DIPLOMA IN ELECTRICAL ENGINEERING (DELVI) / ADVANCED LEVEL CERTIFICATE COURSE IN ELECTRICAL ENGINEERING (ACELVI)

⬜⬜⬜⬜⬜ **Term-End Examination**

December, 2016

BIEE-030 : INDUSTRIAL DRIVES AND CONTROLS

Time : 2 hours   *Maximum Marks : 70*

Note : *Use of scientific calculator is permitted. Attempt any **five** questions. Question no. 1 is **compulsory**.*

1. Attempt the following objective type questions :   *7×2=14*

   (a) A single-phase fully controlled bridge converter is feeding a separately excited d.c. motor. Input voltage is $V_m \sin \omega t$ and firing angle is α. If the average current is I_0, then   2

   (i) $\dfrac{2 V_m}{\pi} \cos \alpha = RI_0 + E$

   (ii) $\dfrac{V_m}{\pi} \cos \alpha = RE_0 + E$

   (iii) $\dfrac{2 V_m}{\pi} \cos \alpha = E_0 - RI_0$

   (iv) $\dfrac{V_m}{\pi} \cos \alpha = E - RI_0$

(b) A chopper converts   2
   (i)   constant voltage d.c. into a.c.
   (ii) constant voltage d.c. into variable d.c.
   (iii) a.c. of one frequency into a.c. of another frequency
   (iv) constant voltage a.c. into variable d.c.

(c) The duty cycle of a step-down chopper is   2

   (i) $\dfrac{T_{on}}{T_{on} + T_{off}}$

   (ii) $\dfrac{T_{off}}{T_{on} + T_{off}}$

   (iii) $\dfrac{T_{on} + T_{off}}{T_{on}}$

   (iv) $\dfrac{T_{on} + T_{off}}{T_{off}}$

(d) A converter may operate in discontinuous conduction mode, if   2
   (i)   d.c. motor inductance is insufficient
   (ii) back emf of the d.c. motor is high
   (iii) trigger delay is large
   (iv) load on motor is heavy

(e) Freewheeling diode is useful when the load is   2
   (i)   resistive
   (ii) capacitive
   (iii) inductive
   (iv) None of the above

(f) Closed-loop control of electric drives   *2*

    (i) increases loading capacity

    (ii) decreases torque

    (iii) decreases power

    (iv) improves steady-state accuracy

(g) In a VSI, variable frequency supply is to be obtained from   *2*

    (i) a d.c. supply

    (ii) an a.c. supply

    (iii) Either (i) or (ii)

    (iv) Neither (i) nor (ii)

2. Explain the working of a single-phase semi-converter connected to a separately excited d.c. motor. Draw the input and output waveforms for discontinuous conduction and derive the expression for speed control.   *14*

3. A 220 V, 1500 rpm, 50 A separately excited motor with armature resistance of 0·5 Ω is fed from a 3-phase full converter. Determine the value of firing angle, when

(a) the motor is running at 1200 rpm, and

(b) the motor is running at – 800 rpm.

The motor terminal voltage equals rated voltage, when $\alpha = 0°$.   *14*

4. (a) Explain the operation of a chopper controlled separately excited d.c. motor. Derive the expressions for armature current and speed. *10*

   (b) Why does the back emf fluctuate with change in armature current when a d.c. series motor is controlled through a single-phase semi-converter? *4*

5. (a) Describe the principle of operation of a VSI fed induction motor drive. Draw the speed – torque characteristics. *7*

   (b) Explain the working of a cycloconverter fed induction motor drive. Draw proper waveshapes. *7*

6. (a) What are the advantages of closed-loop operation of electric drives? *7*

   (b) With the help of a block diagram, explain the operation of a closed-loop induction motor drive. *7*

7. Write short notes on any *two* of the following: *2×7=14*

   (a) Four quadrant operation of a chopper fed separately excited d.c. motor

   (b) Three-phase converter fed d.c. series motor

   (c) PWM control of induction motor drive