Code No: NR410202 **NR**

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

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. Two independent single-phase semi-converters are supplying the armature and field circuits of the separately excited dc motor for controlling its speed. The firing angle of the converter, supplying the field, adjusted such that maximum field current flows. The machine parameters are: armature resistance of 0.25 Ω, field circuit resistance of 147 Ω, motor voltage constant Kv=0.7032 V/A-rad/s. The load torque is T=45 N-m at 1000 rpm. The converter are fed from a 208 V, 50 Hz ac supply. The friction and windage losses are neglected. The inductance of the filed and armature circuits are sufficient enough to make the armature and field currents continuous and ripple free. Determine
   (a) the field current,
   (b) the delay angle of the armature converter,
   (c) input power factor of the armature circuit converter.

2. (a) Distinguish between dual converter with and without circulating current mode operation using proper circuit diagrams.
   (b) A 220v, 750 rpm, 200A separately excited motor has an armature resistance of 0.05Ω. Armature is fed from a 3-phase non-circulating current mode dual converter, consisting of fully controlled rectifiers A and B. Rectifier A provides motoring operation in the forward direction and rectifier B in reverse direction.
   Line voltage of A.C. source is 400v. Calculate firing angle of rectifier for the motoring operation at rated torque and 600 rpm assuming continuous conduction.

3. (a) A 230v, 960rpm and 200A separately excited dc motor has an armature resistance of 0.02Ω. The motor is fed from a chopper, which is capable of providing both motoring and braking operations. The source has a voltage of 230v. Assuming continuous conduction:
      i. Calculate the time ratio of chopper for the motoring action at rated torque and 350 rpm.
      ii. Determine the maximum possible speed if maximum value of time ratio is 0.95 and maximum permissible motor current is twice the rated value.
   (b) Draw the necessary waveforms for the above problem.

4. (a) Why stator voltage control is an inefficient method of Induction motor speed control?

(b) A 3 KW, 400V, 50Hz, 4 pole, 1370 RPM, Y-connected Induction motor has the following parameters.
$R_S = 2\Omega$, $R_r = 5\Omega$, $X_S = X_r = 3\Omega$.
Load characteristics are matched with motor such that motor runs at 1370 RPM with full voltage across its terminals. The motor is controlled by terminal voltage control and load torque is proportional to speed. Calculate the motor terminal voltage and current at half the rated speed.

5. Discuss in detail the role of Cyclo converters for speed control of Induction motor. Draw neat circuit diagram for speed control of 3 phase Induction motor using Cyclo converters. Mention the merits and limitations of the above scheme.

6. An 8 pole, 50Hz, 380V, star connected induction motor has a star connected slip ring rotor. The stator / rotor turns ratio is 1.25. The speed of the motor is controlled by a converter cascade in the rotor circuit. Determine the firing angles of the inverter to get 600rpm and 400rpm at no load. The inverter is connected to a 380V, 3-phase system. Assume no over lap in the rectifier as well as in the inverter . What is the minimum possible speed.

7. Explain the operation of a synchronous motor fed from an adjustable frequency current source, with circuit diagram and characteristic curves.

8. Describe self-controlled and load-commutated inverter controlled synchronous motor drives in detail and compare them

⋆ ⋆ ⋆ ⋆ ⋆