

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI EXAMINATION – SUMMER 2025

Subject Code: 3160919

Date: 30-05-2025

Subject Name: Electric Drives

Time: 10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1** (a) Derive torque equation of DC motor. **03**
(b) Explain the principal of motoring and regenerative braking mode of DC motor. **04**
(c) Discuss the block diagram of close loop DC drive with current limit control. **07**
- Q.2** (a) Draw and explain different types of load torque speed characteristics. **03**
(b) Draw torque speed characteristic of DC shunt motor and explain how change in armature voltage will change in speed of motor **04**
(c) Derive the output voltage equation of step-down chopper fed DC drive and explain the operation with necessary diagram and waveforms. **07**
- OR**
- (c) Discuss the operation of Class E chopper fed DC drive with necessary diagram and waveforms. **07**
- Q.3** (a) Explain current controller specification for chopper-based speed control of separately excited DC motor. **03**
(b) Based on the block diagram of close loop control of DC drives, derive the transfer function. **04**
(c) Explain the feature of PWM inverter fed Induction motor drive. **07**
- OR**
- Q.3** (a) Draw only block diagram of close loop armature control with field flux weakening. **03**
(b) Give of comparison between converter fed dc drives and chopper fed dc drives. **04**
(c) Explain the types of output voltage control methods with the help of chopper. **07**
- Q.4** (a) How torque speed characteristic of induction motor will be modified with change in rotor resistance. **03**
(b) What is slip speed control of induction motor drives? **04**
(c) Derive the torque equation from equivalent circuit of three phase induction motor. **07**
- OR**
- Q.4** (a) What is above base speed and below base speed operation of the motor? **03**
(b) What is slip power? What are the different methods used for control the slip power? **04**
(c) Discuss principle of constant flux operation of induction motor in detail with necessary equation and diagram. **07**
- Q.5** (a) Compare all the PWM technique for voltage source inverter. **03**
(b) Draw and discuss motor characteristics for constant torque and flux weakening region. **04**
(c) Draw the neat circuit diagram and explain the speed control of 3 phase induction motor by static scherbius system. **07**

OR

- Q.5** (a) Explain three regions of torque speed characteristic of induction motor based on slip. **03**
- (b) How torque speed characteristic of induction motor will be modified with (i) change in applied voltage (ii) change in applied frequency **04**
- (c) Discuss the operation of 3 phase AC voltage controller driven induction motor drive with necessary diagram and waveforms. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2024****Subject Code:3160919****Date:24-05-2024****Subject Name:Electric Drives****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Define electric drive and give the classification of electric drive.	03
	(b) Why current sensing is required in electrical drives? Enlist common methods of current sensing.	04
	(c) Explain the multi quadrant operation of electrical drives with suitable conventions and example.	07
Q.2	(a) Briefly explain the steady state analysis of electrical drive.	03
	(b) Explain principle of operation of chopper.	04
	(c) A 5 KW, 220 V shunt motor has an armature resistance of 0.5 Ω and a field resistance of 220 Ω . At no load motor runs at 1000 rpm and draws a current of 5 A. At full load and rated voltage, the current drawn is 15 A and armature reaction caused a drop of 2 % in flux. Calculate: (1) Full load speed (2) Full load torque.	07
OR		
	(c) A 200 V dc series motor resistance is 0.5 Ω . motor runs at 800 rpm when operating at its full load current of 10 A and magnetic circuit can be assumed unsaturated. what will be the speed if (1) load torque is increased by 50 % (2) Motor current is 5 A.	07
Q.3	(a) Enlist method employed for speed control of DC series motor.	03
	(b) State & explain the important features of various braking methods of dc motors.	04
	(c) Explain the dynamic model of dc drive in detail.	07
OR		
Q.3	(a) Enlist method employed for speed control of DC shunt motor.	03
	(b) Explain position control of DC motor.	04
	(c) Derive the expression for average motor current, RMS motor current, torque and average motor voltage for chopper fed d.c. series motor.	07
Q.4	(a) Write down advantages of v/f control other scalar control techniques.	03
	(b) Explain different effect of harmonics on induction motor drive.	04
	(c) Explain constant air gap flux control scheme for induction motor drives.	07
OR		
Q.4	(a) Compare VSI fed Induction motor drive with CSI fed induction motor drive.	03

- (b) For Variable frequency control of induction motor explain the following point **04**
1. For speed below base speed, why (v/f) ratio is maintained constant?
For speed above base speed, why terminal voltage is maintained constant?
- (c) Explain closed loop speed control of induction motor using slip control scheme. **07**
- Q.5** (a) Write down advantages of squirrel-cage induction motor over dc motors. **03**
(b) State & explain briefly different methods of speed sensing. **04**
(c) Explain how static rotor resistance control is achieved during starting of induction motor. **07**

