Code No: 126AJ **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2019
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 few applications of single phase controlled rectifier fed d.c. series motor. [2]
b) What is Constant torque and constant power modes of dc motor? [3]
c) Indicate two quadrant of operation of dc motor with neat diagram? [2]
d) Distinguish between closed loop and open loop operation of dc drive. [3]
e) What are the advantages of continuous operation over discontinuous operation of chopper drive? [2]
f) Draw 2-quadrant chopper and indicate which two quadrants are possible with that chopper. [3]
g) Distinguish between VSI and CSI. [2]
h) What do you understand from the term slip and slip power? What is its significance in induction motors. [3]
i) "CSI fed synchronous motor as a load commutated drive", Justify your answer. [2]
j) Is the synchronous motor self starting? If so, what is the role of damper windings in synchronous motor? [3]

PART - B

(50 Marks)

2.a) A self excited dc series 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 230 Volts, 650 rpm, 100 Amps separately excited dc motor has armature circuit resistance and inductance of 0.08 Ω and 8 mH respectively. Motor is controlled by a single phase half controlled rectifier with source voltage of 230V, 50 Hz. Identify the modes and calculate speeds for
(i) $\alpha = 60^0$ and torque = 1000 N-m; (ii) $\alpha = 120^0$ and torque = 1000 N-m. [5+5]

OR

3.a) Explain the operation of dc separately excited motor fed from three phase half controlled rectifier with neat diagrams?
b) A 220 V, 1500 rpm, 50 A separately excited dc motor with armature resistance of 0.5 ohm is fed from a three phase fully controlled rectifier. Available ac source has a line voltage of 440 V, 50 Hz. A star - delta connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero. Determine the value of firing angle when (i) Motor is running at 1200 rpm and rated torque. (ii) When motor is running at 800 rpm and twice the rated torque? Assume continuous conduction mode of operation. [5+5]

4.a) Draw the speed - torque characteristic for dynamic braking operation of a d.c. series motor. Why does torque become zero at infinite speed? Explain.

b) Describe how four quadrant operation of dc motor drive takes place with dual converters. [5+5]

OR

5.a) Describe the forward motoring of four-quadrant converter operation both in simultaneous and non-simultaneous control modes.

b) Write short note on: [5+5]

i) Plugging and ii) Regenerative braking

6.a) List the advantages of chopper drives when compared to phase controlled rectifier drives. Describe Class A single quadrant 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) It is required to control the speed of a separately excited d.c. motor both in the forward and reverse direction by using suitable controlled rectifier automatically. With an appropriate block schematic, explain how the above objective can be achieved.

b) Describe closed loop speed control operation of a chopper fed d.c. motor drive with appropriate block diagram. [5+5]

8.a) Distinguish between VSI and CSI with respect to regenerative braking operation.

b) What do you understand from the term slip power recovery? Describe in detail about Static Scherbius drive and its advantages. Draw the necessary diagrams with neat sketch. [5+5]

OR

9.a) Draw the per phase equivalent circuit of an induction motor and there from write expression for slip at maximum torque and T max.

b) Explain the functioning of Static Kramer Drive in detail with necessary diagram and draw its performance characteristics. [5+5]

10.a) Explain the operation of self controlled VSI fed synchronous motor drive.

b) Explain the closed loop control of synchronous motor drive with block diagram. [5+5]

OR

11.a) "Synchronous motor drive in self-control mode is treated as brush-less, commutator less d.c. motor", Justify your answer.

b) Describe in brief about the operation of a cyclo-converter driven synchronous motor with neat diagrams and characteristics. [5+5]

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