R16

Answer any Five Questions
All Questions Carry Equal Marks
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1.a) A single-phase fully controlled thyristor converter is supplying a separately excited DC Motor. Draw the relevant waveforms and explain various operating modes of the drive both in motoring and regenerative braking.

b) A 220 V, 970 rpm, 120 A DC separately excited motor has an armature resistance of 0.05ohms. It is braked by plugging from an initial speed of 1000rpm. Calculate resistance to be placed in armature circuit to limit braking current to twice the full load value and Braking torque.   [8+7]

2.a) Explain the operation of a four-quadrant chopper fed to the D.C series motor and draw the current and voltage wave forms for continuous current operation.

b) A 220v, 24A, 1000rpm separately excited dc motor having an armature resistance of 2ohm is controlled by a chopper. The chopping frequency is 500Hz and the input voltage is 230V. Calculate the duty ratio for a motor torque of 1.2 times rated torque at 500rpm.
                                                                                          [8+7]

3.a) Explain with the help torque-speed characteristics, why stator voltage control is suitable for speed control of induction motors in fan and pump dives. Draw a neat circuit diagram for speed control of scheme of 3 phase induction motor using AC voltage controller.

b) A 440V, 3 phase, 50Hz 6 pole 945 RPM delta connected induction motor has the following parameters referred to the stator. R_s=2.0Ω, R_r^1 = 2.0Ω, X_s = 3Ω, X_r = 4Ω. When driving a fan load at rated voltage, it runs at rated speed. The motor speed is controlled by stator voltage control. Determine motor terminal voltage, current and torque at 600 RPM. [7+8]

4.a) Explain the operation of three phase slip ring induction motor drive when static Kramer scheme is employed, with the help of circuit diagram. Draw the speed-torque characteristics.

b) A 3 Phase, 420 V, 50 Hz, star connected Induction motor has the following constants referred to the stator. R_s = 2.95 Ω, R'_r = 2.08 Ω, X_s = 6.82 Ω, X_r' = 4.11Ω per phase. The motor draws a current of 6.7 A at no load and controlled by rotor resistance control. The resistance R_e has been controlled by chopper. Find the value of R_e to get a speed range of 1500 to 500 rpm, assuming a turns ratio of two between stator and rotor. The torque and speed of the load are related by T α N. Determine the characteristics giving the speed Vs time ratio of the chopper.   [8+7]

5.a) Describe self-controlled and separate controlled mode of operation of a synchronous motor drive in detail and compare them.

b) A 500KW, 3-phase, 3.3KV, 50Hz, 0.8(lag) pf, 4 pole star connected synchronous motor has following parameters. X_s=15Ω, R_s=0, rated field current is 10A. Calculate (i) Armature current and power factor at half the rated torque & rated field current. (ii) Field current to get unity power factor at the rated torque.   [8+7]

6.a) Explain the speed control operations of separately excited DC motor fed by armature with 3 – phase full converter and field with 1 – phase semi- converter.

b) Explain the operation of two-quadrant, type-D chopper drive with necessary equivalent circuits and waveforms? [8+7]

7.a) Briefly discuss the speed torque characteristics of 3-phase Induction Motor obtained by stator voltage variation.

b) Compare stator side control and rotor side control of induction motors. [8+7]

8.a) Explain the closed loop control operation of Synchronous motor drive employing variable frequency control.

b) State and explain the important features of various braking methods of dc motors? [8+7]

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