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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 0.06 Ω. 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 0.5 Ω. 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 0.5 Ω. 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.

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 0.02 Ω. 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;

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. | 6

UNIT - III

5 a. Derive an expression for closed loop control of separately exited 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

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