STUCOR

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

UNIT I INTRODUCTION **8**

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

QUESTION BANK

UNIT I INTRODUCTION

PART-A:

1. Define continuous rating of a motor. (may/june2006)
2. What is meant by overload current capability I of motor? (may/june2006)
3. What is meant by electrical drive? .(Nov/Dec2007)
4. Draw the block diagram of an electrical drive system .(Nov/Dec2007) (Nov/Dec2009) (Nov/Dec2015)*
5. Give any two factors that influence the choice of electrical drives. (Nov/Dec2009) (apl/may2011) (Nov/Dec2015)
6. State the advantage of Electric Drive.(apl/may2010)
7. Give the formulae for computing power requirement for a liner movement. (apl/may2010)
8. Explain heating and cooling curves. (apl/may2011)
9. Define cooling time constant of an electrical machine. (Nov/Dec2012)
10. Name the four commonly used methods for the determination of power rating of motors. (Nov/Dec2012)
11. What are the types of electric drives. (Nov/Dec2015)

PART-B

1. Show the relationship between temperature rise and time is an exponential function. [8 MARKS] (May/june2006)
2. At full load of a 10 H.P. the temperature rise of a motor is 25°C after one hour and 40°C after two hours. Find (1) the final temperature rise on full load (2) heating time constant of motor (3) half hour rating if iron losses which remain constant are 80% of copper losses at full load. [8 MARKS] (may/june2006)
3. Explain different types of electric drives and its applications to industry. (Nov/Dec2007)

4. What are the different classes of motor duty and explain in detail? (Nov/Dec2007) (Nov/Dec2009) (apl/may2010) (Nov/Dec2015)*
5. Drive the expression for a thermal of model of motor for heating and cooling. Also draw the heating and cooling curve(Nov/Dec2009) (Nov/Dec2015)
6. Briefly explain the various factors that will influence the choice of an electrical drive. (apl/may2010)
7. Explain the method of estimating equivalent continuous power rating of a motor for short time load applications. (apl/may2010)
8. The temperature rise of motor after operating for 30 minutes on full load is 20ºC and after another 30 minutes it becomes 30ºC on the same load. Find the final temperature rise and time constant. (Apl/may2010). (Apl/may2011).
9. Define heating and cooling time constants. How the thermal rating of the motor is defined? (apl/may2011)
10. Explain how the rating of the motor is determined working on a given duty cycle.(8) (Apl/may2011).
11. Based on the rms torque, estimate the KW rating of a 750 rpm motor used for driving equipment having the following load torque curve.
    (1) For the first 10 seconds, the torque is constant at 40 kg-m.
    (2) For the next 30 seconds, the torque varies linearly with time from 35 kg-m to 15 kg-m.
    (3) For the last 50 seconds, the torque is constant and equal to 10 Kg-m. (8)(Apl/may2011).
12. Explain what is meant by a group drive. What are its advantages and disadvantages?(8) (Nov/Dec2012)
13. The enclosure of a 10 KW motor is equivalent to a cylinder of 70 CM diameter and 100 cm length. The motor weight 500 Kg assuming that the specific heat is 700 J/Kg/ºC and that the peripheral surface of the enclosure of the motor alone is capable of heat dissipation of 12.5 $W/m^2/ºC$. Calculate the heating time constant of the motor and its final temperature rise. Assume the efficiency of the motor as 90 percent (8). (Nov/Dec2012)
14. Show that, for an electric motor, the relationship between temperature rise and time is an exponential function.(8) (Nov/Dec2012)
15. A motor has a thermal heating time constant of 45 minutes. When the motor runs continuously on full load, its final temperature
16. Define an electric drive and describe the classification of electric drives. (8) (Nov/Dec2015)
17. Explain the selection of motor power rating for different loading conditions. (8) (Nov/Dec2015)

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

PART-A

1. Draw the speed torque variation of a type of load. (may/june2006)
2. What are the braking methods employed in a dc separately excited motor? (may/june2006)
3. Draw the mechanical characteristics of DC series motor. (Nov/Dec2007)
4. Define plugging in three phase induction motor.(Nov/Dec2007)
5. Draw the speed torque characteristics of DC series motor. (Nov/Dec2009)
6. What is the need of starter in DC motor drives? (Nov/Dec2009)
7. Write down the torque equation of a DC shunt motor and give the significance of flux. (apl/may2010)
8. A 6-pole, 3-phase induction motor operation on a 50Hz supply has rotor emf frequency as 2 hz. Determine (i) slip (ii) the rotor speed. (apl/may2010)
9. Draw the speed torque characteristics of
    a. Dry friction load
    b. Viscous friction load
    c. Fan type load
    d. Constant power load. (Apl/may2011).
10. Discuss briefly about counter-current braking of DC Shunt Motor. (Apl/may2011).
11. Write down the equation for the back e.m.f of DC motor in terms of flux per pole and speed. (Nov/Dec2012)
12. List the types of single phase induction motors. (Nov/Dec2012)
13. A 220V, Dc shunt motor having the armature current of 10A, runs at 1500 rpm. Find the armature current if the source voltage drops to 150V. Assume the load torque as constant. (Nov/Dec2015)
14. What are the different methods of braking of DC series motor? (Nov/Dec2015)
15. Draw speed-torque characteristics of constant torque and constant power type load. (Nov/Dec2015)
16. Draw torque-armature current characteristics of D.C shunt motor.

