MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : EE-701

PUID : 07277 (To be mentioned in the main answer script)

ELECTRIC DRIVES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) During lowering of an overhauling load, braking takes place is

   a) regenerative braking b) dynamic braking

   c) plugging d) none of these.

   ii) The slip *s* for reversal of an induction motor is

   a) $s - 1$ b) $1 - s$

   c) $2 - s$ d) $1 - 2s$.

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iii) Starting current of a motor is kept low to

a) avoid excessive heating

b) safeguard the life of the motor

c) reduce the acceleration time

d) reduce the fluctuation in supply voltage.

iv) Advantage of PWM inverter over square wave inverter is

a) higher order harmonics are eliminated

b) lower order harmonics are eliminated

c) both order harmonics are introduced

d) none of the above.

v) To get speed higher than the base speed of DC shunt motor, the type of control used is

a) Armature voltage control

b) Field current control

c) Armature resistance control

d) None of these.

vi) Motors commonly used for drive in printer is a

a) stepper motor b) hysteresis motor

c) reluctance motor d) shaded pole motor.

vii) A single motor which actuates several mechanisms or machines is called a

a) Group drive b) Individual drive

c) Multimotor drive d) Active drive.

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viii) Average voltage output from a three-phase full controlled converter is

a) $(3V_m/\pi)\cos\alpha$

b) $(3V_m/2\pi)\cos\alpha$

c) $(3V_m/\pi)(1+\cos\alpha)$

d) $(V_m/3\pi)(1+\cos\alpha)$.

ix) The term 'slip power recovery' is associated with

a) DC Shunt motor

b) 3-phase cage rotor induction motor

c) 3-phase slip ring induction motor

d) both (b) and (c).

x) A typical active load is

a) Hoist b) Fan

c) Blower d) Pump.

xi) Zone of electric drive below base speed is

a) constant power zone

b) constant torque zone

c) constant voltage zone

d) none of these.

xii) Frequency of voltage generated by alternator having 4 poles and rotating at 1800 rpm is

a) 60 Hz b) 50 Hz

c) 120 Hz d) 7200 Hz.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What do you mean by electric drive ? What are the various factors that influence the choice of electric drives ?

3. What are the various factors that influence the choice of electric drives ?

4. Explain the methods to reduce the energy loss during starting.

5. Explain briefly the different components of load torque with their torque-speed characteristics.

6. Derive the heating characteristics of an electric motor. Define heating time constant.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Explain the operation of Ward-Leonard drive system with suitable diagram. Mention the advantages and disadvantages of it.

   b) Why the variable speed applications are dominated by DC drives ?

c) A 200V, 850 rpm, 150A, separately excited DC motor has an armature resistance of 0·06 Ω. It is fed from a single phase full controlled rectifier with a source voltage of 220V, 50Hz. Assume continuous conduction, calculate

i) firing angle for the rectifier for rated motor torque and 750 rpm and

ii) motor speed for firing angle of 160° at rated torque. 6 + 2 + 7

8. a) Discuss closed loop *V/f* control of induction motor drive mentioning its advantages.

b) What do you mean by self-controlled synchronous motor drive ? Explain in detail. 8 + 7

9. a) Explain what you mean by continuous and discontinuous conduction. What are the three intervals present in discontinuous conduction mode of single phase half and fully controlled rectifier ?

b) A 230V, 1200 rpm, 200A, separately excited DC motor has an armature resistance of 0·05Ω. Armature is fed from a three-phase dual converter with circulating current control. The available AC supply has line voltage of 440V, 50Hz. When motor operates in forward motoring mode, the converter *A* works as rectifier and converter *B* as inverter. Determine the firing angle for the converters *A* and *B* for (a) motoring operation at 90% motor torque and 900 rpm speed and (b) braking operation at 120% of rated motor torque and 1000 rpm speed. 7 + 8

10. a) How does the braking resistance control the dynamic braking torque in dc separately excited motor ? How to employ dynamic braking in dc series motors ?

b) Describe the operation of a four quadrant chopper fed separately excited DC motor drive. 8 + 7

11. Write short notes on any *three* of the following : 3 × 5

a) Three-phase Rectifier fed dc drive

b) Drive for paper mills

c) Solar and battery powered drive

d) Drive for textile mills

e) Buck-boost method of speed control of dc motor.