

Electrical Drives & Their Control

P. Pages : 2

NKT/KS/17/7391

Time : Three Hours

0489

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Assume suitable data whenever necessary.
 9. Illustrate your answers whenever necessary with the help of neat sketches.
 10. Use of non programmable calculator is permitted.

- 1.** a) Explain the block diagram of an electric drive. **6**
- b) A 500 V, 45 kW, 600 rpm dc shunt motor has full load efficiency of 90%. The field resistance is 200Ω and the armature resistance of 0.2Ω . The field current is maintained constant. Armature reaction and brush drop is neglected. Calculate the rated armature current and hence the speed under each of the following conditions at which machine develops an electromagnetic torque equal to rated value :
- i) Regenerative braking - no external resistance.
 - ii) Plugging - external resistance of 5.5Ω inserted.
 - iii) Dynamic braking - external resistance of 2.6Ω inserted.

OR

- 2.** a) Discuss speed - torque characteristics of i) dc shunt motor, ii) 3 - phase induction motor, iii) synchronous motor. **6**
- b) A 25 Hp, 500 V, 4 - pole, 50 Hz induction motor with mesh connected stator takes a full load current of 30A and has slip of 4%. The impedance per phase is 3.5Ω . Calculate the starting torque and starting current taken from supply if the motor is started by i) DOL starter, ii) star delta starter, iii) auto-transformer with 70% tap. **8**
- 3.** a) What do you understand by load equilisation? Where do you find its applications? Derive the expression for moment of inertia of flywheel. **8**
- b) Define the following ratings of motor : **5**
- i) Continuous rating
 - ii) Short time rating

OR

- 4.** a) Derive the expression for temperature rise of motor under heating medium. **7**

- b) A 6 pole, 50 Hz, induction motor has a flywheel of 1200kg m^2 as moment of inertia. Load torque is 100 kg - m for 10 secs. No load period is enough for the flywheel to regain its full speed. Motor has slip of 6% at a torque of 50 kg - m . Find i) maximum torque exerted by the motor, ii) speed at the end of deceleration period. **6**
- 5.** a) What are the advantages of PLC over conventional electromechanical control circuits. **5**
- b) What are various methods of programming of PLCs? Explain ladder diagram with reference to PLC programming. **8**
- OR**
- 6.** a) Draw the block diagram of PLC. Explain functions of each block. **6**
- b) Explain in detail how the speed control of dc drive is possible using PLC. **7**
- 7.** a) Differentiate between DC contactors and AC contactors. **6**
- b) Explain the different methods of acceleration control used for controlling the closing of secondary accelerating contactors for 3ϕ Induction motor. **7**
- OR**
- 8.** a) Explain reversing of 3 - phase induction motor using contactor with neat diagram. **6**
- b) Explain in detail the arc interruption process in case of DC contactors. **7**
- 9.** a) Discuss the effect of unequal wheel diameters on the parallel operation of traction motor. **8**
- b) A train has maximum speed of 60 km/hr. The scheduled speed including a station stop of 30 secs is 40 km/hr. If the acceleration is 1.5 km/hr/sec. find the value of retardation when average distance between the stops is 3 km. **6**
- OR**
- 10.** a) Define : **7**
 i) Crest speed ii) Scheduled speed
 Discuss the factors which affect the schedule speed of train.
- b) Explain series parallel control of traction motor with diagram. **7**
- 11.** a) Explain analog and digital control of electric drives. **6**
- b) Draw the block diagram of digital control. Explain the algorithm for control. **7**
- OR**
- 12.** a) Give the advantages and disadvantages of digital control of electric drives. **5**
- b) Giving adequate reasons explain which type of electric motor could be used for following: **8**
 i) Rolling mills
 ii) Punching and Shears
 iii) Cranes
 iv) Lifts