PART-B

1. Establish the basic characteristics of the dc machines from the fundamental equations pertaining to dc machines.(8) (may/june2006)
2. How does the change in supply voltage affect the separately excited motor and Fluctuations in load torques affect the series motor? (8) (May/june2006)
3. From the speed torque relations, derive an expression for maximum torque for an induction motor. (8) (may/june2006)
4. Discuss any two methods for modifying the speed torque characteristics of a 3 phase induction motor. (8) (may/june2006)
5. What are the different electrical braking methods used in electrical drives? Explain any one method applied to DC shunt motor. (Nov/Dec2007)

6. Draw and explain the torque – speed characteristic of three phase induction motor with necessary equation. (Nov/Dec2007) (Nov/Dec2009)
7. Explain the different method of braking of a DC motor drive with a neat sketch. (Nov/Dec2009)
8. Explain the plugging and regenerative braking in 3 phase induction motor. (Nov/Dec2009)
9. From electrical characteristics, derive the mechanical characteristics of DC series motor. (apl/may2010)
10. Explain the dynamic braking of DC shunt motor with the required diagram and equations. (apl/may2010)
11. Derive the speed-torque characteristic of 3-phase slip ring induction motor. (apl/may2010)
12. Explain the principle operation of capacitor start and run 1-phase Induction motor. (apl/may2010)
13. Draw the modified speed torque characteristics of a 3 phase induction motor with variation of supply frequency and discuss in detail. (Apl/may2011).
14. A 220 V DC Shunt motor has an armature resistance of 0.5 Ohms and takes a current of 40A on full load. By how much must be the main flux is reduced to raise the speed by 50% if the development torque is constant. (Apl/may2011).
15. Explain the necessary diagrams the difference between regenerative braking and dynamic braking with DC Shunt motor.(8) (Apl/may2011).
16. A 400V DC Shunt motor takes full load armature current of 150A and has an armature resistance of 0.1Ohm. It is braked by plugging while running at 500 RPM. Calculate the value of the resistance to be placed in series with the armature to limit the initial current to 200A and initial value of braking torque(8) (Apl/may2011).
17. Explain the four quadrant operation in motor drives. (16) (Nov/Dec2015)
18. Discuss the dynamic braking of Dc shunt motor. (8) (Nov/Dec2015)
19. Describe the speed-torque characteristics of DC shunt and DC series motor with neat sketch. (8) (Nov/Dec2015)
20. Explain mechanical characteristics of DC series and DC compound motor.(16) (Nov/Dec2015)
21. With a diagram explain regenerative and dynamic braking of electric motor. (16) (Nov/Dec2015)

UNIT III STARTING METHODS 8

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

PART-A

1. Why DC series motor should not be started on no-load? (may/june2006)
2. What are the different types of protection provided in the starter used for a 3- phase induction motors? (may/june2006)
3. Why a starter is necessary for a DC Motor? .(Nov/Dec2007) (Nov/Dec2009) (Nov/Dec2012) (Nov/Dec2015)

4. Name the various types of starters commonly used for starting an induction motor. .(Nov/Dec2007).
5. How the starting current is limited in three phase induction motor using star – delta starter? (Nov/Dec2009)
6. List various methods of starting of DC series motor.
7. Why are centrifugal switches provided on many 1-phase inductions motor? (apl/may2010)
8. Draw the block diagram of soft starter for an induction motor. (apl/may2010)
9. What is the necessity of a starter for DC shunt motor? (Apl/may2011).
10. Draw the circuit diagram of a star-delta starter of 3 – phase induction motor. (Apl/may2011).
11. What is the advantage of three phase slip ring induction motor? (Nov/Dec2012)
12. Mention the advantages of four point starter over three point starters. (Nov/Dec2015)

