

Code No: 126A1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, May - 2017

**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) | Draw the circuit symbol of thyristor and mark its terminals.        | [2] |
| b)   | What is a freewheeling diode? What is its purpose?                  | [3] |
| c)   | What are four quadrants of an electric drive?                       | [2] |
| d)   | Mention the advantages of electric braking over mechanical braking. | [3] |
| e)   | What are the applications of four quadrant choppers?                | [2] |
| f)   | Explain basic principle of a chopper.                               | [3] |
| g)   | What is slip power?   | [2] |
| h)   | Compare between VSI and CSI.  | [3] |
| i)   | What is a damper winding? What is its need?                         | [2] |
| j)   | What are the advantages of self controlled synchronous motor drive? | [3] |

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

2. A 220 V, 1500 rpm, 11.6 A D.C separately excited motor is controlled by a 1-phase fully controlled rectifier with an ac source voltage of 230 V, 50 Hz. Enough filter inductance is added to ensure continuous conduction for any torque greater than 25 percent of rated torque,  $R_a = 2\Omega$ .
- What should be the value of the firing angle to get the rated torque at 1000 rpm?
  - Calculate the firing angle for the rated braking torque and -1500 rpm.
  - Calculate the motor speed at the rated torque and  $\alpha = 160^\circ$  for the regenerative braking in the second quadrant. [10]

**OR**

- Compare between semi converters and fully controlled converters.
- What are the advantages of three-phase converters over single phase converters?
- Write the speed and torque expressions for single phase fully controlled converter fed separately excited DC motor. [3+3+4]

4. With a neat block diagram, explain the closed loop control of DC motor drive. [10]

**OR**

- What is regenerative braking? Explain regenerating braking of DC motors. Also mention its advantages.
- What are dual converters? Discuss its principle. Also mention their applications. [5+5]

- 6.a) What are different choppers? Explain the time ratio control of choppers.  
b) A 220V, 24A, 100 rpm separately excited DC motor has an armature resistance of  $2\Omega$ . Motor is controlled by a chopper with frequency of 500 Hz and source voltage of 230V. Calculate the duty ratio for 1.2 times rated torque and 500 rpm. [5+5]

OR

7. A 230V, 960 rpm, 200A separately excited DC motor has an armature resistance of  $0.02\Omega$ . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230V. Assume continuous conduction.  
a) Calculate the duty ratio of the chopper for motoring operation at rated torque and 350 rpm  
b) Calculate the duty ratio of the chopper for braking operation at rated torque and 350 rpm  
c) If the maximum duty ratio of the chopper is limited to 0.95 and maximum permissible motor current is twice the rated, calculate maximum permissible motor speed obtainable without field weakening and power fed to the source.  
d) If the motor field is also controlled in (c), calculate field current as a function of its rated value for a speed of 1200 rpm [2+2+3+3]

8. What are ac voltage controllers? Explain the speed control of three-phase induction motors using ac voltage controllers. Also draw the speed-torque characteristics. [10]

OR

- 9.a) What is a PWM inverter? Explain its operation.  
b) With a neat block diagram, explain the closed loop control of PWM inverter fed three-phase induction motor drive. [5+5]

- 10.a) Compare between self control and separate control of synchronous motor drive.  
b) With a neat block diagram, explain the separate control of synchronous motor drive. Also mention its applications. [5+5]

OR

- 11.a) List and explain various applications of load commutated CSI fed synchronous motor.  
b) Explain the operation of Load commutated CSI fed Synchronous Motor. [5+5]

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