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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; Dec - 2017/Jan - 2018

AC-DC Drives

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. With a neat block diagram, state the essential parts of an electric drive system. Explain them briefly. 10

b. Explain the four quadrant operation of DC motor drive. State the conditions to be satisfied for each quadrant operation. 10

2 a. With a neat circuit diagram and waveforms, explain the working of DC series motor fed from single phase half controlled rectifier. Assume continuous conduction mode. 10

b. A 200 V, 875 rpm, 150 A separately excited DC 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 $\alpha = 160^{o}$ and rated torque.

UNIT - II

3 a. Explain the operation of three phases fully controlled rectifier control of DC separately excited motor. 10

b. A 220 V, 1500 rpm, 50 A separately excited DC motor with armature resistance of 0.5 Ω is fed from a three phase fully controlled rectifier. Available AC source has a line voltage of 440 V, 50 Hz. A star-delta connected transformer is used to feed the armature. So that motor terminal voltage equals rated voltage when converter firing angle is zero. 10

I) Calculate transformer turns ratio

II) Determine the value of living angle :

i) Motor is running at 1200 rpm and rated torque

ii) When motor is running at -800 rpm and twice the rated torque.

4 a. Explain with a circuit diagram and waveforms, the regenerative braking of a separately excited DC motor by using Chopper. 10

Contd...2

b. A DC-DC converter is used on regenerative braking of a DC series motor. The DC supply voltage is 600 V. The armature resistance is R_a = 0.02 Ω and the field resistance is R_f = 0.03 Ω. The back emf constant is K_v = 15.27 mV/A rad/s. The armature current is I_a = 250 A. If the duty cycle is 0.6. Determine; 10

i) Average voltage across chopper ii) Power regenerated to the dc supply

iii) Minimum possible braking speed iv) Maximum possible braking speed

v) Motor speed.

UNIT - III

5 a. Derive an expression for closed loop control of a separately excited DC motor for change in voltage. 10

b. With the help of block diagram, explain the open loop control operation of a DC drives. 10

6 a. What meant by phase locked loop? With the help of block diagram, explain the concept of PLL. 10

b. With the help of block diagram, explain the closed loop control operation of DC drives using microcontroller. 10

UNIT - IV

7 a. Discuss on brief the speed control by frequency control and v/f control methods. 10

b. Explain in brief the plugging and regenerative braking of an induction motor. 10

8 a. A three phase, 460 V, 60 Hz, 4 pole Y connected induction motor has the following parameters :

R_s = 1.01 Ω, R'_r = 0.69 Ω, X_s = 1.3 Ω, X'_r = 1.94 Ω and X_m = 43.5 Ω. The no-load loss is negligible. The load torque is proportional to the speed squared, is 41 N-m at 1740 rpm. If the motor speed is 1550 rpm. Determine; 10

i) Load torque ii) Rotor current iii) Stator supply voltage

iv) Motor input current v) Motor input power.

b. With necessary circuit and speed torque curves, explain the operation of static scherbius drive. 10

UNIT - V

9 a. With a neat circuit, explain the working of self controlled synchronous motor drive employing load commutated thyristor inverter. 10

b. Explain the operation of a synchronous motor when fed from a fixed frequency supply. 10

10 a. With a neat sketch, explain paper mill drive system. 10

b. With the help of block diagram, explain the various stages of operation involved in cement mills. 10

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