

R15

Code No: 126ZJ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, April - 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) Which drives are best suitable for electric traction purpose and why? [2]
- b) Which converters are suitable for four quadrant operations of D.C. motor? [3]
- c) Indicate reverse and regenerative braking in 4 quadrants of operation of dc motor with neat diagram? [2]
- d) List out the advantage of having closed loop over open loop operation of dc drive. [3]
- e) What are the advantages of continuous operation over discontinuous operation of chopper drive? [2]
- f) Draw 1-quadrant chopper and indicate the equations used in it. [3]
- g) What are the advantages of VSI over CSI? [2]
- h) What do you understand from the term slip power recovery? What is its significance in induction motors? [3]
- i) What is the basic difference between true synchronous mode and self controlled mode for variable frequency control of synchronous motor? [2]
- j) Justify how synchronous motor drive in self-control mode is treated as brush-less, commutator less d.c. motor? [3]

PART - B
(50 Marks)

- 2.a) A separately excited dc motor is fed from a single-phase fully controlled converter. Derive an expression for average speed when it is operated in continuous current mode (CCM)?
- b) A 220 V, 100 A d.c. series motor has armature resistance and inductance of 0.04 ohm and 2 mH, and field winding resistance and inductance of 0.06 ohm and 18 mH, respectively, Running on no load as a separately excited generator at 1000 rpm it gave following results:

| | | | | | | | |
|---------------------|------|-----|-------|-----|-------|-----|-------|
| Field current, A | 25 | 50 | 75 | 100 | 125 | 150 | 175 |
| Terminal voltage, V | 66.5 | 124 | 158.5 | 181 | 198.5 | 211 | 221.5 |

 Calculate and plot the speed torque and speed - current curves of this motor for firing angles of 60° and 120° when fed by a single-phase half-controlled rectifier with an ac source voltage of 230V, 50 Hz. [5+5]

OR

- 3.a) Explain the operation of dc series motor fed from three phase semi converter with neat diagrams?
- b) Draw and explain the operation of dc separately excited motor fed 3- ϕ fully controlled rectifier with necessary sketches. [5+5]

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- 4.a) Draw the speed - torque characteristic for regenerative braking operation of a d.c. series motor. Why is dc series motor best suited for electrical traction application, Explain?
b) A 230 Volts, 960 rpm and 200 Amps d.c. separately excited motor has an armature resistance of 0.02 ohm. It is driving an overhauling load whose torque may vary from zero to rated motor torque. Field flux can be changed and field saturates at 1.2 times the rated flux. Calculate the speed range in which motor can hold the load by regenerative braking without exceeding twice the motor current? [5+5]

OR

- 5.a) Where do you find four quadrant operation of dc motor drive? Describe the role of dual converters?
b) Classify dual converters and describe them in brief with neat diagrams. [5+5]
6.a) List the advantages of chopper drives when compared to phase controlled rectifier drives? Describe Class B chopper with neat circuit diagram?

- b) A 220V, 300 A dc series motor has combined resistance of armature and field of 0.04 Ω Running on no load as a generator with field winding connected to a separate source it gave following magnetization characteristic at 600 rpm.
Field Current, A 50 100 150 250 300 350
Terminal voltage, V 66 124 158.5 198.5 211 221.5
Motor is controlled by a chopper from source voltage of 220 V. Calculate the motor speed for a duty ratio of 0.8 and motor current of 300 A? [5+5]

OR

- 7.a) Explain the closed loop speed control of a chopper d.c. motor drive with necessity diagrams.
b) Distinguish clearly between voltage commutation and current commutation used in choppers. [5+5]

- 8.a) Describe cyclo-converter fed induction motor drive? What are its limitations when compared to VSI drive?
b) A 2.8 KW, 400 V, 50 HZ, 4 pole, 1370 rpm delta connected squirrel - cage induction motor has following parameters referred to the stator: $R_s = 2 \Omega$; $R'_r = 5 \Omega$; $X_s = X'_r = 5 \Omega$; $X_m = 80 \Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed and at rated voltage. Calculate motor terminal voltage, current and torque at 1200 rpm. [5+5]

OR

- 9.a) "Addition line side converter is not required for regenerating braking of CSI fed induction motor", if so, describe with appropriate diagrams.
b) Explain the functioning of Static Scherbius Drive in detail with necessary diagram and draw its performance characteristics. [5+5]

- 10.a) "Over excited synchronous motor under lightly or no-load condition behaves as synchronous capacitor" if-so, describe? Explain the operation of separately controlled synchronous motor drive.
b) Explain the closed loop control of synchronous motor drive with block diagram. [5+5]

OR

- 11.a) What do you understand from the term load commutation? Describe the load commutated synchronous motor drive.
b) Describe the methods available for speed control of synchronous motor. [5+5]

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