R15

Code No: 126ZJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech III Year II Semester Examinations, December - 2018
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) Give two methods of improving the power factor of line commutated converter without using forced commutation. [2]
b) Explain what is meant by inversion mode? [3]
c) What is the advantage of regenerative braking over other methods of braking? [2]
d) What are the basic operational aspects and salient features of four quadrant operation? [3]
e) What is chopper? Explain the chopper control of a d.c series motor in motoring mode. [2]
f) What are the drawbacks of rectifier fed dc drives? [3]
g) What are the disadvantages of cyclo converter driving a 3-Φ Induction motor? [2]
h) What is the advantage of rotor resistance control? [3]
i) What is PWM technique? How is it used in synchronous motor speed control? [2]
j) What are the advantages of load commutated CSI fed synchronous motor? [3]

PART - B

(50 Marks)

2.a) Draw the circuit diagram of a single phase semi-converter fed d.c series motor and explain its operation with the help of associated voltage and current waveforms assuming discontinuous conduction.
b) A 210V, 1200rpm, 10A separately excited d.c motor is controlled by a single phase full converter with an a.c source voltage of 230V, 50Hz. Armature resistance is 1.5Ω. Assuming continuous and ripple free armature current
i) What should be the value of the firing angle to get the rated torque at 800rpm?
ii) Compute the firing angle for the rated braking torque at -1200 rpm.
iii) Calculate the motor speed at rated torque and $\alpha=165^0$ for regenerative braking in the second quadrant? [5+5]

OR

3. Draw the circuit diagram and explain the operation of a three-phase full converter fed d.c motor with the help of associated voltage and current waveforms. Also, sketch the speed-torque characteristic. [10]

4.a) Explain in detail the four quadrant operation of a d.c motor using dual converters.

b) Discuss relative merits and demerits of four quadrant d.c drives employing non-circulating and circulating current dual converters. [5+5]

OR

5.a) What are the advantages of electric braking over mechanical braking of dc motors?

b) Explain with suitable circuit diagram, speed-torque characteristics of dc motor under regenerative braking, for the following types:
i) Separately excited dc motor
ii) Dc series motor. [4+6]

6.a) A 230V, 1200rpm, 15A separately excited motor has an armature resistance of 1.2Ω. Motor is operated under dynamic braking with chopper control. Braking resistance has a value of 20Ω.
i) Calculate duty ratio of chopper for motor speed of 1000rpm and braking torque equal to 1.5 times rated motor torque.
ii) What will be the motor speed for duty ratio of 0.5 and motor torque equal to its rated torque?

b) Draw the circuit diagram and explain the operation of chopper fed d.c shunt motor with the help of speed-torque characteristics. [5+5]

OR

7.a) Describe regenerative braking of a chopper fed separately excited dc motor with circuit diagram and relevant waveforms.

b) Draw the block diagram of a closed loop chopper fed dc drive and explain its operation? [5+5]

8.a) Describe stator voltage control technique using AC voltage controller for the speed control of a 3-Φ induction motor.

b) Why stator voltage control is suitable for speed control of induction motor in fan and pump drives? [5+5]

OR

9. Explain in detail about static scherbius drive and static Kramer drive. [10]

10.a) Describe VSI fed synchronous motor drive in detail with a suitable block diagram.

b) A 3 phase, 230V, 60 Hz, 40 KW, 8 pole star connected salient pole synchronous motor has Xd =2.5Ω and Xq =0.4Ω. The armature resistance is negligible. If the motor operates with an input power of 25KW at a leading p.f of 0.86. Determine,
i) The torque angle ii) The torque Td. [5+5]

OR

11.a) Explain briefly about closed loop operation of synchronous motor drive.

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

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