PART-B

1. Explain why a dc shunt motor cannot normally be switched straight on to the supply and requires a starter.(4) (may/june2006)
2. Draw a neat diagram of the 4-point starter used for a DC shunt motor.(12) (may/june2006) (apl/may2010)mention the advantage over a three point starter. (Nov/Dec2015)
3. Derive the expression for the ratio of starting to full load torque for direct online switching of an induction motor.(8) (may/june2006)
4. Describe a method for starting a slip ring induction motor. (8) (may/june2006) (Apl/may2011). Explain with a diagram the rotor resistance starter type for 3-phase slip ring induction motor. (16) (Nov/Dec2015)
5. Describe the principle of starting of DC shunt motor using power and control circuit with neat circuit diagram. (16) (Nov/Dec2007).
6. What do you understand by the term soft start? Explain the soft start method employed for induction motor? (16) (Nov/Dec2007).
7. Explain the 3 point starter operation with a neat sketch. (16) (Nov/Dec2009). (Nov/Dec2015)
8. Explain the operation of a rotor rheostat starter for a 3 phase induction motor. (16) (Nov/Dec2009). (Apl/may2011).
9. Draw the control circuit for time limit acceleration DC shunt motor(4) (apl/may2010)
10. State the various starting methods of squirrel cage induction motor. Explain any two of them.(16) (apl/may2010)
11. Calculate the resistance steps of a 250V DC shunt motor starter. The resistance of the armature is 0.08 Ohm. The maximum current to be limited to 300A and minimum current to 180A.(8) (Apl/may2011).
12. A 3-phase, 400V, 50 Hz, 1420 RPM, 100A delta connected squirrel cage induction motor takes 8 times full load current and develops 2.2 times full-load torque at stand-still when started direct on-line. What will be the motor current and starting torque as a ratio of full load torque when the motor is started by star-delta starter?(8) (Apl/may2011).
13. Briefly explain the various types of starters used in 3Φ induction motor. (16) (Nov/Dec2015)

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

PART-A:

1. Specify the operating quadrants of a dc shunt motor fed by a fully controlled rectifier. (may/june2006)
2. What is meant by constant torque operation of a dc motor? (may/june2006)
3. What is static Ward-Leonard drive? .(Nov/Dec2007)
4. State the advantages of DC chopper drives. .(Nov/Dec2007)
5. What is meant by time ratio control in DC chopper? (Nov/Dec2009).
6. List the disadvantage of Ward Leonard method of speed control of DC motor. (Nov/Dec2009).
7. Compare the chopper control and phase control scheme for DC motor drives. (apl/may2010)
8. State the different methods of speed control of induction motor? (apl/may2010)
9. Draw the circuit diagram of a chopper controlled DC series motor drive. (Apl/may2011).
10. Draw the torque speed characteristics at different firing angle for a full converter feeding a separately excited DC motor. (Apl/may2011).
11. Enumerate the limitations of field control in DC motors. (Nov/Dec2012)
12. What is DC chopper? (Nov/Dec2012)
13. List the applications of chopper fed DC drives. (Nov/Dec2015)
14. Write the disadvantages of armature resistance methods of speed control in DC shunt motor. (Nov/Dec2015)
15. What is armature diverter speed control of DC series motor? (Nov/Dec2015)
16. How to control speed of DC shunt motor by armature control method? (Nov/Dec2015)

PART-B:

1. A 200V, 10.5A, 2000 rpm shunt motor has the armature and field resistances of 0.5ohms and 400ohms respectively. It drives a load whose torque is constant at rated motor torque. Calculate the motor speed if the source voltage drops to 175V. (may/june2006)
2. State the merits and demerits of rheostatic control method. (may/june2006)
3. Explain how duty ratio can be derived in DC choppers. (may/june2006)
4. Draw and discuss a speed control scheme of a separately excited dc motor using dc choppers. (may/june2006)
5. Discuss in brief various conventional methods of speed control of DC motors. (Nov/Dec2007)
6. Draw and explain some of the commonly used controlled rectifier circuits for DC drive. (Nov/Dec2007)
7. Explain the operation of a single phase fully controlled rectifier fed DC separately excited motor. Use a neat sketch.(16) (Nov/Dec2009).
8. Explain the Ward-Leonard method of speed control of DC separately excited motor use a neat sketch. (16) (Nov/Dec2009).(8) (Apl/may2011). (Nov/Dec2015)*

