Set No. 1

IV B.Tech I Semester Regular Examinations, November 2008
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Explain the fundamentals of thyristor controlled drives and their operation. [16]

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

3. Explain briefly the following methods of braking of a D.C Motor

   (a) Regenerative braking

   (b) Dynamic braking

   (c) Plugging. [16]

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) Starting from fundamentals prove that torque developed by the Induction motor is proportional to square of the supply voltage.

   (b) Draw the speed torque curves for different voltages fed from stator voltage controller. [8+8]

6. A 3 Phase,1500 rpm Induction motor is developing torque of 3000 Syn. watts at an input frequency of 50Hz. If the motor torque is now reduced to 1500 Syn.watts, determine the new value of stator frequency. The motor is operating in constant HP region. Assume constant rotor frequency and neglect effect of rotor resistance. [16]

7. A three phase, 460V, 60Hz, 1164 rpm, six pole star connected, wound rotor Induction motor has the following parameters per phase referred to the stator.
   $R_1 = 0.4$ ohm, $R_2 = 0.6$ ohm, $X_1 = X_2 = 1.8$ ohm, $X_m = 40$ Ohm. Stator to rotor turns ratio is 2.5. The motor speed is controlled by static rotor resistance control. The filter resistance is 0.02 Ohm. The value of external resistance is chosen such that $\alpha = 0$ and the breakdown torque is obtained at stand still. Determine the following:

   (a) The value of the external resistance

   (b) α for a speed of 960 rpm at 1.5 times the rated torque. [16]

8. Explain separate control & self control of synchronous motor.

[16]

⋆ ⋆ ⋆ ⋆ ⋆

$$\boxed{\textbf{Set No. 2}}$$

IV B.Tech I Semester Regular Examinations, November 2008
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆⋆⋆⋆⋆

1. Draw and Explain Speed-torque characteristics of semi converter feeding a D.C series motor. [16]

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

3. (a) Discuss in detail counter current and dynamic braking operations of D.C. shunt motors.

   (b) A 400V, 750 rpm, 70A dc shunt motor has an armature resistance of 0.3Ω when running under rated conditions, the motor is to be braked by plugging with armature current limited to 90A. What external resistance should be connected in series with the armature? Calculate the initial braking torque and its value when the speed has fallen to 300rpm. [8+8]

4. (a) Distinguish between class A and class B choppers with suitable examples of speed control of motors.

   (b) A 220V, 190A dc series motor has armature and field resistance's of 0.03 and 0.02 ohms respectively. Running on no load as a generator with field wining connected to a separate source it gave following magnetization characteristic at 500rpm.

FieldCurrent(A)	40	80	120	160	200
TerminalVoltage (V)	52	108	148	176	189

   Motor is controlled by a chopper in dynamic braking with a braking resistanceof 2Ω.

      i. Calculate motor speed for a duty ratio of 0.6 and motor current of 160A.
      ii. What will be the motor speed for a duty ratio of 0.75 and motor torque equal to half of rated torque? [8+8]

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. A 3 Ph Star connected Induction motor operating at a frequency of 60 Hz consists of 4 poles. The parameters of the stator and rotor referred to stator side are $R_1 = R_2 = 0.024$ ohm and $X_1 = X_2 = 0.18$ ohm. If the motor is controlled by the variable frequency control with v/f constant ratio determine the following parameters at an operating frequency of 12 Hz. Starting torque and rotor current in terms of their values at rated frequency. [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. With suitable circuit diagrams discuss in detail the principle of operation of Self controlled Synchronous motor drive employing a Cyclo converter. [16]

⋆ ⋆ ⋆ ⋆ ⋆

Set No. 3

IV B.Tech I Semester Regular Examinations, November 2008
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

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. The speed of a separately excited dc motor is controlled by means of a 3 phase semi converter from a 3 phase 415V 50Hz supply. The motor constants are inductance 10mH, resistance 0.9 ohm and armature constant 1.5v/rad/s.calculate speed of the motor at a torque of 50 Nm when the converter is fired at 45^0. Neglect losses in the converter.

[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. (a) Explain the principle of speed control of a dc motor and show how it can be achieved by a chopper.

   (b) A 230V, 1200rpm, 15A separately excited motor has an armature resistance of 1.2Ω. Motor is operated under dynamic braking with chopper control. Braking resistance has a value of 20Ω.

       i. Calculate duty ratio of chopper for motor speed of 1000rpm and braking torque equal to 1.5times rated motor torque.
       ii. What will be the motor speed for duty ratio of 0.5 and motor torque equal to its rated torque?   [8+8]

5. (a) Explain variable voltage charecter stics of Induction motor

   (b) Explain Torque & speed charecterstics of Induction motor.   [8+8]

6. A 400V, 50HZ Star connected Induction motor is fed from a six step inverter which in turn fed from a six-pulse fully controlled rectifier. The a.c supply mains are rated at 440V, 50HZ. What should be the firing angle of the rectifier to operate the motor at 50 HZ under v/f control?   [16]

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

[16]

8. A 20 kW, 3-phase, 440V, 4 pole, delta connected permanent magnet synchronous motor has following parameters. X_s = 5 ohm, R_s = 0, rated power factor =1.0. Machine is controlled by variable frequency control at a constant (V/f) ratio. Calculate armature current, torque angle and power factor at half full load torque and 750 rpm. [16]

$\star\,\star\,\star\,\star\,\star$

IV B.Tech I Semester Regular Examinations, November 2008
POWER SEMICONDUCTOR DRIVES
(Electrical & Electronic Engineering)

Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Derive the Speed, Torque Equations of a fully controlled converter connected to separately excited D.C motor with continuous current operation with necessary waveforms. [16]

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

3. (a) With neat circuit diagram and waveforms, explain dynamic braking of separately excited motor by single phase converter.

   (b) A dc shunt motor has the armature resistance of 0.04Ω and the field winding resistance of 10Ω. Motor is coupled to an over hauling load with a torque of 400N-m. Following magnetization curve was measured at 600 rpm:

Field Current, A	2.5	5	7.5	10	12.5	1.5	17.5	20	22.5	25
Back emf, V	25	50	73.5	90	102.5	110	116	121	125	129

   Calculate the value of R_B when the motor is required to hold overhauling load at 1200rpm. [8+8]

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 by a chopper with source voltage equal to 220V. calculate

   (a) Motor Speed for a duty ratio of 0.6 and motor current of 60A

   (b) Torque for a speed of 400 rpm and duty ratio of 0.65. [16]

5. Draw the following AC voltage controllers for varying the speed of a 3 phase Induction motor

   (a) Star connected controller

   (b) Delta connected controller

   (c) Delta connected Stator and controller.

   Discuss in detail about the above types of controllers. [16]

6. With neat block diagrams explain closed loop operation of Induction motor drives. [16]

Set No. 4

7. (a) Why rotor resistance control is preferred in low power crane drives?

   (b) What are the advantages of static rotor resistance control over conventional method of rotor resistance control? Explain its principle of operation with suitable circuit diagrams and characteristics.   [8+8]

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]

⋆ ⋆ ⋆ ⋆ ⋆