Reg. No. : | | | | | | | | | | | | |

J 3224

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Sixth Semester

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Common to B.E. (Part-Time) Fifth Semester Regulation 2005)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Write down the fundamental torque equation of motor-load system.

2. Give the condition to be satisfied to operate a motor in regenerative braking mode.

3. Write down the speed torque equation of dc separately excited motor fed drive.

4. Write down the advantages of chopper fed drives.

5. State the applications of induction motor drives controlled by ac voltage controllers.

6. Write down the consequences of increasing the frequency of induction motor without a change in the terminal voltage.

7. Define self control mode of synchronous motor.

8. State the advantages of permanent magnet synchronous motors.

9. Write the transfer function of converter.

10. What is the function of inner current control loop closed loop speed control system?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the mathematical condition for steady state stability analysis of equilibrium operating point. (8)

(ii) A motor drives two loads. One has rotational motion. It is coupled to the motor through a gear with $a = 0.1$ and efficiency of 90%. The load has a moment of inertia of 10 kg-m^2 and a torque of 10 N-m. Other load has translational motion and consists of 1000 kg weight to be lifted up at an uniform speed of .15 m/s. Coupling between this load and the motor has an efficiency of 85%. Motor has inertia of 0.2 kg-m^2 and runs at a constant speed of 1420 rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor. (8)

Or

(b) (i) Explain in detail with an example(low speed hoist), multiquadrant dynamics in the speed torque plane. (8)

(ii) Explain in detail regenerative braking of dc separately excited motor. (8)

12. (a) (i) Explain single phase fully controlled converter fed dc separately excited motor in discontinuous conduction mode with necessary waveforms and steady state analysis. (12)

(ii) A 200 V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate firing angle for rated motor torque and 750 rpm. (4)

Or

(b) (i) Explain the motoring mode operation of chopper fed dc motor. (8)

(ii) A 220 V, 960 rpm and 200 A separately excited dc motor has an armature resistance of 0.02 Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction,

(1) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.

(2) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm. (4 + 4 = 8)

13. (a) (i) Explain the speed control scheme of induction motor drive with stator voltage control and also state the disadvantages of this method. (8)

(ii) A 3 phase star connected, 60 Hz, 4 pole induction motor has the following parameters for the per phase equivalent circuit.

$R_s = R'r = 0.024\Omega$ and $X_s = X'r = 0.12\Omega$

The motor is controlled by the variable frequency control with a constant (v/f) ratio. For an operating frequency of 12 Hz, calculate the breakdown torque as a ratio of its value at the rated frequency for both motoring and braking. (8)

Or

(b) (i) Explain slip power recovery scheme of induction motor drives. (8)

(ii) Explain adjustable frequency constant air gap flux control method of speed control of induction motor drives. (8)

14. (a) (i) Explain open loop v/f control of synchronous motor drives. What is the need of delay circuit in open loop v/f control? (8)

(ii) A 5000 kW, 3 phase , 3.3 kV, 50 Hz, 0.8 (lagging) power factor, 4 pole, star connected synchronous motor has the following parameters : $X_s = 15\Omega$, $R_s = 0$. Rated field current is 10 A. Calculate armature current and power factor at half the rated torque and field current. (8)

Or

(b) (i) Explain self control of synchronous motor drive operated with constant margin angle control. (10)

(ii) Write brief notes on different types of permanent magnet synchronous motors. (6)

15. (a) (i) Derive the transfer function of dc motor load system with armature voltage control. (10)

(ii) Write down the approximate expressions with respect to converter selection and characteristics. (6)

Or

(b) Explain in detail the design of current controller of closed loop speed control system of dc separately excited motor. (16)

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T 3263

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Sixth Semester

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Common to B.E. (Part-Time) Fifth Semester Regulation 2005)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. How are loads classified?

2. What is meant by acceleration mode of an electric drive?

3. Write the expression for the average output voltage of a full converter fed dc drive.

4. What are the advantages in operating choppers at high frequency?

5. Name the methods of speed control applicable on the rotor side of a three phase induction motor.

6. State the advantages of closed loop systems.

7. What are the different modes employed to achieve variable frequency control in synchronous motors?

8. When can a synchronous motor be load commutated?

9. Give the transfer function relating speed and armature current of a dc motor.

10. What are the functions of feed back loops in an electrical drive?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Develop a criteria for evaluating the steady state stability of an electrical drive. (8)

(ii) A motor having a suitable control circuit develops a torque given by the relation $T_m = pw + q$ where p and q are positive constants. The motor is used to drive a load whose torque is expressed as $T_L = rw^2 + s$ where r and s are two other positive constants. The total inertia of the rotating masses is J.

