



# MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : PC-EE 701 Electric Drive

UPID : 007598

Time Allotted : 3 Hours

Full Marks : 70

*The Figures in the margin indicate full marks.**Candidate are required to give their answers in their own words as far as practicable*

## Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[ 1 x 10 = 10 ]

- (I) Why heating occurs in motor drives?
- (II) Which type of drive is used in Electric vehicles?
- (III) Which control mechanism is used to get speed higher than the base speed of a DC shunt motor ?
- (IV) what is meant by the VSCF drive?
- (V) What is the expression for step angle?
- (VI) How will you classify electric drives based on the method of speed control?
- (VII) A three-phase induction motor having a combination of a diode rectifier & line combination of diode rectifier & line commutated inverter in the rotor circuit can give speed \_\_\_\_\_ synchronous speed only.
- (VIII) What is meant by "short time rating of motor"?
- (IX) For the speed lower than the base speed of a DC shunt motor
  - a) armature voltage control is used
  - b) field control is used
  - c) armature resistance control is used
  - d) torque control is used.
- (X) The direction of mmf when a single phase supply is given to the stator of three phase induction motor is \_\_\_\_\_
- (XI) The Variable frequency control of induction motor is more efficient than stator voltage control. Why?
- (XII) Why is it necessary to operate a solar panel near the maximum power point?

## Group-B (Short Answer Type Question)

Answer any three of the following :

[ 5 x 3 = 15 ]

2. What are the advantages and disadvantages of ward Leonard method of speed control ? [5]
3. Write short notes on load commutated thyristor inverter on synchronous motor Drive. [5]
4. Why VVVF method of speed control of a three phase induction motor is preferable to the frequency control Method? [5]
5. What do you mean by group, individual and multimotor drives? [5]
6. Draw a neat circuit diagram of a four quadrant MOSFET chopper drive and explain regenerative control. [5]

## Group-C (Long Answer Type Question)

Answer any three of the following :

[ 15 x 3 = 45 ]

7. (a) Explain the principle of speed control of slip ring induction motors by slip power recovery. [ 7 ]
- (b) A three-phase bridge inverter is used to run a three-phase induction motor rated at 440V, 15A, and 1440 rpm. The maximum to minimum speed ratio required is 10:1 . Find the minimum and maximum dc input voltage for the inverter. The inverter is operated in 180 conduction mode. If this voltage is to be obtained from a three-phase full controlled bridge converter from 440V mains, calculate the firing angle as needed. [ 8 ]
8. (a) With the help of relevant characteristics and circuits explain the principle of braking while lowering a load by a dc motor [ 6 ]
- (b) A 220v,10 kW,1200 rpm dc shunt motor has full load efficiency of 85%. The field resistance and the armature resistance are 110  $\Omega$  & 0.25  $\Omega$ . Neglect rotational losses and armature reaction. Calculate the value of resistance required to be inserted in series with the armature to reduce the speed to 900 rpm when
  - i) load torque is constant regardless of the speed. [ 9 ]

- ii) the load torque is directly proportional to the speed.  
 iii) the load torque varies as the square of the speed
9. (a) Deduce the relationships necessary to obtain the heating & cooling curve of an electric motor [ 7 ]  
 (b) A motor has a thermal heating time constant of 50 minutes. When the motor runs continuously on full load, its final temperature rise is  $80^{\circ}\text{C}$ . [ 8 ]  
 I) what would be the temperature rise after 1 hour? if the motor runs continuously on full load?  
 II) How long will the motor take for its temperature to rise from  $50^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ ? if it is working at its 1-hour rating.
10. (a) Explain stator voltage control using an AC voltage controller for an induction motor with neat circuit diagrams. Draw the necessary wave forms. [ 7 ]  
 (b) Explain with neat diagrams, how a phase-controlled Cyclo-converter can be used to control the frequency and applied voltage to a synchronous motor to control its speed. Draw the necessary wave forms. [ 8 ]
11. (a) Explain the principle of Rheostatic braking of a dc separately excited motor [ 6 ]  
 (b) A 230V, 960 RPM, 200A separately dc motor has an armature resistance of  $0.02\Omega$ . The motor is fed from a chopper. The source voltage of 230V. The motor is now operated in dynamic braking with chopper control with a braking resistance of  $2\Omega$  [ 9 ]  
 i) Calculate the duty ratio of the chopper for a motor speed of 600 RPM and braking torque of twice the rated value  
 ii) What will be the motor speed for a duty ratio of 0.6 and motor torque equal to twice its rated torque

\*\*\* END OF PAPER \*\*\*

**<https://www.makaut.com>**  
**Whatsapp @ 9300930012**  
**Send your old paper & get 10/-**  
**अपने पुराने पेपर्स भेजे और 10 रुपये पायें,**  
**Paytm or Google Pay से**