Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Regular and Supplementary Examination December 2023 (2019 Scheme)

Course Code: EET413

Course Name: ELECTRIC DRIVES

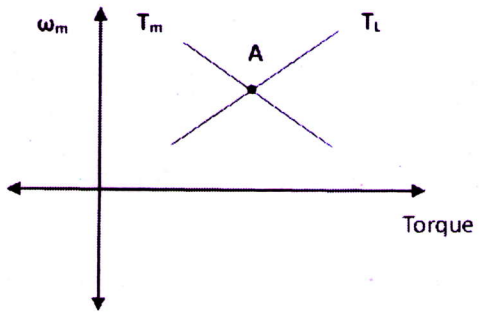
Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carry 3 marks. Marks

1 Draw the torque-speed curve of (a) High speed hoist (b) Traction drive (3)

2 Determine the stability of the following drive system. (3)



3 Can a half-controlled rectifier fed separately excited DC drive operate in quadrant IV? Justify your answer. (3)

4 Draw the armature voltage waveform of single-phase half-controlled rectifier fed separately excited DC motor for motoring mode. (3)

5 Explain the operation of chopper fed separately excited DC motor drive working in regenerative braking mode. (3)

6 A 230V, 960rpm, 200A separately excited DC motor has an armature resistance of 0.02Ω. The motor is fed from a chopper and source voltage is 230V. Assuming continuous conduction, calculate duty ratio of chopper for motoring operation at rated torque and 350rpm. (3)

7 What you mean by v/f control of Induction motors. (3)

8 What is the principle of operation of slip power recovery scheme. (3)

9 What is Parks Transformation. (3)

10 Give the advantages of self-controlled mode of operation of synchronous motor drive. (3)

PART B

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

Module I

11 a) Explain with block diagram, the various components of an Electric Drive. (10)

b) Discuss about the components of load torque. (4)

OR

12 a) Derive the torque equation of an electric drive. What is the condition to work the drive at equilibrium point? (6)

b) A motor drives two loads. One has rotational motion. It is coupled to the motor through a reduction gear with a=0.1 and efficiency of 90%. The load has a moment of inertia of 10k-m^2 and a torque of 10Nm. Other load has translational motion and consists of 1000 kg weight to be lifted up at an uniform speed of 1.5m/s. Coupling between this load and the motor has an efficiency of 85%. Motor has inertia of 0.2 kg-m^2 and runs at a constant speed of 1420rpm. Determine equivalent inertia and torque referred to the motor shaft. Also draw the arrangement of the above system. (8)

Module II

13 a) Select a suitable single-phase rectifier to operate the separately excited DC motor drive in motoring and braking mode. Explain with relevant circuit diagram and waveforms for continuous mode of operation. (7)

b) A 220V, 1200rpm, 20A separately excited DC motor is fed from a single phase fully controlled rectifier with an AC source voltage of 230V, 50Hz. Armature resistance is 5Ω. Assuming continuous conduction, Calculate firing angle for (7)

i) Half the rated motor torque and 500rpm, ii) Rated motor torque and (-800) rpm.

OR

14 Explain the operation of 3 phase fully controlled rectifier fed separately excited DC motor drive operating in motoring mode. Also draw the circuit diagram, waveforms indicating switching sequence of thyristors. (14)

Module III

15 a) A chopper fed separately excited DC motor needs to work in all the four quadrants. With suitable circuit diagram explain its working. (7)

b) Explain the closed loop speed control of spartanly excited DC motor drive. (7)

OR

16 a) Describe the operation of chopper fed DC series motor drive. (7)

b) A Chopper used for the control of a DC separately excited motor, has supply voltage of 230V, Ton = 15ms, Toff = 20ms. Neglecting armature inductance and assuming continuous conduction, calculate average armature current when the motor speed is 3000rpm. It has a voltage constant, Kv = 0.5V/rad/sec. The armature resistance is 4Ω. (7)

Module IV

17 a) Explain the working of three phase AC voltage controller fed induction motor drive. (7)

b) Describe the operation of Voltage Source Inverter (VSI) fed induction motor v/f control using sine triangular PWM. (7)

OR

18 a) With relevant circuit diagram, detail the operation of a slip power recovery scheme which can operate in sub-synchronous speed. (8)

b) With relevant circuit diagram, explain the static rotor resistance speed control employing chopper. (6)

Module V

19 a) Explain the operation of CSI fed synchronous motor drive employing load commutated thyristor inverter. (7)

b) Discuss the operation of Voltage Source Inverter (VSI) fed Synchronous Motor Drive working in self-controlled mode. (7)

OR

20 Describe the working of direct vector control of induction motors with block diagram. Also explain the associated transformations. (14)

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