(1) Determine the relation among p, q, r and s in order that the motor can start together with the load and have an equilibrium operating speed.

(2) Calculate the equilibrium operating speed. (8)

Or

(b) (i) Discuss the different modes of operation of an electrical drive. (8)

(ii) Explain the multiquadrant operation of an electric motor driving a hoist load. (8)

12. (a) (i) Explain using a power circuit the working of a single phase semi converter fed separately excited motor drive. (8)

(ii) A separately excited dc motor operating from a single phase half controlled bridge at a speed of 1400 rpm has an input voltage of 330 sin $314t$ and a back emf of 80 V. The SCR are fired symmetrically at $\alpha = 30°$ in every half cycle. The armature has a resistance of 4 ohms. Calculate the average armature current and the motor torque. (8)

Or

(b) (i) Describe DC shunt motor can be made to both run as a motor and operate in the braking mode using a chopper. (8)

(ii) A dc shunt motor fed from 400 V dc source through a chopper has the following parameters. Ra = 0.02 ohms $R_f = 0.04$ ohms $k = 5 \times 10^{-3}$ Nm/Amp^2. The average armature current of 300 Amps is ripple free F or a chopper duty cycle of 50% determine

(1) Input power from the source,

(2) Motor speed and

(3) Motor torque. (8)

13. (a) (i) Discuss how the speed of a three phase induction motor can be controlled by varying the frequency of the applied voltage. (5)

(ii) Draw the speed torque characteristics of the motor with constant supply voltage and variable frequency. (3)

(iii) A three phase 400 V, 15 kW, 1440 rpm 50Hz star connected induction motor has rotor leakage impedance of (0.4 + j1.6) ohms. The stator leakage impedance and rotational losses are assumed negligible. If the motor is energised from a 120 Hz, 400 V, 3 phase source, then calculate

(1) the motor speed at rated load

(2) the slip at which maximum torque occurs and

(3) the maximum torque. (8)

Or

(b) (i) Explain using a power circuit the working of a static Kramer drive system. (6)

(ii) A 420 V 50 Hz 6 pole star connected slip ring induction motor speed is controlled by a static Kramer drive. The effective phase turns ratio from rotor to stator is 0.7 and the transformer phase turns ratio from low voltage to high voltage is 0.5. Losses in diode rectifier, inductor , inverter and transformer were neglected. The load torque proportional to speed squared is 275 N - M at 900 rpm. For a motor operating at 750 rpm calculate

(1) Rotor rectified voltage

(2) Inductor current,

(3) Delay angle of the inverter

(4) Efficiency if the inductor resistance is 0.02 ohms and stator and rotor resistances are 0.01 and 0.03 ohms respectively. (10)

14. (a) (i) Explain the control characteristics of an open loop V/f controlled synchronous motor. (8)

(ii) A 7 mw three phase 12 KV star connected 6 pole 50 Hz 0.9 readings power factor synchronous motor has X_s = 10 ohms and $R_s = 0$. The rated field current is 40 Amps. The machine is controlled by variable frequency control at constant V/f ratio upto the base speed and at constant V above base speed. Determine

(1) Torque and

(2) The field current for the rated armature current 750 rpm and 0.8 leading power factor. (8)

Or

(b) (i) Show that the torque of a synchronous motor is independent of speed, when it operates in the controlled current mode. (8)

(ii) Explain using a power circuit, the working of a trapezoidally excited permanent magnet synchronous motor, operating in the self controlled mode. (8)

15. (a) Discuss using a diagram the operation of a closed loop scheme for speed control of a dc motor, below and above the base speed. (16)

Or

(b) (i) Derive the transfer function of the speed controller. (8)

(ii) Explain how the converter power output and the controller characteristics are related. (8)

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R 3344

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Common to B.E. (Part–Time) Fifth Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the principle of regenerative braking?

