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

M.E./M.TECH. DEGREE EXAMINATIONS, MAY/JUNE 2017

SECOND SEMESTER

POWER ELECTRONICS AND DRIVES

PD16201 – SOLID STATE DC DRIVES

(Regulation 2016)

Q. Code: 164196

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

1. Explain constant torque and constant horse power operation of dc motors.
2. Mention the main factors which decide the choice of an electrical drive.
3. List the input supply performance parameters pertaining to phase controlled dc drives.
4. Give the drawbacks of rectifier fed DC Drives.
5. What do you meant by multiphase chopper?
6. Does the source current of a chopper fed DC drive contain harmonics? If so, what is its effect and How can it be prevented?
7. Compare speed loop and current loop.
8. Give advantages of current guided control in drives.
9. Mention the advantages of microcomputer controlled dc drives.
10. What are current sensing circuits?

PART B - (5 X16 = 80 Marks)

11. (a) Explain the Ward-Leonard method of speed control of dc motors. Mention the advantages and disadvantages of this method of speed control. (16)

(OR)

(b) Explain multi quadrant operation of a dc drive. (16)

12. (a) Explain operation of dual converter with and without circulating current mode in detail. Give the comparison of dual converter in both the modes of operation. (16)

(OR)

(b) (i) The speed of a 125hp, 600V, 1800 rpm separately excited dc motor is controlled by a three phase full converter. The converter is operated from a three phase, 480V, 50 Hz supply. The rated armature current of the motor is 165A. The motor parameters are Ra=0.0874Ω, La = 6.5mH and Kaϕ = 0.33V/rpm. The converter and ac supply are considered to be ideal. Find no Load speeds at firing angles $\alpha = 0°$ and $\alpha = 30°$ assume at no load the armature current is 10% of rated current and is continuous. (8)

(ii) Discuss in detail, the principle of operation of a single phase full converter feeding a separately excited DC motor with relevant circuit diagram and waveforms. Assume the motor current is continuous. (8)

13. (a) Discuss in detail, the principle of operation of Type A fed separately excited DC motor. Draw relevant diagrams and waveforms for continuous and discontinuous current mode of operation. Derive the expressions for maximum and minimum values of currents. Derive the expression for per unit ripple current. (16)

(OR)

(b) (i) The speed of a separately excited DC motor is controlled by a step down chopper. DC supply voltage is 120 V, armature circuit resistance Ra=0.5Ω, armature inductance La = 20mH and motor constant Kaϕ = 0.05V/rpm. The motor drives a constant load torque load requiring an average armature current of 20A. Assume current is continuous. Find (a) Range of speed control (b) Range of duty cycle. (10)

(ii) What are the various schemes of control of choppers? How are they employed in control of DC drives? (6)

14. (a) Starting from fundamentals develop the transfer function of a separately excited DC motor. Draw the separately excited DC motor model, its functional block diagram and simplified block diagram. (16)

(OR)

(b) Draw the flow charts for the simulation of (16)

(1) Single quadrant phase controlled DC motor drive.
(2) Chopper controlled DC motor drive.

15. (a) (i) Draw and explain the block schematic of a 4-Quadrant micro-computer controlled dc drive system. Draw and explain a flow chart for the same scheme. (8)

(ii) Explain feedback elements used for speed detection and current sensing in details. (8)

(OR)

(b) (i) List the advantages of phase locked loop control of DC drives. With a block schematic diagram explain the principle of operation of phase locked loop control of DC drive system. (8)

(ii) Draw the circuit diagram and explain the operation of closed loop speed control using field weakening. (8)