are the advantages of semi-converter fed dc motor over full-converter fed motor? (2)

6. A 220 V, 800 rpm, 150 A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate firing angle for rated torque at 600 rpm. (3)

7. A 3-phase, 50 Hz, 1440 rpm induction motor is fed from a 3-phase cyclo-converter. Calculate its speed at same slip, when frequency output of cyclo-converter is 12.5 Hz. (3)

8. Draw speed-torque characteristics of 3-phase induction motor fed from a 3-phase ac voltage controller for any two firing angles. (2)

9. As load torque on a BLDC motor increases, then its supply frequency _____ (increases / decreases / remain constant) and its speed _____ (increases / decreases / remain constant). (2)

10. What are the industrial applications of switched reluctance motor? (2)

PART - B (50 Marks)

11 a) What is load equalization? Derive an expression for moment inertia of a flywheel. (6)

   b) A 150 HP, 800 rpm dc shunt motor has stored energy of 5000 Joules per HP. Determine the time taken to start the motor, if the load torque is equal to full load torque and the current is limited to two and half times the full load current during starting. (4)

12 a) Explain any one scheme of dc dynamic braking of 3-phase induction motor. (6)

   b) Draw speed-torque characteristics of any four types of loads along with examples. (4)

13 a) Draw and explain the operation of single-phase semi converter fed separately excited dc motor with a neat circuit diagram and show input and output voltages and currents, assuming continuous load current. (6)

   b) Explain briefly how energy loss can be minimized during starting of a motor. (4)

14 a) Draw and explain briefly speed-torque characteristics of 3-phase induction motor operating in reverse motoring for (i) dc dynamic braking and (ii) regenerative braking. (5)

b) A 3-phase, 440 V, 50 Hz, 10 kW, 960 rpm, 6 pole, star connected slip-ring induction motor has the following constants per phase : $R_1 = 0.4\ \Omega$, $R_2' = 0.6\ \Omega$, $X_2 = X_2' = 1.4\ \Omega$. The load torque is proportional to speed at rated speed and the motor is controlled by static rotor resistance control. The stator to rotor turns ratio is 2. Calculate the value of external resistance so that motor runs at 800 rpm for duty ratio of 0.5. (5)

15 a) Draw and explain non-circulating current mode of operation a dual converter fed dc drive. (5)

b) With neat schematic circuit diagram, explain speed control of 3-phase induction motor in both forward motoring and reverse motoring using 3-phase ac voltage controller. (5)

16 a) Draw and explain briefly any two configurations of variable voltage and variable frequency control of synchronous motor using dc link converter with a neat block diagrams. (5)

b) What is the principle of switched reluctance motor? Explain the same for a 4 phase, 4/2pole motor with a neat schematic diagram. (5)

17 Discuss the following: (10)

a) Static Scherbius drive

b) Modified speed-torque characteristics of dc shunt motor with shunted armature.

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