2. Draw the complete speed – torque curve of induction motor.

3. Is a sine – wave output current possible from a chopper circuit.

4. What are the two types of current controllers used in motor drive system?

5. Write any two applications of slip – power recovery drives in induction motors.

6. What is the meaning of voltage – fed inverter locomotive drive with parallel machines?

7. Write any two applications of synchronous motor drives.

8. Write any four special features of self – controlled synchronous machine.

9. What is current controller and how it is represented in the form of simple equation?

10. Write the transfer function equation for a D.C. motor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw the typical speed – torque characteristics of D.C. shunt motor, D.C. series motor, 3 phase induction motor. (8)

(ii) Explain the principle of regenerative braking used in four – quadrant industrial drives. (8)

Or

(b) (i) Explain the concept of steady state stability condition in industrial drives. (8)

(ii) Write equations governing D.C. motor load dynamics. (8)

12. (a) Discuss the control circuit design for a two – quadrant chopper circuit. (16)

Or

(b) Evaluate the instantaneous steady–state armature current and electromagnetic torque including harmonics for continuous current conduction mode for a chopper controlled d.c. motor drive. (16)

13. (a) (i) Explain with diagrams a speed control system of a Kramer drive and its typical performance for a three phase induction motor. (8)

(ii) Derive the relationship between stator voltage and stator frequency and draw corresponding graphs for a three phase induction motor. (8)

Or

(b) (i) Explain with diagrams a minimal closed loop control system of a current – fed inverter system and its performance characteristics. (8)

(ii) Describe with a diagram the open loop volts/Hz control of an induction motor. (8)

14. (a) Draw the open loop volts/Hz speed control of multiple PM synchronous motors and volts/Hz speed control characteristics in torque – speed plane. (16)

Or

(b) Explain the special features of self – controlled synchronous motor with diagram and write the differences between this and a d.c. motor. (16)

15. (a) Draw and explain a close loop speed control system of a BLDM drive with the inverter operating in PWM feed back mode. (16)

Or

(b) Explain with diagram a control schematic of the four – quadrant d.c. motor drive. (16)

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Question Paper Code : Q 2219

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Sixth Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Common to B.E. (Part – Time) Fifth Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is passive load torque?

2. Mention the factors to be considered to select a motor to drive the load.

3. What is TRC?

4. How is continuous conduction mode of motor drive obtained?

5. What is meant by slip power recovery system?

6. What are the three regions in the speed-torque characteristics of the induction motor?

7. What are the characteristics of self controlled mode operated synchronous motor?

8. What are the different modes of control that exist in a synchronous motor on a variable frequency supply?

9. What are the advantages of closed loop control of dc drives?

10. Draw the characteristics of maximum torque and power limitations of dc drives operating with combined armature voltage and field control.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail the multi quadrant dynamics in the speed-torque plane. (8)

(ii) Explain the principle of regenerative braking used in four- quadrant industrial drives. (8)

Or

(b) (i) Explain the concept of steady state stability condition in Industrial drives. (8)

(ii) Discuss the different modes of operation of an electrical drives. (8)

12. (a) (i) Explain the steady state analysis of the single phase fully controlled converter fed separately excited DC motor drive. (10)

(ii) Speed of a separately excited dc motor is controlled by means of two 3 ϕ full converters one in the armature circuit and the other in the field circuit and both are fed from 3 ϕ, 400 V, 50 Hz supply. Resistance of the armature and field circuits are 0.2 Ω and 320 Ω respectively. The motor torque constant is 0.5 V.S/A-rad. Field converter has zero degree firing angle delay. Armature and field currents have negligible ripple. For rated load torque of 60 N-m at 2000 rpm, Calculate the rated armature current. (6)

Or

(b) (i) Explain the four quadrant operation of the chopper. (8)

(ii) A dc chopper is used to control the speed of a separately excited dc motor. The dc voltage is 220 V, R_a = 0.2 Ω and motor constant $k_e\phi$=0.08 V/rpm. The motor drives a constant load requiring an average armature current of 25 A, Determine.

(1) The range of speed control.

(2) The range of duty cycle.

