

**IV B.Tech I Semester Supplementary Examinations, April/May 2005**  
**POWER SEMICONDUCTOR DRIVES**  
**(Electrical & Electronic Engineering)**

Time: 3 hours

Max Marks: 70

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) What is the purpose of a free wheeling diode in converters when fed to DC motors.  
(b) A  $1\phi$ , half controlled converter is fed from a 120V rms, 60 HZ supply and provides a variable dc voltage at the terminals of a dc motor. The thyristor is triggered continuously by a dc signal. The resistance of armature circuit is  $10\Omega$  and because of fixed motor excitation and high inertia, the motor speed is considered constant so that the back emf is 60V. Find the average value of the armature current neglecting armature inductance.
2. A 220v, 970 rpm, 100A dc separately excited motor has an armature resistance of  $0.05\Omega$ . It is braked by plugging from an initial speed of 1000rpm. Calculate
  - (a) Resistance to be placed in armature circuit to limit braking current to twice the full load value.
  - (b) Braking torque and
  - (c) Torque when the speed has fallen to zero.
3. (a) Explain with neat circuit diagram the basic principle of operation of a class A type of chopper. The chopper is connected to R-L-E load. Analyze the same for continuous current mode of operation.  
(b) A dc supply of 200v supplied power to separately excited dc motor via a class A thyristors chopper. The motor has an armature circuit resistance of  $0.33\Omega$  and inductance of 11mH. The chopper is fully on at the rated motor speed 1200rpm when the armature current is 20A. If the speed is to be reduced to 800rpm with the load torque constant, calculate the necessary duty cycle. If the chopper frequency is 500Hz, is the current continuous?
4. (a) Using 3 phase solid state AC Voltage Controllers explain clearly how it is possible to achieve 4 quadrant operation of 3 phase Induction motors.  
(b) Draw a closed loop block schematic diagram for the above speed control technique. Mention the merits of the above method of speed control.
5. (a) Draw and explain the speed torque curves with variable frequency control for two different modes.
  - i. Operation at constant flux.
  - ii. Operation at constant  $\left(\frac{v}{f}\right)$  ratio

- (b) Explain the advantages of variable frequency drives.
6. A 3-phase, 460V, 60Hz, 1164rpm, 6 pole, star connected, wound rotor induction motor has the following parameters referred to the stator:  $R_1 = 0.4\Omega$ ,  $R_2' = 0.6\Omega$ ,  $X_1 = X_2' = 1.8\Omega$ ,  $X_0 = 40\Omega$ , Stator to rotor turns ratio = 2.5. The motor speed is controlled by static rotor resistance control. The filter resistance is  $0.02\Omega$ . The value of the external resistance is chosen such that  $\alpha = 0$  and the breakdown torque is obtained at Standstill:  
Determine the following:  
The value of the external resistance  
a for a speed of 60rpm at 1.5 times the rated torque.  
The speed for a = 0.6 and 1.5 times the rated torque neglect the friction and windage loss.
7. Describe cycloconverter drive versus VSI drive for synchronous motor in detail and state their advantages and disadvantages.
8. Describe self-controlled and load-commutated inverter controlled synchronous motor drives in detail and compare them

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