Code No: 07A70201 **R07** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
POWER SEMICONDUCTOR DRIVES
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. 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]

2. Explain the operation of three phase semi converter drive with necessary wave forms. And also draw
   (a) Output voltage and current at α=90^0
   (b) Output voltage and current at α=120^0. [16]

3. Compare the performance of static scherbius drive & static kramer drive. [16]

4. Compare VSI & CSI fed synchronous motor drives- mention advantages and disadvantages of each method. [16]

5. Give the circuit layout for single phase DC drives .Enumerate the various single phase DC drives used. [16]

6. A 3 phase, 4 pole, 50 Hz Induction motor has rotor resistance of 0.2 ohm and stand still reactance of 0.1 ohm. At full load it operates at a slip of 4%. If the voltage is reduced to 50 %, at what speed will the motor operates with full load torque applied. [16]

7. A 230V 100A, 1200 rpm D.C Separately excited motor has an armature resistance of 0.04 ohms. The motor armature is fed from a variable source with an internal resistance of 0.056 ohms.
   (a) Calculate internal voltage of the variable voltage source when the motor is operating in regenerative breaking at 60% of the rated motor torque and 800 rpm.
   (b) If the motor is operated under dynamic breaking at twice the rated torque and 1000 rpm then calculate the value of breaking current and resistor by assuming linear magnetic circuit. [16]

8. (a) Derive the expressions for average motor current, current Imax and Imin and average torque for chopper-fed dc separately excited motor.

(b) A dc chopper controls the speed of a separately excited motor. The armature resistance is R_a=0.05Ω. The back emf constant is K_v=1.527v/A-rad/s. The rated field current is I_f= 2.5A. The dc input voltage to the chopper is V_s= 600V. If it is required to maintain a constant developed torque of T_d = 547N-m, plot the motor speed against the duty cycle k of the chopper. [8+8]

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Code No: 07A70201 **R07** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
POWER SEMICONDUCTOR DRIVES
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. 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]

2. Explain static motor resistance control for speed control of I.M. Draw speed & torque charecterstics. [16]

3. 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]

4. Explain various relative operational merits and demerits of single phase semi and fully controlled converters fed to DC motors. [16]

5. What is a dual converter? Explain the principle of operation of a dual converter in circulating current mode. How the same is used for speed control of dc drive. [16]

6. Discuss in detail with suitable diagrams how the speed of a 3 phase cage type Induction motor can be varied using A.C. voltage controllers. Also draw the various types of AC voltage controllers which are used for speed control of Induction motor. [16]

7. 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: When motor is operated in Dynamic breaking, with Braking resistance of 2 ohms
   (a) calculate Duty ratio of chopper for a motor speed of 600 rpm and breaking torque of twice the rated value
   (b) What will be the motor speed for a duty ratio of 0.6 and motor torque equal to twice its rated value? [16]

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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Code No: 07A70201 **R07** **Set No. 1**

IV B.Tech I Semester Examinations,November 2010
POWER SEMICONDUCTOR DRIVES
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare the performance of VSI & CSI fed.IM drives.Mention advantages & Disadvantages. [16]

2. With neat block diagram explain closed loop operationo of synchronous motor drives. [16]

3. Derive relation between Speed torque, duty ratio and armature current of a D.C series motor using chopper control under
   (a) Motoring mode
   (b) Regenerative braking. [16]

4. With neat sketch and necessary waveforms explain how continuous current operation is obtained with single phase full controlled converter fed to D.C series drive. Also derive output current and voltage expressions. [16]

5. What are the modifications can be suggested for improving the power factor of the slip energy recovery scheme. Explain the principle of operation solid state (Commutatorless Krammer) drive. [16]

6. Discuss briefly the various methods of controlling the speed of the 3 Phase Induction motor from stator side using solid state converters. [16]

7. (a) Explain with circuit diagram, the speed control of separately excited D.C. motor using fully controlled single-phase bridge converter. Show how 2-quadrant of drive is made possible.
   (b) A 220 Volts, 960rpm, 13 Amps separately excited d.c. motor has armature resistance of 2 ohms. It is fed from a single-phase half controlled rectifier with an a.c.source of 230 volts, 50HZ. Assuming continuous conduction, calculate motor torque for $\alpha = 60^o$ and speed 600 rpm. [8+8]

8. A dc motor driven from a 3 phase full converter draws a dc line current of 60 A with negligible ripple.
   (a) Sketch the line voltage taking it zero crossing and becoming positive at wt=0.Also sketch line current and thyristor current for a firing angle of 150^0.
   (b) Calculate average and rms values of thyristor current.

(c) Compute power factor at ac source.

(d) For motor constant of 2.4 and R_a of 0.5Ω.calculate the motor speed. [16]

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Code No: 07A70201 **R07** **Set No. 3**

IV B.Tech I Semester Examinations,November 2010
POWER SEMICONDUCTOR DRIVES
Electrical And Electronics Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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

2. 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]

3. The speed of a 25 HP 380V 1800 rpm separately excited dc motor is controlled by a three phase semi controlled converter and is fed from a 415V, 50 hz supply .motor parameters are Ra=0.9Ω, La=10mh.Ka=50.Calculate the speed of the motor at a torque of 50 Nm when the converter is fired at 45^0. Neglect losses. [16]

4. A dc series motor fed from 400 V source through a chopper has the following parameters. R_a=0.05Ω R_s=0.07Ω k= 0.005 Nm/amp
The average armature current of 200 A is ripple free. For a chopper duty cycle of 50 % Determine
   (a) input power from the source
   (b) motor speed.
   (c) motor torque. [16]

5. Discuss in detail about the stator voltage control scheme of Induction motor. Draw and explain the speed torque curves pertaining Stator voltage control. [16]

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

7. 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]

8. (a) Why a self controlled mode is free from hunting oscillations?
   (b) When operating in true synchronous mode, why the frequency must be changed in small steps? [8+8]

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