Assume–continuous conduction. (8)

13. (a) (i) Explain in detail, closed loop control of 3ϕ VSI fed induction motor. (8)

(ii) A 3ϕ, 56 kW, 4000 rpm, 460 V, 60 Hz, 2 pole star connected induction motor has the following parameters : $R_s = 0$, $R_r = 0.28\ \Omega$, $X_s = 0.23\Omega$, $X_r = 0.23\,\Omega$ and $X_m = 11\,\Omega$. The motor is controlled by varying the supply frequency. If the break down torque requirement is 70 Nm. Calculate

(1) The supply frequency and

(2) The speed W_m at the maximum torque. (8)

Or

(b) (i) Explain the principle of operation of static Scherbius system. (8)

(ii) A 3-phase, 4 pole, 50 Hz slip ring Induction motor when fully loaded, run with a slip of 4%. Find the value of the resistance necessary in series per phase of the rotor to reduce the speed by 15%. Assume that the resistance of the rotor per phase is 0.5 ohm. (8)

14. (a) Explain the closed loop control of synchronous motor with neat block diagram. (16)

Or

(b) Draw the open loop volts/Hz speed control of multiple PM synchronous motors and volts/Hz speed control characteristics in torque-speed plane. (16)

15. (a) With a block diagram discuss the operation of a closed loop scheme for speed control of a dc motor, below and above the base speed. (16)

Or

(b) Write short notes on :

(i) Converter selection and characteristics

(ii) Field weakening mode control.

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Question Paper Code : R 3697

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Seventh Semester

Electrical and Electronics Engineering

EE 432 — SOLID STATE DRIVES

(Regulation 2001)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. List the types of loads.

2. What are the functions of a power modulator?

3. When varying speed by field flux control, flux must be varied in small steps only. Why?

4. List any four applications of dc drives.

5. Draw the speed-torque characteristics of a 3ϕ induction motor.

6. What are the advantages of CSI fed drives?

7. Why is the power factor of the slip power recovery scheme of speed control of induction motor low?

8. What is plugging?

9. What is the basic difference between true synchronous mode and self control mode for variable frequency control of synchronous motor?

10. Suggest a drive for gyroscope motors used in aerospace applications.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What do you understand by constant torque drive and constant power drive?

(ii) State essential parts of electrical drives. Write a note on speed sensing devices. (8 + 8)

Or

(b) What are the main factors which decide the choice of electrical drive for a given application?

12. (a) Explain the chopper control of separately excited dc motors to operate in motoring and braking operations.

Or

(b) Explain closed loop speed control scheme of dc drives with a block diagram.

13. (a) Explain the Voltage Source Inverter (VSI) fed induction motors drive operated as (i) stepped wave inverter (ii) PWM inverter.

Or

(b) Explain the closed loop speed control of CSI fed induction motor drives.

14. (a) Explain the static rotor resistance control scheme for an induction motor and compare with the conventional rotor resistance control method.

Or

(b) Write notes on : (4 × 4 = 16)

(i) Harmonics

(ii) Soft starter

(iii) Multimotor drives

(iv) Hunting.

15. (a) Explain the variable frequency control of multiple synchronous motors.

Or

(b) Describe the operation of brushless dc motor drive and its applications.

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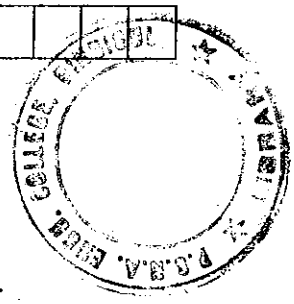


Question Paper Code : C 1261

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Sixth Semester

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Regulation 2004)

(Common to B.E. (Part-Time) Fifth Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What are the three modes of operation for electric drive?

2. What is dynamic torque?

3. Draw the characteristics of torque and power limitations of dc drives operating with combined armature of field control.

4. Give the conditions under which the DC motor operates under continuous current mode.

5. Why is the speed control of a 3ϕ induction motor with constant supply voltage and reduced supply frequency not preferred?

6. Draw the basic block diagram of closed loop drive.

7. Why is a self-controlled synchronous motor free from hunting operation?

8. What is meant by margin angle of commutation in the control of synchronous motors?

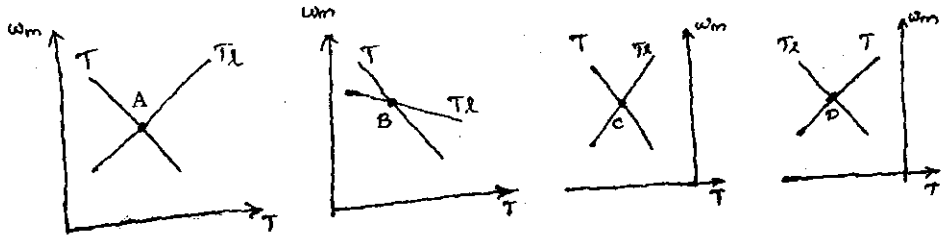
9. What is field weakening mode control?

