Hall Ticket No | | | | | | | | | | | Question Paper Code: BPE001

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Supplementary) - July, 2017

Regulation: IARE–R16

POWER ELECTRONIC CONTROL OF AC DRIVES

(Power Electronics and Electric Drives)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Draw and explain the power circuit of a single phase semi converter feeding a separately excited dc motor. Explain with typical voltage and current waveforms the operation in continuous armature current. **[7M]**

   (b) A 200V, 875RPM, 150A Separately excited DC motor has armature circuit resistance and inductance of 0.06Ω. The motor is controlled by a single phase fully controlled rectifier with source voltage of 220V, 50 Hz. For continuous conduction operation calculate **[7M]**

   i. firing angle for rated motor torque and 750RPM

   ii. firing angle for rated motor torque and -500RPM

2. (a) Draw and explain the power circuit of a single phase fully controlled converter feeding a separately excited dc motor. Explain with typical voltage and current waveforms the operation in discontinuous conduction. **[7M]**

   (b) The speed of a 10HP, 210V, 1000RPM separately excited dc motor is controlled by a single phase full converter. The rated motor armature current is 30 A and armature resistance is 0.25Ω. The ac supply voltage is 230V. The motor voltage constant is $K_a\phi$= 0.172V/RPM. Assume that sufficient inductance is present in the armature circuit to make the motor current continuous and ripple free. For a firing angle $\alpha = 45^0$ and rated motor current determine **[7M]**

   i. The motor torque

   ii. The speed of the motor

UNIT – II

3. (a) Explain the principle of operation of dual converter control of separately excited DC motor in simultaneous current control method. **[7M]**

   (b) A 220V, 750RPM, 200A separately excited DC motor has an armature resistance of 0.05Ω. Armature is fed from a three phase dual converter with circulating current control. The A.C source voltage is 400V(Line). When motor operates in forward motoring converter A works as a rectifier and B as an inverter. Calculate firing angles of converters A & B for the following operating points for the following assuming continuous conduction. **[7M]**

   i. Motoring operation at rated torque and -600RPM

   ii. Regenerative braking operation at rated torque and 600RPM

4. (a) Explain the principle of operation of a three phase full wave controlled bridge rectifier with R-L load and ideal supply with neat circuit diagram and waveforms. **[7M]**

   (b) Discus the principle of operation of a three phase fully controlled converter control of separately excited d.c motor. **[7M]**

UNIT – III

5. Draw the block diagram of a DC motor drive and derive the transfer function of the following sub-systems. **[14M]**

   i. DC motor and load

   ii. Converter

   iii. Current and speed controller

   iv. Current feedback

   v. Speed feedback

6. (a) Draw the block diagram for the closed loop control of the two quadrant DC motor drive with field weakening using a phase controlled converter and explain the speed control below and above the rated speed. **[7M]**

   (b) Explain the control modeling of the three phase fully controlled converter. **[7M]**

UNIT – IV

7. (a) Explain in detail about chopper with regenerative capability with circuit diagram. **[7M]**

   (b) Describe the principle of operation of a two quadrant chopper with neat circuit diagram and necessary waveforms. **[7M]**

8. Explain the methods of hysteresis control and PWM control for controlling current in DC motor drives. **[14M]**

UNIT – V

9. Describe the methods of hysteresis control and PWM control for controlling current in DC motor drives. **[14M]**

10. Draw the flowchart for the dynamic simulation of the chopper controlled dc motor drive and explain the dynamic performance of a chopper controlled separately excited dc motor drive for a step command in speed reference, in normalized units with necessary wave forms. **[14M]**

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