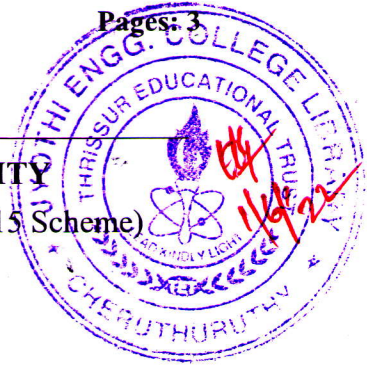


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Sixth Semester B.Tech Degree (S,FE) Examination May 2022 (2015 Scheme)

**Course Code: EE308****Course Name: Electric Drives**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 5 marks.*

Marks

- | | | |
|---|---|-----|
| 1 | Write down the fundamental torque equation of an electric drive system. What are the different components of load torque? | (5) |
| 2 | Draw the circuit diagram of a single phase semi-controlled rectifier fed separately-excited DC motor drive. In which all quadrants can the drive operate? | (5) |
| 3 | What is meant by regenerative braking? How regenerative braking is achieved with a chopper fed DC drive? | (5) |
| 4 | What are the benefits of keeping the value of V/f ratio constant while controlling the speed of an induction motor? | (5) |
| 5 | Draw the circuit diagram of a Current Source Inverter (CSI) fed induction motor and list any two advantages of CSI over Voltage Source Inverter (VSI). | (5) |
| 6 | What is meant by vector control of AC motor? | (5) |
| 7 | List down the salient features of "True Synchronous Mode" of operation of Synchronous Motor. | (5) |
| 8 | Why a "self controlled" synchronous motor is free from hunting oscillations? | (5) |

PART B*Answer any two full questions, each carries 10 marks.*

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|---|--|-----|
| 9 | a) Explain the concept of steady state stability of an electric drive system? | (5) |
| | b) A 200 V, 30 A, 1000 rpm, Separately excited DC Motor has an armature resistance of 0.3 Ω . The speed of the motor is controlled using Armature-Voltage Control technique, employing a single-phase fully controlled rectifier fed from 230 V, 50 Hz AC Source. Assume continuous conduction mode of operation. Calculate the firing angle for load torque of 40 Nm at rated speed. | (5) |

- 10 a) Derive the condition for steady state stability of a motor-drive system (5)
- b) With neat circuit diagram compare the two modes of operation of dual converter fed DC drive. (5)
- 11 a) How is closed loop speed control achieved in an electric drive system? (5)
- b) A 200 V, 30 A, 1000 rpm, Separately excited DC Motor has an armature resistance of 0.3Ω and field resistance of 300Ω . Rated field voltage is 200 V. The speed of the motor is controlled using Field Voltage Control technique, employing a single-phase fully controlled rectifier fed from 230 V, 50 Hz AC Source. Assume continuous conduction mode of operation. Calculate the firing angle of the converter for rated load at 1400 rpm. (5)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) With neat circuit diagram and waveforms, explain the working of a step up cyclo-converter. (5)
- b) What is meant by stator voltage control? How stator voltage control is employed in three phase induction motor? (5)
- 13 a) A 230 V, 960 rpm, 200 A separately excited DC motor has armature resistance of 0.02Ω . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction. Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm. (5)
- b) Why does Kramer drive has a low range of speed control? (5)
- 14 a) A 230 V, 90 A, 500 rpm. separately excited DC motor has an armature resistance of 0.15Ω . The motor is controlled by a class-C chopper operating with a source voltage of 230 V and a frequency of 400 Hz. Calculate the motor speed for a braking operation at a duty ratio of 0.4 and half the rated torque. (5)
- b) Derive the condition for maximum torque of an induction motor. Also derive the value of the maximum torque the machine can develop. (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Draw the circuit diagram of a voltage source inverter fed induction motor drive and explain its working. (5)

- b) What is meant by margin angle control? List the advantages of margin angle control. (5)
- 16 a) Explain how a voltage source inverter fed induction motor is operated in dynamic braking and regenerative braking. (5)
- b) Draw the block diagram of microcontroller based permanent magnet synchronous motor. (5)
- 17 a) A space vector, at a given time instant is given by $V_{abc} = 7.07 - 9.66 a + 2.59 a^2$, (5)
where "a" is the phasor rotation operator, given by $a = e^{j(2\pi/3)}$.
Transform the given space vector into a stationary, orthogonal reference frame and express the space vector in the new reference frame. Specify the transformation matrix used.
- b) Explain the operation of a self-controlled synchronous motor drive using load commuted thyristor inverter. (5)
