

B.Tech IV Year I Semester (R07) Supplementary Examinations December 2015

POWER SEMICONDUCTOR DRIVES

(Electrical & Electronics Engineering)

(For 2008 Regular admitted batch only)

Time: 3 hours

Max. Marks: 80

Answer any FIVE questions
All questions carry equal marks

- 1 (a) Derive the speed and torque expressions for a single-phase semi controlled converter connected to a separately excited dc motor.
(b) Speed of a dc series motor coupled to a fan load is controlled by variation of armature voltage. When armature voltage is 400 V, motor takes 20 A and the fan speed is 250 rpm. The combined resistance of armature and field is 1.0Ω . Calculate motor armature voltage for the fan speed of 350 rpm.
- 2 (a) Explain the basic operational aspects of three phase semi controlled converters with neat sketches of the waveforms and the circuit diagram. What is the effect of freewheeling diode?
(b) The speed of separately-excited dc motor is controlled by means of a 3-phase full converter from a 3-phase, 415 V, 50 Hz supply. The motor constants are: inductance 10 mH, resistance 0.9Ω and armature constant 1.5 V/rad/s (Nm/A). Calculate the speed of this motor at a torque of 50 Nm when the converter is fired at 45 deg. Neglect losses in converter.
- 3 (a) Draw the speed torque characteristics of for dynamic braking operation of d.c. series motor. Why torque become zero at infinite speed?
(b) A 230 V, 870 rpm, 100 A separately excited motor has an armature resistance of 0.05Ω it is coupled to an overhauling load with a torque of 400 N-m. Determine the speed at which motor can hold the load by regenerative braking.
- 4 (a) List the advantages offered by dc chopper drives over line-commutated converter controlled dc drives.
(b) A dc chopper controls the speed of dc series motor. The armature resistance $R_a = 0.04 \Omega$, field circuit resistance $R_f = 0.06 \Omega$ and back e.m.f constant $K_v = 35 \text{ m V/rad/s}$. The dc input voltage of the chopper $V_s = 600 \text{ V}$. If it is required to maintain a constant developed torque of $T_d = 547 \text{ N-m}$, plot the motor speed against the duty cycle K of the chopper.
- 5 (a) How the speed control of IM is achieved by $1 - \phi$ A.C voltage controller?
(b) Derive output voltage of a $1 - \phi$ AC voltage controller and draw output voltage & current waveforms.
- 6 (a) Explain about the variable frequency control by CSI induction motor drives.
(b) A 400 V, 50 Hz star connected induction motor is fed from a six step inverter which in turn is fed from a six-pulse fully controlled rectifier. The a.c supply mains are rated at 440 V, 50 Hz. What should be the firing angle of the rectifier to operate the motor at 50 Hz under v/f control?
- 7 What modifications can be suggested for improving the power factor of the slip power recovery scheme? Explain the principle of operation of Static Kramer drive.
- 8 With suitable circuit diagrams, discuss in detail the principle of operation of self controlled synchronous motor drive employing a cyclo converter.