OR

- Q.5** (a) Discriminate the constant torque and constant power region from torque speed characteristics of 3 phase induction motor. **03**
(b) Explain space vector modulation technique. **04**
(c) Explain any one slip power recovery scheme for slip ring induction motor. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2023****Subject Code:3160919****Date:14-07-2023****Subject Name:Electric Drives****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Draw torque speed characteristic of separately excited dc motor. Explain how change in armature voltage will cause change in speed of motor.	03
	(b) Compare working of conventional speed control methods with converter based speed control of DC motor on the basis of (i) Range of speed (ii) Efficiency of operation (iii) Possibility of automation (iv) Requirement of space	04
	(c) Draw torque speed characteristic of induction motor. Draw and Explain how torque speed characteristic will be modified with (i) change in applied voltage (ii) change in applied frequency	07
Q.2	(a) Explain operation of step down chopper with duty ratio control.	03
	(b) Explain smooth starting of converter based operation of DC motor.	04
	(c) Explain losses occurring in DC drive with one quadrant chopper. Discuss how losses will change if four quadrant chopper is used in drive as compared to operation with one quadrant chopper.	07
OR		
	(c) Derive the equation of armature current for discontinuous mode of operation of chopper based drive for separately excited DC motor.	07
Q.3	(a) Explain current controller specification for chopper based speed control of separately excited DC motor.	03
	(b) Explain operation of induction motor with flux weakening.	04
	(c) Explain a 4 quadrant chopper circuit suitable for 4 quadrant operation of DC motor.	07
OR		
Q.3	(a) Explain speed controller specification for chopper based speed control of separately excited DC motor.	03
	(b) Explain characteristic of fan and pump load driven by induction motor.	04
	(c) What is regenerative braking? Explain regenerative braking of separately excited DC motor operated with 4 quadrant chopper.	07
Q.4	(a) Draw equivalent circuit of induction motor with proper nomenclature.	03
	(b) Explain sinusoidal pulse width modulation for inverter.	04
	(c) Derive transfer function of DC motor using dynamic modeling.	07
OR		

- Q.4** (a) List advantages of scalar control of induction motor. **03**
(b) Explain generation of basic vectors for space vector modulation. **04**
(c) Draw block diagram of chopper based DC drive with closed loop operation with speed control and current control. Explain working of each block. **07**
- Q.5** (a) Draw and Explain how torque speed characteristic of induction motor will be changed with change in rotor resistance. **03**
(b) Explain V/f control of induction motor. **04**
(c) Schematize closed loop control of induction motor based on slip power recovery and explain the schematic. **07**
- OR**
- Q.5** (a) Compare ac drive and dc drive on the basis of (i) converter used (ii) self start (iii) quantity to be varied for speed control **03**
(b) Draw and Explain how torque speed characteristic of induction motor will be modified with change in voltage and frequency. **04**
(c) Schematize closed loop V/F control of induction motor and explain the schematic **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – SUMMER 2022****Subject Code:3160919****Date:10/06/2022****Subject Name:Electric Drives****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- | | | | |
|------------|-----|---|-----------|
| Q.1 | (a) | Draw speed torque characteristic of DC separately excited, shunt and series motor with proper labeling. | 03 |
| | (b) | Enlist methods for speed control of DC motor. Explain any one in brief. | 04 |
| | (c) | Describe four quadrant operation of a dc motor. | 07 |
| Q.2 | (a) | Give of comparison between converter fed dc drives and chopper fed dc drives. | 03 |
| | (b) | Explain dynamic model of DC motor drive. | 04 |
| | (c) | Explain chopper controlled DC shunt motor drive operation for motoring mode and regenerative mode. | 07 |
| OR | | | |
| | (c) | A dc chopper is used for regenerative braking of a separately excited dc motor. The dc supply voltage is 400 V. The motor has $r_a=0.2 \Omega$, $k_m=1.2V\text{-s/rad}$. The average armature current during regenerative braking is kept constant at 300 A with negligible ripple. For a duty cycle of 60% for a chopper, determine: (a) power returned to the dc supply (b) equivalent load resistance of motor acting as a generator (c) minimum and maximum permissible braking speeds and (d) speed during regenerative braking. | 07 |
| Q.3 | (a) | Draw the circuit and waveform of 1- ϕ dual converter drive for the speed control of separately excited dc motor. | 03 |
| | (b) | Explain the closed loop speed control technique for DC motor. | 04 |
| | (c) | Discuss chopper controlled Separately excited DC motor drive operation for motoring mode. | 07 |
| OR | | | |
| Q.3 | (a) | Define the principle of vector control. | 03 |
| | (b) | Compare DC Drive with AC Drive. | 04 |
| | (c) | Explain closed loop speed control of induction motor using slip control scheme. | 07 |
| Q.4 | (a) | Discuss the points to be considered while selecting carrier frequency for inverter. | 03 |
| | (b) | Compare VSI with CSI fed induction motor drives. | 04 |
| | (c) | Draw and explain block diagram of CSI variable frequency drive with current control. | 07 |

OR

- Q.4** (a) List advantages of V/f control over scalar control. **03**
(b) Discuss effect of various harmonic torques of VSI based induction motor drive. **04**
(c) Explain the feature of PWM inverter fed Induction motor drive. **07**
- Q.5** (a) Explain the effect of non-sinusoidal supply on VSI. **03**
(b) Explain stator voltage control of induction motor. **04**
(c) Explain constant air gap flux control scheme for induction motor drives. **07**

OR

- Q.5** (a) Explain operation of doubly fed induction machine in sub synchronous mode. **03**
(b) Compare scalar control and vector control. **04**
(c) Apply the slip recovery scheme for speed controlling of induction motor drive. **07**
