



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

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. – Electrical and Electronics Engineering

Semester End Examination; Dec - 2016/Jan - 2017

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 modulator and explain them in brief. 8
- b. Explain the basic speed-torque characteristic of DC separately excited motor. 6
- c. With relevant circuit and waveforms, explain the operation of a single-phase half controlled converter fed separately excited dc motor drive under dis-continuous mode. 6
- 2 a. A 200 V, 875 rpm, 150 A separately excited D.C. motor has an armature resistance of 0.06Ω . 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.
- b. With relevant circuit diagrams and characteristics, explain the different types of braking of DC separately excited motor. 10

UNIT - II

- 3 a. Explain with neat circuit diagram and waveforms, the motoring and braking operation of a three phase fully controlled rectifier fed separately excited DC motor. 8
- b. Explain non-circulating current control method for achieving multi-quadrant operation for a DC separately excited motor. Discuss how speed reversal is obtained? 6
- c. A 220 V, 1500 rpm, 50 A separately excited DC motor has an armature resistance of 0.5Ω . It is fed from a 3-phase fully controlled rectifier. Available AC source has a line voltage of 440 V, 50 Hz, assume continuous conduction. Calculate the value of firing angle, 6
- i) When motor is running at 1200 rpm and rated torque
- ii) When motor is running at - 800 rpm and twice the rated torque.
- 4 a. A 220 V, 1500 rpm, 50 A separately excited DC motor has an armature resistance of 0.5Ω . It is fed from a circulating current dual converter with AC source voltage (line) = 165 V. Determine the converter firing angles for ; 6
- i) Motoring operation at rated motor torque and 1000 rpm
- ii) Braking operation at rated motor torque and 100 rpm.

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- b. With relevant circuit diagram and waveworms, explain the motoring and regenerative braking of chopper controlled separately excited DC motor. 8
- c. A 230 V, 960 rpm, 200 A separately excited DC motor has an armature resistance of 0.02Ω . The motor is fed from a chopper which provides both motoring and braking operation. For a source voltage of 230 V, assuming continuous conduction, calculate; 6
- i) Duty ratio of chopper for motoring operation at rated torque and 350 rpm
- ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.

UNIT - III

- 5 a. Derive an expression for closed loop control of separately excited DC motor for change in voltage. 10
- b. Explain the phase locked loop control of a DC motor. 10
- 6 a. Derive an expression for closed loop control of a separately excited DC motor for change in load torque. 10
- b. With the help of block diagram, explain the closed loop control scheme for a DC drive using micro computer. 10

UNIT - IV

- 7 a. With a neat circuit diagram and waveforms, explain the operation of a voltage source inverter (VSI) fed Induction motor drive. 10
- b. A 3-phase 1370 rpm, 400 V, 2.8 kW, 4-pole, Y-connected squirrel cage induction motor has $R_s = 2 \Omega$, $R_r' = 3 \Omega$, $X_s = X_r' = 3.5 \Omega$. The motor is controlled by a voltage source inverter at constant V/f ratio. Inverter allows frequency variation from 10 to 50 Hz. Calculate starting torque and current of this drive as a ratio of their values when motor is started at rated voltage and frequency. 10
- 8 a. With a neat block diagram, explain closed loop speed control operation for induction motor drive using either CSI or VSI. 10
- b. With necessary circuit and speed torque curve, explain the operation of static scherbius drive system. 10

UNIT - V

- 9 a. Explain variable frequency control scheme for both true synchronous and self synchronous mode of operation for synchronous motor drive. 10
- b. With a neat circuit diagram, explain the operation of self-controlled synchronous motor drive employing load commutated Inveter. 10
- 10 a. With the help of single line diagram, explain the operation of cement mill and the drives used in operation. 10
- b. Explain the different stages involved in production of cloth in a textile industry. Clearly mention the ratings and types of electric drive used in each stage. 10