

Code No: 126AJ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech III Year II Semester Examinations, May - 2016****STATIC DRIVES****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) Explain what is meant by rectification mode? [2]
- b) What is the principle of phase control? [3]
- c) What is four quadrant operation? Explain. [2]
- d) Draw the equivalent circuit of dual converter driving a dc motor. [3]
- e) Give three advantages of chopper drives compared to rectifier drives. [2]
- f) What are the two control strategies of dc chopper? [3]
- g) What are the applications of rotor resistance control? [2]
- h) What are the advantages of Kramer drive compared to scherbius drive? [3]
- i) What are the applications of load commutated CSI fed synchronous motor? [2]
- j) Explain briefly about closed loop operation of synchronous motor drive. [3]

**PART - B****(50 Marks)**

- 2.a) Derive the expression for critical speed which separates continuous conduction from discontinuous conduction for a 1- $\Phi$  full converter fed separated excited dc motor.
- b) A 200V, 875 rpm, 150A separately excited dc motor has an armature resistance of 0.06 ohm. It is fed from a single phase fully controlled rectifier with an a.c source voltage of 220V, 50Hz. Assuming continuous conduction mode. Calculate:
  - i) Firing angle for rated motor torque and 750 rpm
  - ii) Firing angle for rated motor torque and 500 rpm
  - iii) Motor speed for a firing angle of  $160^0$  and rated torque. [5+5]

**OR**

- 3.a) Derive the relation between speed and torque of a single phase full wave converter feeding a series excited dc motor for continuous mode of operation and draw its speed-torque characteristics.
- b) Explain the effect of armature inductance on the performance of a d.c drive. [5+5]
- 4.a) Draw the speed torque characteristics for dynamic braking of d.c series motor. Why torque becomes zero at finite speed?
- b) Discuss relative merits and demerits of four quadrant d.c drives employing non-circulating and circulating current dual converters. [5+5]

- 5.a) Draw speed torque characteristic for regenerative braking operation of a d.c shunt motor and explain the operation.  
b) Explain the principle of operation of closed loop control of dc drive using suitable block diagram. [5+5]

- 6.a) Derive the expressions for average motor current, ripple in motor currents and average torque for chopper fed separately excited d.c motor.  
b) A dc chopper is used for regenerative braking of a separately excited d.c motor. The dc supply voltage is 400V. The motor has  $R_a=0.2\Omega$ ,  $K_m=1.2V\cdot S/rad$ . The average armature current during regenerative braking is kept constant at 300A with negligible ripple. For a duty cycle of 60% for a chopper, determine  
i) Power returned to supply  
ii) Minimum and maximum permissible braking speeds and speed during regenerative braking. [5+5]

**OR**

7. Explain in detail the two quadrant and four quadrant operation of chopper fed separately excited DC motor. [10]
- 8.a) Explain plugging operation of 3- $\Phi$  induction motor and also explain how it is implemented using AC voltage controllers.  
b) Explain why stator voltage control is an inefficient method of induction motor speed control. [5+5]

**OR**

- 9.a) Discuss about the different speed control methods of induction motor from rotor side.  
b) Draw a suitable diagram and explain the working of slip power recovery system using static Scherbius drive. [5+5]
10. With suitable circuit diagrams explain the principle of operation of current source inverter fed synchronous motor drive. [10]

**OR**

- 11.a) Explain the operation of a cyclo-converter fed synchronous motor.  
b) Explain the operation of a load commutated CSI fed synchronous motor. [5+5]

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