B.E. Instrumentation Engineering (Model Curriculum) Semester-V

IN503M - Industrial Drives Control

P. Pages : 2 **GUG/W/23/14023**

Time : Three Hours * 7 6 1 0 * Max. Marks : 80

Notes : 1. Same answer book must be used for each section.
2. All questions carry marks as indicated.
3. Due credit will be given to neatness and adequate dimensions.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Elaborate the term thyristor. Define latching current, holding current, forward break over voltage and reverse break over voltage. **8**

b) Discuss the operation of Power MOSFET and IGBT. **8**

OR

2. a) Elaborate in detail about Series and parallel operation of SCR. **8**

b) A particular MOSFET has VA = 50 V for operation at 0.1 mA and 1mA what are the expected output resistance? In each case, for change VDS of 1V, what percentage change in drain current would you expect? **8**

3. a) Classify the rectifiers & discuss the advantages of freewheeling diode in controlled rectifiers. **8**

b) Center tapped full wave rectifier, the internal resistance of each diode is 10Ω, and the transformer RMS voltage from center tap to each end of secondary is 60V and load resistance is 870 ohm. **8**
Find
1) Average load current 2) RMS value of load current 3) Dc output voltage 4) pick inverse voltage

OR

4. a) Examine the operation of step-up chopper. Derive an expression for the average output voltage in terms of input dc voltage and duty cycle. **8**

b) Describe the working operation of parallel inverter. **8**

5. a) List various types of d.c. motors. Compare d.c motors with a.c. motors. **8**

b) Discuss the operation of Brushless dc motor. **8**

OR

6. a) Elaborate different types of single phase induction motor with neat diagrams. **8**

b) A 3-phase, 5000 kW, 11 kV, 200 RPM, 50 Hz synchronous motor has per phase synchronous reactance of 1.5Ω. At full-load, the torque angle of the motor is 23^{o} electrical. If the excitation EMF is 3.4 kV. Calculate 1) the mechanical power developed and 2) maximum mechanical power developed by the motor. **8**

7. a) Elaborate the H-Bridge control drive with neat circuit diagrams. **8**

b) An 80kW, 440V, 800rpm d.c. motor is operating at 600rpm and developing 75% rated torque is controlled by $3-\Phi$, dix pulse thyristor converter. If the back emf at rated speed is 410V, determine the triggering angle of the converter. The input to the converter is $3-\Phi$, 415V, 50Hz a.c. supply **8**

OR

8. a) Mention the different methods of speed control employed for DC Series Motor. **8**

b) A 210, 1200 rpm, 10 A separately excited motor is controlled by a 1-phase fully controlled converter with an a.c. Source voltage of 230V, 50Hz. Assume that sufficient inductance is present in the armature circuit to make the motor current continuous and ripple free for any torque greater than 25% of rated torque Ra = 1.5Ω. **8**

1) What should be the value of the firing angle to get rated torque at 800rpm?
2) Compute the firing angle for the rated braking torque at – 1200rpm.
3) Calculate the motor speed at the rated torque and $\alpha = 165^{o}$ for regenerative braking in the second quadrant?

9. a) Discuss how Solid State Relays are used for control of a. c. Motor. **8**

b) A three phase, squirrel-cage induction motor is developing torque 1500sync. watts at 50Hz and 1440rpm (synchronous speed is 1500rpm). If the motor frequency is now increased to 75Hz using constant power mode, determine the new value of torque developed by motor at constant slip. **8**

OR

10. a) Discuss briefly static Scherbius drive. **8**

b) Discuss briefly the stator voltage control of induction motor drive. Also draw and explain the speed torque curve. **8**

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