

Code No: 56010

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year II Semester Examinations, May - 2015

POWER SEMICONDUCTOR DRIVES

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Explain the operation of a separately excited dc motor fed by a single-phase semi converter. Discuss the continuous mode of operation with the help of their governing equations.
- b) In a single-phase fully controlled converter fed with a separately excited dc motor having source voltage $V_s = 220V$, speed 1000 rpm, 50 Hz, $K_v \phi = 0.85 \text{ N-S/A-rad}$, armature resistance $R_a = 1\Omega$, assume continuous and ripple-free current. Determine the following for a firing angle of $\alpha = 45^\circ$ and speed 1000rpm:
- The motor torque
 - The supply power factor
 - The speed regulation or back emf voltage
 - The efficiency.
- [7+8]
- 2.a) Explain the operation of a three-phase converter fed (with series motor) in three-phase semi-converters for firing angle $\alpha = 45^\circ$. Sketch its input and output voltage waveforms.
- b) The speed of a 50 kW, 500 V, 120 A, 1000rpm, separately excited dc motor is controlled by a three-phase full converter fed from 440 V, 50 Hz supply with $R_a = 0.1\Omega$. Find the range of firing angle required between 500 rpm and -500 rpm at rated torque.
- [7 8]
- 3.a) Describe the relative merits and demerits of the following types of braking for dc motors: (i) Mechanical braking (ii) Dynamic braking and (iii) Regenerative braking, with a neat diagram.
- b) A 220 V, 1000 rpm, 50 A separately excited dc motor with a armature resistance of 0.5Ω , AC source 440 V, 50 Hz is fed in dual converters with ac source voltage (line) = 165 V.
- Determine converter firing angles for the following operations:
- First quadrant at rated motor torque and 500 rpm
 - Third quadrant at rated motor torque and -500 rpm.
- [8+7]
- 4.a) Write the voltage equations of type A chopper during T_{on} and T_{off} periods for an RLE load. Hence, obtain steady state analysis expressions for maximum and minimum currents considered by the load.
- b) A dc series motor, fed from a 400 V dc source through a chopper, has parameters $r_a = 0.05\Omega$, $r_s = 0.07\Omega$, $K = 5 \times 10^{-1} \text{ Nm/A}^2$, and the average armature current is 100 A. For a chopper of cycle of 40%, determine:
- The input power factor
 - The motor speed and torque
- [8+7]