10. What are the advantages of closed loop speed control?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the mathematical condition for steady state stability of equilibrium point. (6)

(ii) Based on the mathematical condition, examine the stability equilibrium points given in Fig. (10)



Or

(b) (i) Explain in detail the multi quadrant dynamics in the speed-torque plane. (8)

(ii) A drive has following parameters : J = 10 kg-m^2, T = 100 – 0.1 N, N-m. Passive load torque T_l = 0.05 N, N-m where N is the speed in rpm. Initially the drive is operating in steady state. Now it is to be reversed. For this motor characteristic is changed to T = –100 – 0.1 N, N-m. Calculate the time of reversal. (8)

12. (a) Explain in detail the operation of 3ϕ fully controlled converter fed dc drive with neat waveforms for $\alpha = 30°$ and $\alpha = 140°$. (16)

Or

(b) (i) Explain the operation of Four-Quadrant chopper. (8)

(ii) A chopper used for ON and OFF control of a dc separately excited motor has supply voltage of 230 V, T_{ON} = 10 ms, T_{OFF} = 15 ms. Neglecting armature inductance and assuming continuous conduction of motor current. Calculate the average load current when the motor speed is 1500 rpm, has a voltage constant $K_v = 0.5$ V/rad/sec. The armature resistance is 2Ω. (8)

13. (a) (i) With an aid of a neat diagram, explain the operation of static scherbius system for slip power recovery scheme. (8)

(ii) Explain the principle of operation and drive strategy of constant air gap flux control of induction motors. (8)

Or

(b) (i) With CSI fed induction motor and compare CSI drive with VSI drives. (10)

(ii) At 50 Hz the synchronous speed and full load speed are 1500 rpm and 1370 rpm respectively. Calculate the approximate value speed for a frequency of 30 Hz and 80% of full load torque for inverter fed induction motor drive. (6)

14. (a) (i) Explain the operation of self controlled synchronous motor. (8)

(ii) Explain power factor control of synchronous motor with relevant vector diagrams. (8)

Or

(b) (i) Explain open loop control of synchronous motor with constant v/f ratio. (8)

(ii) Explain the operation of trapezoidal permanent magnet ac motors. (8)

15. (a) (i) Derive the transfer function for DC separately excited DC motor. (12)

(ii) What is the need of PI controller in speed control loop and write the transfer function of PI controller. (4)

Or

(b) (i) Give the design procedure of speed controller. (8)

(ii) Explain in detail about converter selection and characteristics. (8)

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Question Paper Code : B 4610

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Seventh Semester

Electrical and Electronics Engineering

EE 432 — SOLID STATE DRIVES

(Regulation 2001)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give the classification of electric drives.

2. What are the advantages of solid state drives?

3. What is Time Ratio Control?

4. What is the role of current feedback in the closed loop speed control scheme of a dc motor?

5. What is the reactive power due to harmonics in single phase AC voltage controller fed drive?

6. What are the influences of the type of load on a ac motor drive?

7. Give the expression for Torque of a static rotor resistance controlled three phase induction motor.

8. Where are closed loop control schemes of induction motors preferred?

9. List the demerits of the rotor resistance control using SCR switching with external resistance.

10. Show the slip power recovery scheme for slipping ring induction motor. Offer both sub–synchronous and super–synchronous range of speeds.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Give in brief the different types of loads. (4)

(ii) Explain in detail constant HP and constant torque operations. (6)

(iii) Explain the regenerative braking in separately excited DC motor. (6)

Or

(b) (i) Explain in detail the criteria for selection of drives. (6)

(ii) Develop an expression for power rating of an electric motor when it is intermittently loaded. (10)

12. (a) (i) Draw the power circuit diagram, mode diagrams, waveforms of terminal voltage and armature current of a single phase semiconverter fed DC series motor drive working in the continuous current mode. (6)

(ii) Develop a relation between its speed and torque. (4)

(iii) The speed of a 15 HP 220 V 1000 rpm dc series motor is controlled using a single phase half controlled bridge converter. The combined armature and field resistance is 0.2 ohms. Assuming continuous and ripple free motor current determine the motor current and motor torque for a firing angle of 30°, if the speed is 1000 rpm and $K = 0.03$ N–M/Amp^2. The ac supply voltage is 250 V. (6)

