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Pages: 2

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021



Course Code: EE308

Course Name: ELECTRIC DRIVES

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

- 1 With relevant mathematical derivation, explain the torque equation of motor with rotational motion. (5)
- 2 State and explain how armature current and speed of a dc separately excited motor will be affected by halving armature voltage and field current with load torque remaining constant. (5)
- 3 Draw the circuit diagram of a class-C chopper fed DC motor. Draw its V/I characteristics. (5)
- 4 Explain the closed loop static rotor resistance control method for the speed control of a slip ring induction motor. What are the disadvantages of this method? (5)
- 5 With neat block diagram, explain Indirect field oriented control of IM. (5)
- 6 What is space vector? What are the applications of reference frame conversion in PWM modulation? (5)
- 7 Explain the V/f control characteristics in torque-speed plane of a SM drive (5)
- 8 What are the advantages and disadvantages of true synchronous mode of operation? (5)

PART B

Answer any two full questions, each carries 10 marks.

- 9 a) Explain the different types of closed loop control configurations of an electric drive. (7)
- b) What are the factors influencing the choice of an electric drive? (3)
- 10 a) A drive has the following parameters, $J=10 \text{ kgm}^2$, $T=100-0.1N \text{ Nm}$, active load torque $T_l=0.05N \text{ Nm}$, where N is the speed in rpm. Initially the drive is operating in steady state. Later it is reversed and the motor characteristic is changed to $T=100-0.1N \text{ Nm}$. Calculate the time of reversal. (7)

03000EE308052103

- b) How the load torques are classified? (3)
- 11 a) Explain the multi quadrant operation of dual converter fed dc motor drives. (5)
- b) With a neat sketch, explain the motoring and braking operation of three phase fully controlled rectifier control of separately excited DC motor. (5)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) With neat circuit and waveforms, explain the midpoint type single phase to single phase cycloconverter. (5)
- b) What are the slip power recovery control schemes used in induction motors? Explain how static Scherbius drive is used to control the speed of induction motors. (5)
- 13 a) Explain with neat sketch working principle of four quadrant chopper fed DC motor drives. Mention its applications. (7)
- b) Why chopper based DC drives give better performance than rectifier controlled drives. (3)
- 14 a) A d.c. motor is driven from a class-A d.c. chopper with source voltage of 220 V and at frequency of 1000 Hz. Determine the range of duty cycle to obtain a speed variation from 0 to 2000 rpm while the motor delivered a constant load of 70 Nm. The motor details as follows: 1kW, 200 V, 2000 rpm, 80% efficiency, $R_a = 0.1\Omega$, $L_a = 0.02$ H and $k\phi = 0.54$ V/rad /s. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Describe the operation of CSI fed induction motor drive. Explain its regenerative braking and multi-quadrant operation. (7)
- b) Explain in detail about the classification of PM synchronous motor? (3)
- 16 a) If the induced emf in the stator of an 8 pole induction motor has a frequency of 50 Hz and that in the rotor is 1.5 Hz, at what speed is the motor running and what is the slip? (4)
- b) Briefly describe the working of trapezoidal permanent magnet AC motor. (6)
- 17 a) Draw the block diagram of microcontroller based control of permanent magnet synchronous motor drive. (6)
- b) Explain the modes of operation of PMSM drives. (4)
