

Jan 2023

M. Tech- I

Electric Drives System (MPED101)

Time: 3 hours

Max. Marks:75

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) What factors limit the maximum speeds of field controlled dc motors? (1.5)
- (b) Give a classification of load torques on the basis of their application. (1.5)
- (c) Why the slip power recovery scheme is suitable mainly for drives with a low (1.5) speed range?
- (d) Why stator voltage control is an inefficient method of induction motor speed (1.5) control?
- (e) What are the advantages of using electric braking instead of mechanical brakes? (1.5)
- (f) Why a train driven by separately excited dc motors has better adhesion than a (1.5) train driven by series dc motors?
- (g) Give a few applications of stepper motors. (1.5)
- (h) Why a permanent magnet dc motor is preferred for low power applications? (1.5)
- (i) For variable frequency control of induction motor, the terminal voltage is (1.5) maintained constant, for speeds above base speed, Why?
- (j) Field control is employed for getting speeds higher than rated and armature (1.5) voltage control is employed for getting speeds less than rated. Why?

PART -B

- Q2 (a) Explain the operation of a closed loop speed control scheme with inner current (7.5) control loop. What are the various functions of inner current control loop?
- (b) What are the various components of load torque? (7.5)
- Q3 (a) A 200 V, 875 rpm, 150 A separately excited dc motor has an armature resistance (7.5) of 0.06 ohm. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50 Hz. Assuming continuous conduction, calculate
- i) firing angle for rated motor torque and 750 rpm
 - ii) firing angle for rated motor torque and (-500) rpm
 - iii) motor speed for $\alpha=160$ degree and rated torque.
- (b) Discuss multi quadrant operation of a drive? With the help of an example, (7.5) explain in detail.
- Q4 (a) Write short note on 'Stator Voltage Control' of an induction motor. (7.5)

- (b) A 3-phase, 400 V, 50 Hz, 10 KW, 960 rpm, 6 pole star connected slip ring (7.5) induction motor has following parameters referred to the stator: $R_s=0.4$ ohm, $R_r'=0.6$ ohm, $X_s=X_r'=1.4$ ohm

The motor drives a fan load at 960 rpm. The stator to rotor turns ratio is 2.

- i) What resistance must be connected in each phase of the rotor circuit to reduce the speed to 800 rpm?
 - ii) When the motor is controlled by static rotor resistance control, calculate the value of external resistance so that motor runs at 800 rpm for duty ratio of 0.5
- Q5 (a) Write a short note on 'Traction motors used in practice and their control'. (7.5)
(b) Discuss Speed-time characteristics of Traction Drives. (7.5)
- Q6 (a) Discuss principle of operation of 'Switched Reluctance Motor' and its applications. (7.5)
(b) Explain in detail the operation of BLDC drive. (7.5)
- Q7 (a) Discuss in detail motoring operation of a chopper fed separately excited dc motor. (7.5)
(b) Discuss the operation of Scherbius drive for speed control of an induction motor. (7.5)
