



# P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

**Seventh Semester, B.E. - Electrical and Electronics Engineering**

**Semester End Examination; February - 2022**

**AC and DC Drives**

Time: 3 hrs

Max. Marks: 100

*Note: Answer FIVE full questions, selecting ONE full question from each unit.*

## UNIT - I

- 1 a. Draw the block diagram of an electric drive. State the different classifications of power modulators and explain them in brief. 10
- b. A 200 V, 875 rpm, 150 A separately excited DC motor has an armature resistance of  $0.06 \Omega$ . It is fed from a single-phase fully controlled rectifier with an AC source voltage of 220 V, 50 Hz, assuming continuous conduction. Calculate; 10
- i) Firing angle for rated motor torque and 750 rpm
- ii) Firing angle for rated motor torque and  $-500$  rpm
- iii) Motor speed for  $\alpha = 160$  and rated torque
- 2 a. With a relevant circuit and waveforms, explain the operation of a single-phase fully-controlled converter fed separately excited DC motor drive under dis-continuous mode. 14
- b. Explain the basic speed-torque characteristic of DC separately excited motor. 6

## UNIT - II

- 3 a. Explain with a neat circuit diagram and waveforms, the motoring and braking operation of a three-phase fully controlled rectifier fed separately excited DC motor. 10
- b. A 220 V, 1500 rpm, 50 A separately excited DC motor has an armature resistance of  $0.5 \Omega$ . It is fed from a circulating current dual converter with AC source voltage (line) = 165 V. Determine the converter firing angles for; 10
- i) Motoring operation at rated motor torque and 1000 rpm
- ii) Braking operation at rated motor torque and 1000 rpm
- 4 a. Explain circulating current control method for achieving multi-quadrant operation for a DC separately excited motor. 10
- b. Explain the motoring and regenerative braking of chopper controlled separately excited DC motor with a relevant circuit diagram and waveforms. 10

## UNIT - III

- 5 a. Explain the phase-locked loop control of a DC motor. 10
- b. Derive an expression for closed loop control of a separately excited DC motor for change in load torque. 10

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- 6 a. With relevant circuit diagrams and characteristics, explain the different types of braking of DC separately excited motor. 10
- b. With the help of a block diagram, explain the closed-loop control scheme for a DC drive using a microcomputer. 10

#### UNIT - IV

- 7 a. Explain the Voltage Source Inverter (VSI) fed induction motor drive operation with a neat circuit and waveform. 10
- b. A 2.8 kW, 400 V, 50 Hz, 4 pole, 1370 rpm, delta connected squirrel-cage induction motor has following parameters referred to the stator:  
 $R_S = 2 \Omega$ ,  $R_r = 5 \Omega$ ,  $X_S = X_r = 5 \Omega$ ,  $X_m = 80 \Omega$   
 Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate; 10
- i) Motor terminal voltage, current and torque at 1200 rpm  
 ii) Motor speed, current and torque for the terminal voltage of 300 V
- 8 a. With the necessary circuit and speed torque curve, explain the operation of static scherbius drive system. 10
- b. A 3 phase 400 V, 6-pole 50 Hz, delta connected, slip ring induction motor has rotor resistance of 0.2 and leakage reactance of  $1 \Omega$  per phase referred to the stator. When driving a fan load it runs at full load at 4% slip what resistance must be inserted in the rotor circuit to obtain a speed of 850 rpm. Neglect stator impedance and magnetizing branch. The stator to rotor turns ratio is 2.2. 10

#### UNIT - V

- 9 a. With a neat circuit, explain how speed control is achieved in a self-controlled synchronous motor by employing a load commuted thyristor inverter? 10
- b. With the help of a single line diagram, explain the operation of the cement mill and the drives used in the process. 10
- 10 a. Explain variable frequency control scheme for both true synchronous and self synchronous mode of operation for synchronous motor drive. 10
- b. Explain different stages involved in the production of cloth in the textile industry. Mention the rating and types of electric drive used in each stage. 10

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