Code No: 137FW **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, July/August - 2023
POWER SEMICONDUCTOR DRIVES
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) What are the advantages of electrical drives? [2]
b) Explain briefly the speed control techniques of dc motors. [3]
c) List the differences between circulating and non circulating current dual converters. [2]
d) Give the advantages of chopper fed dc drives. [3]
e) Draw the block diagram of closed loop operation of induction motor drives. [2]
f) Compare VSI and CSI speed control of Induction motor. [3]
g) What are the disadvantages of rotor resistance control in Induction motor? [2]
h) Define slip power recovery scheme with suitable mathematical equations. [3]
i) Why a self controlled synchronous motor is free from hunting oscillations? [2]
j) Explain true synchronous mode operation of synchronous motor drive. [3]

PART – B

(50 Marks)

2.a) With neat sketch and necessary waveforms explain how continuous current operation is obtained with single phase full controlled converter fed to D.C series drive. Also derive output current and voltage expressions.
b) Draw the output voltage of 3-Φ full bridge converter for a firing angle of 120 degrees considering DC motor as load? Assume continuous ripple free load current. [5+5]

OR

3.a) Explain various relative operational merits and demerits of single phase semi and fully controlled converters fed to DC motors.
b) Explain the principle of working of a single phase half wave controlled rectifier feeding a separately excited dc shunt motor. Draw the output waveforms. [4+6]

4. What is a Chopper? Explain the Chopper control of a D.C series motor in Regenerative braking mode and also draw the Speed-Torque Curves in each mode. [10]

OR

5.a) A dc series motor is fed from 600 V dc source through a chopper. The dc motor has the following parameters.
Armature resistance is 0.04 ohm, series field resistance is 0.06 ohm,
$K = 4 \times 10^{-3}$ Nm/amp^2, the average armature current of 300 A is ripple free. For a chopper duty cycle of 60 %, determine
i) Input power from the source
ii) Motor speed, iii) Motor torque
b) Distinguish between class A and class B choppers with suitable examples of speed control of motors. [5+5]

6. Why the terminal voltage is maintained constant, when Induction motor is operated above base speed. Draw relevant speed torque characteristics. [10]

OR

7. Discuss in detail how the variable frequency control of an Induction motor can be achieved using voltage source Inverter. Mention the various advantages of the above method.[10]

8.a) Draw and explain a closed loop operation for a static Kramer controlled drive.

b) Explain the speed torque characteristics of three phase induction motor using static rotor resistance control. [5+5]

OR

9.a) Compare the performance of static scherbius drive & static kramer drive.

b) A 3 phase, 4 pole, 50 Hz Induction motor has rotor resistance of 0.2 ohm and stand still reactance of 0.1 ohm. At full load it operates at a slip of 4%. If the voltage is reduced to 50 %, at what speed will the motor operate with full load torque applied? [6+4]

10. Explain the principle of operation of self control of synchronous motor fed from VSI.[10]

OR

11. What are the methods of variable frequency control of a 3-phase synchronous motor? Discuss the role of a damper winding in a synchronous motor. [10]

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