

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (R,S) Examination November 2025 (2019 Scheme).

Course Code: EET413**Course Name: ELECTRIC DRIVES****Max. Marks: 100****Duration: 3 Hours****PART A***Answer all questions, each carries 3 marks.*

Marks

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| 1 | A DC motor is used to drive a textile mill, the supply available is single phase AC supply. Draw the block diagram representation of this drive system. | (3) |
| 2 | A drive has following torque equations
Motor torque, $T_m = 100 - 0.15X$ N-m and Passive load torque, $T_L = 0.05X$ N-m where X is speed in rpm. Find the steady state speed of the motor. | (3) |
| 3 | Draw the armature voltage waveform of a fully controlled rectifier fed separately excited DC motor working in motoring mode (continuous conduction). | (3) |
| 4 | Explain the method of speed control suitable for getting speeds higher than base speed in a dc motor? | (3) |
| 5 | Describe the operation of first quadrant chopper fed separately excited DC motor drive. | (3) |
| 6 | A 230V, 1100rpm, 220A separately excited DC motor has an 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 230V. Assuming continuous conduction, calculate the duty ratio of chopper for braking mode at rated torque and 400rpm. | (3) |
| 7 | What you understood by Rotor chopper speed control. | (3) |
| 8 | A 6 pole, three-phase, 50Hz induction motor is having maximum torque at slip=0.1, what is the maximum range of speed in rpm if voltage and frequency remains at rated value? | (3) |
| 9 | What is Clarke Transformation? | (3) |
| 10 | Explain v/f control of Synchronous motor drive. | (3) |

PART B*Answer any one full question from each module, each carry 14 marks.*

Module I

- 11 a) Explain the four-quadrant operation of an electric drive, considering hoist as an example. (10)
- b) Discuss about the steady state stability of an electric drive. (4)

OR

- 12 a) Describe various components of load torques with reference to electric drive. (7)
- b) Derive the expression for equivalent value of moment of inertia and load torque of an electric drive which has loads with rotational motion. (7)

Module II

- 13 a) Explain the operation of half controlled rectifier fed separately excited DC motor drive. (7)
- b) A 220V, 1500rpm, 50A separately excited DC motor with armature resistance of 0.5Ω is fed from a 3-phase fully controlled rectifier (continuous conduction mode). Available AC source has a line voltage of 440V, 50Hz. 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 value of firing angle when i) the motor is running at 1200rpm and rated torque and ii) the motor is running at -800rpm and twice the rated torque. (7)

OR

- 14 a) Describe the operation of dual converter fed separately excited DC motor in circulating and non-circulating current mode. (14)

Module III

- 15 a) DC series motor is controlled from a two-quadrant chopper, explain its operation with relevant circuit diagram and waveforms. (7)
- b) Discuss the operation of four quadrant chopper fed separately excited DC motor drive. (7)

OR

- 16 a) Separately excited DC motor needs to operate in below and above base speed, explain its closed loop speed control with suitable block diagram. (7)
- b) The source voltage of 230V is applied to a 230V, 960rpm, 200A separately excited DC motor with an armature resistance of 0.02Ω through a chopper which provides both motoring and braking operation. The maximum duty ratio of chopper in braking mode is limited to 0.95 and maximum permissible motor current is twice (7)

the rated value. Calculate maximum permissible motor speed obtained without field weakening and power fed to the source.

Module IV

- 17 a) Explain the operation of Static Kramer Drive. (7)
b) Discuss the operation of Voltage Source Inverter (VSI) fed Induction motor drive. (7)

OR

- 18 a) Explain the operation of three phase AC voltage controller fed induction motor drive. (7)
b) With the relevant equations and torque speed characteristics, explain the v/f control of induction machine. (7)

Module V

- 19 With block diagram and equations, explain Field Oriented Control (Vector Control) of induction motor drives. (14)

OR

- 20 a) Explain the operation of Voltage Source Inverter (VSI) fed Synchronous Motor Drive working in True Synchronous mode. (7)
b) Describe Self-controlled synchronous motor drive employing a load commutated thyristor inverter. (7)