9. Explain the operation of armature control of DC shunt motor(8) (apl/may2010)
10. Draw and explain the four quadrant speed control of DC motor using various choppers. (apl/may2010)
11. With the block diagram explain the operation of armature and field control of DC motor drive using controlled rectifier(12) (apl/may2010)
12. Name the different flux control methods adopted for DC series motor.(4) (apl/may2010)
13. A 250V, 10KW, 1200 RPM DC shunt motor has a full load efficiency of 80 percent. It's field and armature resistances are 110 Ohms and 0.25 Ohms respectively. Calculate the value of the resistance to be inserted in series with the armature and the power lost in the armature circuit to reduce the speed to 80 percent when the load torque is constant regardless of the speed.(8) (Apl/may2011).
14. Explain in detail the operation of a speed control of a DC series motor fed by a single phase semi-converter for the continuous motor current. Draw relevant circuit diagram and waveforms.(16) (Apl/may2011).
15. A 220V, 1200 rpm, 1Φ full converter fed separately excited DC motor having a armature resistance and current of 0.25Ω and 40 A respectively. For the delay angle of 30°, find the speed of the motor. Consider motor constant, $K_a\Phi$=0.18N/rpm(48 (Nov/Dec2015)
16. Explain the voltage control strategies employed in DC chopper drives. (8) (Nov/Dec2015)
17. A 220V, Dc shunt motor having field flux of 0.8Wb, runs at a speed of 900 rpm. Find the speed of the motor, if the field flux reduced by 0.6 Wb by field resistance control methods. (4) (Nov/Dec2015)
18. With a circuit explain speed control strategies of DC motor using first quadrant chopper. (16) (Nov/Dec'15)

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 10

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

PART-A:

1. How is speed control achieved by voltage/frequency control in a 3 phase induction motor?(may/june2006) (Nov/Dec2015)
2. What is meant by slip power recovery scheme? (may/june2006)
3. Mention some of the merits and demerits of ac drives.(Nov/Dec2007)
4. What is meant bv v/f control? (Nov/Dec2007)
5. List the drawbacks of stepped wave inverter fed 3 phase induction motor? (Nov/Dec2009)
6. Specify the dominant application of induction motor. (Nov/Dec2009)
7. Why stator voltage control is suitable for speed control of induction motor in fan and pump drives? (Nov/Dec2009)R2004
8. Why is a slip power recovery scheme suitable mainly for drives with a low speed range? (Nov/Dec2009)R2004
9. What is advantage of V/F speed control of Induction Motor? .(april/may2010)(nov/dec2012)

10. Draw the block diagram of speed control scheme for a slip ring Induction motor. .(april/may2010)
11. Explain the advantage of variable frequency induction motor drives. .(april/may2011).
12. Explain the importance of AC voltage regulator for speed control of 3 phase induction motor.(april/may2011)
13. Mention the advantage of slip power recovery scheme of controlling the speed of induction motor. .(april/may2012)
14. Name the power modulators (converters) used for V/F control of three phase induction motor.(nov/dec2013)
15. State the applications where stator voltage control is employed for three phase induction motors. (nov/dec2013)
16. What are the various speed control methods used in AC motors? (Nov/Dec2015)
17. What are the different types of slip power recovery scheme? (Nov/Dec2015)
18. State conventional methods of speed control of stator side of three phase induction motor. (Nov/Dec2015)

PART-B:

1. With a neat diagram discuss the speed control schemes of a 3 phase induction motor using AC voltage regulators. (may/june2006)
2. Discuss the effect of power injection into the rotor circuit on the speed and input PF of a three phase induction motor. (may/june2006)
3. Explain the method of speed control of three phase induction motor by
   a. Stator voltage control (8)
   b. Frequency control (8) (Nov/Dec2007)
4. Explain with neat sketch the static Kramer variable speed drive system used for slip power recovery(Nov/Dec2007)
5. Discuss the operation of a 3 phase AC voltage controller fed 3 phase induction motor.(6) (Nov/Dec2009)
6. With neat speed-torque characteristics explain the voltage/frequency control of 3 phase induction motor.(10) (Nov/Dec2009)
7. Explain the operation of two methods of static slip power recovery scheme to control speed of 3 phase slip-ring induction motor.(16) (Nov/Dec2009)
8. Explain the operation of speed control techniques employed for 3-phase squirrel cage induction motor.(16) (apl/may2010)
9. What is meant by slip power recovery scheme? Explain with the necessary diagram. (apl/may2010)
10. Explain the scherbius system of slip energy recovery schemes used in the speed control of large induction motor.(16)_ (Apl/may2011).
11. State and explain the various scheme adopted for speed control of induction motor using voltage source inverter.(16) (Apl/may2011).
12. Explain the rotor resistance control employed in 3 phase induction motor.(16) (Nov/Dec2015)
13. Explain the concept of slip power recovery scheme in static scherbius method of speed control of induction motor.(16) (Nov/Dec2015)
14. With a block diagram explain conventional Kramer system type slip power recovery scheme. (16) (Nov/Dec2015)

15. Explain voltage source inverter fed AC drive speed control of induction motor with circuit and its characteristics. (16) (Nov/Dec2015)