Or

(b) (i) A dc chopper is used to control the speed of a separately excited dc motor. The dc supply voltage is 220 V. The armature resistance is 0.2 ohms and the motor constant $K_a\phi = 0.08$ V/rpm. The motor drives a constant torque load requiring an average current of 25 A. Determine the range of speed control and the range of duty cycle. Assuming the motor current to be continuous. (6)

(ii) Describe the working of a two quadrant chopper fed separately excited DC motor drive. (10)

13. (a) (i) A three phase squirrel cage induction motor drives a blower type load. The no load rotational losses are negligible. Show that the rotor current is maximum when the motor runs at a slip equal to 1/3. Find the expression for maximum rotor current. (8)

(ii) Derive an expression for the torque of an inverter fed three phase induction motor when it is operated with v/f control. Show that the maximum torque remains unaltered in this scheme. (8)

Or

(b) (i) Explain the mechanical characteristics of a three phase induction motor with stator current control. (8)

(ii) A 400 V 4 pole 50 Hz three phase star connected induction motor has $r_1 = 0, x_1 = x_2 = 1$ ohm, $r_2 = 0.4$ ohm, $x_m = 500$ ohms. The induction motor is fed from

(1) a constant voltage source of 231 volts per phase and

(2) a constant current source of 28 Amps. For both the cases calculate the slip at which maximum torque occurs and the starting and maximum torques. (8)

4. (a) (i) Explain using a power circuit how static rotor resistance control serves to vary the speed of a three phase slipring induction motor. (7)

(ii) Bring out its advantages and limitations. (3)

(iii) Derive the expression for torque of the induction motor, when it is working in above scheme. (6)

Or

(b) (i) Draw and explain the slip power recovery scheme applicable for three phase slipring induction motors. (8)

(ii) Show how the above scheme can offer both subsynchronous and super synchronous ranges of speed. (4)

(iii) Compare slip power recovery scheme with rotor resistance control. (4)

5. (a) (i) Describe the self control of synchronous motor fed from VSI. Discuss about the separately controlled synchronous motor fed from VSI. (12)

(ii) Compare the above two schemes. (4)

Or

(b) (i) Explain the closed loop control scheme of adjustable speed synchronous motor drive. (10)

(ii) Write a brief note on brushless excitation. (6)

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G 0024

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010

SEVENTH SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

EE1403 SOLID STATE DRIVES

(REGULATION 2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the various power modulators used in electric drives?
2. Mention the three modes of operation of an electric drive.
3. Which converter are suitable for multiquadrant operation of DC motor?
4. Draw the speed-torque curve of a dc series motor fed from as controlled rectifier.
5. List any four methods of starting of induction motor.
6. How is ac dynamic braking employed?
7. What do you mean by self control mode in synchronous motor?
8. Why a synchronous motor does not have starting torque?
9. Mention the special features of BLDC motor.
10. What is a stepper motor?

PART B — (5 × 16 = 80 marks)

11. Discuss in detail the thermal model of a motor for heating and cooling. (16)

Or

12. (a) Discuss briefly the factors involved in the selection of drives. (8)

    (b) Explain briefly the eight standard classes of motor duty. (8)

13. A 200 V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50Hz. Assuming continuous conduction, calculate

(a) Firing angle for rated motor torque and 750 rpm.

(b) Firing angle for rated motor torque and (–500) rpm.

(c) Motor speed for $\alpha = 160°$ and rated torque. (16)

Or

14. Explain in detail the chopper control of separately excited dc motor under

(a) Motoring mode and

(b) Regenerative breaking mode. (16)

15. Explain in detail the static rotor resistance control in induction motor. (16)

Or

16. Draw and explain the working of static scherbius drive. (16)

17. (a) State and explain the role of damper winding in a synchronous motor. (8)

(b) Write short note on cycloconverter fed synchronous motor. (8)

Or

18. Discuss in detail the principle of self control in voltage source inverter fed synchronous motor. (16)

19. (a) Compare the permanent magnet stepper motor with variable reluctance motor. (8)

(b) Discuss the advantages and disadvantages of using stepper motor. (8)

Or

20. With a neat diagram, diagram, describe the working of switched reluctance motor. (16)

Reg. No. : | | | | | | | | | | | |

Question Paper Code : 42189

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2010.

Sixth Semester

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Regulation 2004)

(Common to B.E. (Part-Time) Fifth Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define steady state stability in drive characteristics.

