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Question Paper Code: 51338

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Third Semester

Chemical Engineering

15UEE324 - ELECTRICAL DRIVES AND CONTROL FOR CHEMICAL ENGINEERING

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The rating of motor to be selected from the view point of temperature rise depends on
 - type of starting
 - class of motor duty
 - type of speed control
 - none of these
- _____denotes a sequence of identical duty cycle each consisting of a period of operation at load and a period of no load.
 - Short time duty
 - Intermittent duty
 - Continuous duty, constant load
 - Continuous duty, variable load
- When R_2 is the rotor resistance, X_2 is the rotor reactance at supply frequency and s is the slip, then the condition for maximum torque under running conditions will be
 - $sR_2X_2 = I$
 - $sR_2 = X_2$
 - $R_2 = sX_2$
 - $R_2 = sX_2$
- In regenerative braking, above synchronous speed, the active power delivered back is proportional to the slip, the slip is
 - positive
 - negative
 - zero
 - none of these

5. Starters are used with DC motor because
- (a) these motors have high starting torque
 - (b) these motors are not self-starting
 - (c) back emf of these motors is zero initially
 - (d) to restrict armature current as there is no back emf while starting
6. When two DC series motors are connected in parallel, the resultant speed is
- (a) more than the normal speed
 - (b) less than the normal speed
 - (c) normal speed
 - (d) zero
7. In Ward-Leonard speed control, the lower limit of speed is imposed by
- (a) residual magnetism
 - (b) core losses of motor
 - (c) mechanical losses of motor and generator
 - (d) all the above
8. _____ conducts only due to the energy stored in inductance and output current flows in the load itself.
- (a) Thyristor
 - (b) Freewheeling diode
 - (c) Both (a) and (b)
 - (d) None of these
9. _____ method of speed control employs controlling the number of pulses.
- (a) Multiple stator winding
 - (b) Supply voltage control
 - (c) V/f control
 - (d) Adding rheostats in stator circuit
10. The speed control of AC drives involves
- (a) choppers
 - (b) inverters
 - (c) rectifiers
 - (d) both (a) & (c)

PART - B (5 x 2 = 10 Marks)

11. Mention different modes of operation of an electric drive.
12. What are the different methods of braking employed in electric motors?
13. In a 250 V DC motor, the starting current is to be limited to 25 A. Find the starting resistance required if the armature resistance is 0.05 Ω .
14. Why is field control method used only above rated speed?
15. Write the advantages of static Kramer system over static scherbius system?

PART - C (5 x 16 = 80 Marks)

16. (a) Derive an expression for a thermal model of motor for heating and cooling. Also draw its characteristic curves. (16)

Or

- (b) (i) Explain in detail, the various factors influencing the selection of an electric drive for a particular application. (8)
- (ii) Explain how the rating of motor is determined working on a given duty cycle. (8)
17. (a) (i) Draw and explain speed torque characteristics various types of loads with examples. (8)
- (ii) Explain with necessary circuit diagram, electric braking in DC series motor. (8)

Or

- (b) Draw and explain the construction and torque-speed characteristics of 3ϕ induction motor with necessary equations. Sketch the different regions of operation. (16)
18. (a) Explain in detail, different methods of starting for DC motors. (16)

Or

- (b) A delta connected, 400 V, 36 kW, and 750 rpm, squirrel cage motor takes a full load current of 50 A and has a full load slip of 4.5%. The impedance per phase is 2.5Ω . Determine the starting torque and the starting line-current if the motor is started by
- (i) Star-Delta starter
- (ii) DOL starter
- (iii) Autotransformer starter with 70% tapping (16)
19. (a) (i) A 230 V, 1200 rpm, 1ϕ , full converter fed separately excited DC motor having an armature resistance and current of 0.25Ω and 40 A respectively. For the delay angle of 30° , find the speed of the motor. Consider the motor constant, $K_a\phi = 0.18 \text{ V/rpm}$. (8)
- (ii) Explain the voltage control strategies employed in DC chopper drives. (8)

Or

- (b) (i) Discuss in detail, Ward Leonard method of speed control in DC shunt motor. (8)
- (ii) A 230 V DC shunt motor takes a current of 30 A on a certain load. The armature resistance is 1 Ω and the field circuit resistance is 230 Ω . Find resistance to be inserted in series with the armature to halve the speed if the load torque is constant. (8)
20. (a) Using speed-torque characteristics, explain how stator voltage change can be used for speed control of 3 ϕ induction motor. What are the drawbacks of this method of speed control? Briefly explain any two conventional methods of implementing stator voltage control. (16)

Or

- (b) Explain the constant torque mode and constant power mode of operation of VSI fed induction motor drive with necessary diagrams. (16)
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