Q.P. Code: **16EE4303** **R16**

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
M.Tech I Year I Semester (R16) Regular Examinations January 2017
POWER ELECTRONIC CONTROL OF DC DRIVES
(Power Electronics)
(For Students admitted in 2016 only)

Time: **3 hours** Max. Marks: **60**

(Answer all Five Units **5 X 12 =60** Marks)

UNIT-I

Q.1 a. Sketch the variation of the average output voltage versus firing-angle for (i) semi-converter, (ii) full converter with continuous conduction. 6M

b. For a single-phase, fully controlled bridge rectifier with continuous load current, show that the peak amplitude of the n^{th} harmonic load voltage. Calculate and sketch the amplitudes of harmonics n = 2, 3, 4, 5, 6 when a = 0°, 30°, 60° and 90°. 6M

OR

Q.2. a. Plot comparative curves of the variation of the average load voltage, versus thyristor firing-angle, for the three-phase semi-converter, the full converter and the full converter with freewheel diode 6M

b. A separately excited d.c. motor rated at 50 kW, 300 V, 1000 r.p.m. is supplied with power from a fully controlled, three-phase bridge rectifier. The rectifier is energised from an ideal three-phase supply rated at 225 V, 50 Hz. The motor has an armature resistance of 0.15 ohm. Series inductance is included in the armature circuit to ensure continuous conduction. Speed adjustment is required in the range 700-1000 r.p.m. while delivering rated torque. Calculate the necessary retardation of the firing-angle and the range of current variation. 6M

UNIT-II

Q.3. A three-phase full-wave controlled bridge has a resistive load, R = 100 *ohm.* The three-phase supply 415 V, 50 Hz may be considered ideal. Calculate the average load voltage and the power dissipation at (i) α= 45°, (ii) α = 90°. 12M

OR

Q.4 a. A naturally commutated, three-phase inverter contains six ideal SCRs and transfers energy into a 440 V, 50 Hz, three-phase supply from an 800 V d.c. battery. The battery and the inverter are linked by a smoothing inductor with a resistance of 12.4 ohms. Calculate the power transferred at a = 90°, 120°, 150° and 170°. 6M

b. Sketch the main circuit of a naturally commutated, three-phase, controlled bridge inverter. If the a.c. side r.m.s. line voltage V is fixed, sketch the variation of inverter power transfer with SCR firing-angle α and d.c. side voltage V_{dc}. If α= 120°, what is the minimum value of ratio V_{dc}/V that will permit inversion? 6M

UNIT-III

Q.5	a.	Discuss the effect of harmonics and its associated problems in DC drive	6M
	b.	With the help of schematic diagram, explain the operation of 3 phase controlled drive	6M

OR

Q.6		Obtain the expression of the magnitude of sixth harmonic torque and also write its effects on the armature heating.	12M

UNIT-IV

Q.7.	a.	Draw the gating pulses for each of the four quadrants of operation of the chopper- controlled de motor drive.	6M
	b.	A chopper-controlled de series motor drive is intended for traction application. Calculate its torque-speed characteristics for various duty cycles. The motor details are as follows: 100 hp, 500 V, 1500 rpm, R_a + R_f = 0.01 ohm, L_a+ L_{se} = 0.012 H. M = 0.1 H, J = 3 Kg·m^2, 81 = 0.1 N·m/rad/sec. The chopper has an input source voltage of 650 V and operates at 600 Hz	6M

OR

Q.8	a.	Explain the principle of regenerative brake control of a chopper fed separately excited dc motor.	6M
	b.	Explain the operation of the closed loop speed controlled separately excited dc motor chopper drive	6M

UNIT-V

Q.9	a.	Explain speed feedback speed controller	6M
	b.	Explain current controller and its significance	6M

OR

Q.10		Write short notes on the following	
	a.	Pulse width modulated current controller	6M
	b.	Hysteresis Current controller	6M