2. What is meant by Regenerative braking?

3. What is the discontinuous conduction mode of a separately excited DC motor drive?

4. Define Time ratio control of a Chopper fed DC drives.

5. What is slip power recovery scheme?

6. What are constant volt / frequency control?

7. What is Self control of Synchronous motor?

8. Define Marginal angle control.

9. What is field weakening mode control for drives?

10. What is speed feedback?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the mathematical condition for steady state stability of electrical drives. (8)

(ii) Explain the multi quadrant operation of a motor with a suitable application. (8)

Or

(b) (i) Describe the dynamics of motor load system. (8)

(ii) Explain the typical load torque characteristics of electrical drives. (8)

12. (a) Explain with circuit diagram and waveforms the operation of a single phase fully controlled converter fed separately excited DC motor. (16)

Or

(b) (i) Describe with neat diagrams the operation of a four quadrant chopper. (10)

(ii) Discuss the two methods of Time ratio control. (6)

13. (a) Explain the slip power recovery scheme with a neat diagram. (16)

Or

(b) (i) Describe the closed loop speed control of Voltage source inverter drives. (8)

(ii) Explain the working of a Current source inverter fed drives with a neat diagram. (8)

14. (a) (i) Describe the open loop voltage / Hz speed control scheme of synchronous motor. (8)

(ii) Discuss the Marginal angle control scheme with a neat diagram. (8)

Or

(b) (i) Explain the self controlled mode of operation of synchronous motor. (8)

(ii) Describe the working of a Permanent Magnet synchronous motor. (8)

15. (a) (i) Describe with necessary diagrams the design of speed controller. (8)

(ii) Describe briefly the converter selection and characteristics. (8)

Or

(b) (i) Describe with necessary diagrams the design of current controller. (8)

(ii) Describe the closed loop speed feedback control scheme. (8)

Reg. No. : | | | | | | | | | | | |

H 0120

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2011

SEVENTH SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

EE1403 SOLID STATE DRIVES

(REGULATION 2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention any two factors upon which the choice of an electrical drive depend?

2. What is the use of prioriding feedback loops in an electrical drive?

3. What is a Dual Converter?

4. Compare the controlled rectifier fed dc drive with ward Leonard system.

5. Write the various methods of braking of induction motor.

6. Mention the drawbacks of an induction motor drive fed from a stepped wave inverter.

7. Name the commonly used synchronous motors.

8. What is the advantage of using cycloconverter in synchronous motor drive.

9. Mention few applications of BLDC motor.

10. List the advantages of switched reluctance motor.

PART B — (5 × 16 = 80 marks)

11. (a) Enumerate the advantages of using electrical drives. (8)

(b) A motor operates on a periodic duty cycle in which it is clutched to its load for 10 min and declutched to run on no-load for 20 min. Minimum temperature rise is 40°C. Heating and cooling time constants are equal and have a value of 60 min. When load is declutched continuously the temperature rise is 15°C. Determine,

(i) The maximum temperature during the duty cycle.

(ii) Temperature when the load is clutched continuously. (8)

Or

12. Discuss in detail about the various power modulators used in electric drives. (16)

13. A 200V, 875 rpm, 150A separately excited dc motor has an armature resistance of 0.06Ω and armature circuit inductance of 2.85 mH. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50Hz. For a firing angle of $\alpha = 120°$ and T = 1200 N – m Determine.

(a) The average output voltage

(b) The armature current

(c) Back emf

(d) Speed

(e) The conduction is continuous or discontinuous. (16)

Or

14. (a) Draw neatly the schematic diagram of closed loop dc drive. Explain the scheme for the speed control below and above the base speed. (8)

(b) Briefly explain dynamic braking of separately excited dc motor by chopper control. (8)

15. Discuss in detail the various methods of starting of induction motor. (16)

Or

16. (a) Write short notes on stator voltage control. (8)

(b) Explain the operation of CSI fed induction motor. (8)

17. (a) Explain briefly the power factor control and V- curves of a synchronous motor. (8)

(b) Write short notes on cycloconverter fed synchronous motor. (8)

Or

18. Discuss in detail the principle of operator of self control in VSI fed synchronous motor drive. (16)

19. (a) Discuss the important features of a stepper motor. (8)

(b) With a neat diagram briefly explain the working principle of permanent magnet stepper motor. (8)

Or

20. Draw neatly the switched reluctance motor. Explain its operation and control requirements. (16)
