Code No: M0221/R07

Set No. 1

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
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1. Write down the basic performance equations for a D.C Series motor Sketch characteristics of constant torque drive and constant power drive regions.   [16]

2. Explain the Speed - torque Characteristics of a dc series motor connected to a three phase semi controlled converter.   [16]

3. Explain various speed control method of D.C motors and also draw speed-torque curves for each method.   [16]

4. A 220V, 70A D.C series motor has combined resistance of armature and field is 0.12 ohms running on no-load with the field winding connected to a separate source. It gave following magnetization characteristics at 600 rpm

FieldCurrent(A)	10	20	30	40	50	60	70	80
TerminalVoltage (V)	64	118	150	170	184	194	202	210

Motor is controlled in regenerative braking by a chopper with a source voltage of 220V.

  (a) Calcul;ate motor speed for a duty ratio of 0.5 and motor breaking torque equal to rated motor torque.

  (b) Calculate maximum allowable motor speed for a maximum permissible current of 70A and maximum permissible duty ratio of 0.95.

  (c) What resistance must be inserted in armature circuit for the drive to run at 1000 rpm without exceeding armature current beyond 70 A? the duty ratio of the chopper has a range from 0.05 to 0.95.

  (d) To What extent the number of turns in field winding should be reduced to run at 1000 rpm without exceeding armature current beyond 70 A?   [16]

5. (a) Generally the stator voltage control is suitable for speed control of Induction motor in fan and pump drives. Discuss in detail why the above method is useful.

  (b) Explain why the stator voltage control is not an efficient method of control.
                                                                                [8+8]

6. Discuss in detail how the variable frequency control of an Induction motor can be achieved using voltage source Inverter. Mention the various advantages of the above method.   [16]

7. Discuss briefly about the traditional Scherbius system. Explain how the same operation can be achieved using solid state Scherbious system.   [16]

$$\boxed{\textbf{Set No. 1}}$$

8. (a) What is the basic difference between true synchronous mode and self control mode for variable frequency control of Synchronous motor?

   (b) When operating in true synchronous mode, why the frequency must be changed in small steps? [8+8]

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Set No. 2

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. A 200V, 10.5A, 2000 rpm, Shunt Motor has the armature and field resistances of 0.5 and 400 ohms respectively. It drives a load whose torque is constant at rated motor torque. Calculate motor speed if the source voltage drops to 175V.   [16]

2. In a speed controlled dc drive the load torque is 40 Nm. At time t=0 the operation is under steady state and the speed is 500 rpm. Under this condition at t=0+ the generated torque is instantly increased to 100 Nm. The inertia of the drive is 0.01.friction is negligible.

   (a) Write down the differential equation governing the speed of the drive for t >0.

   (b) Evaluate the time taken for the speed to reach 1000rpm.   [16]

3. Describe the relative merits and demerits of the following types of braking for dc motors: mechanical braking, dynamic braking and regenerative braking with neat diagrams.   [16]

4. (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.   [8+8]

5. Discuss why the rotor of an Induction motor should have very large rotor resistance when it is controlled from a three phase ac voltage controller.   [16]

6. Mention the reasons

   (a) Why V/f ratio is maintained constant when the motor is operated below the base speed.

   (b) Why the terminal voltage is maintained constant, when Induction motor is operated above base speed. Draw relevant speed torque characteristics. [8+8]

7. Explain static motor resistance control for speed control of I.M. Draw speed & torque charecterstics.

   [16]

Set No. 2

8. (a) What is a self control mode of Synchronous motor?

   (b) Draw and explain the block diagram of a self controlled synchronous motor fed from a three phase inverter. [8+8]

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Set No. 3

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. A dc series motor has $R_a = 3\Omega$, $R_f = 3\ \Omega$ and $M_{af}= 0.15$ H. The motor speed is varied by a phase-controlled bridge. The firing angle is $\frac{\pi}{4}$ and the average speed of the motor is 1450 rpm. The applied ac voltage to the bridge is 330 Sin wt. Assuming continuous motor current find the steady state average motor current and torque. Sketch the waveforms for output voltage, current and gating signals.
[16]

2. Describe the use of three phase semi converter for the speed control of a D.C series motor. Illustrate your answer with appropriate wave forms and also derive the rms values of source and thyristor currents. [16]

3. What are the advantages of electric braking over mechanical braking of D.C. motors? Explain with proper circuit diagram Speed-Torque characteristics of D.C motor under dynamic braking, for the following types:

   (a) Separately excited dc motor
   (b) Series motor. [8+8]

4. Explain the operation of four quadrant chopper fed to the D.C series motor and also draw the current and voltage wave forms for continuous current operation.[16]

5. A 3ϕ, 8 pole, $50H_z$ IM has the following circuit parameters $r_2=0.15\Omega$ $x_2 = 0.7\Omega$. The motor speed is controlled by varying the applied voltage by an AC voltage controller, which operates from a 380v, $50H_z$ supply. Detemine the applied voltage perphase of the motor to have a slip of 0.15. The motor drives a load with a charectersitc of $T_1 = 0.014W^2$NW-m. Determine the firing angle of the converter. [16]

6. Discuss in detail how the variable frequency control of an Induction motor can be achieved using Current source Inverter. Mention the advantages and limitations of the above method. [16]

7. Draw the circuit diagram and explain the operation of rotor- resistance control using chopper. Mention the advantages and disadvantages of the above method of control. [16]

8. Explain separate control & self control of synchronous motor.
[16]

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Code No: M0221/R07

Set No. 4

IV B.Tech I Semester Supplementary Examinations, Feb/Mar 2011
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) What are the assumptions made while doing the steady-state performance of the converter fed dc drives. Justify your answers.

   (b) Explain the use of freewheeling diode in the converter fed dc drives. Take an example of 1-phase fully controlled converter for explanation. How it is going to affect the machine performance?   [8+8]

2. Describe how the speed of a separately excited D.C motor is controlled through the use of two three phase full converters. Discuss how two quadrant drive can be obtained from this scheme.   [16]

3. Explain in detail the braking operation of a controlled separately excited d.c motor.   [16]

4. Derive the expressions for average motor current, RMS motor currents, Torque, and average motor voltage, for chopper fed D.C separately excited motor.   [16]

5. An inverter supplies a six pole three-phase cage Induction motor rated at 415V, 50Hz. Determine the approximate voltages required of the inverter for motor speeds 600/800/1500/ 1800 rpm.   [16]

6. Explain briefly the various methods of achieving variable frequency control of 3 Phase Induction motor using solid state switches SCRs / IGBTs.   [16]

7. Draw the circuit diagram and explain the operation of rotor- resistance control using chopper. Mention the advantages and disadvantages of the above method of control.   [16]

8. In variable frequency control of asynchronous motor why (V/f) ratio is maintained constant up to base speed and V constant above base speed. Draw the relevant characteristics.   [16]

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