M.Tech. 3rd Semester

Examination, December–2018

ELECTRICAL POWER SYSTEMS ELECTIVE-III

Paper– MTEPS–301 (i)

Digital Control System

Time allowed : 3 hours] *[Maximum marks : 100*

***Note:** Attempt five questions in all.*

1. (a) Enumerate basic elements of a digital control system and show the block diagram representation of such a system. Also discuss briefly about functioning of these elements. 10

(b) Discuss the principle of signal conversion./Find the maximum conversion time to digitize a 1 – kHz sinusoidal signal $v(t) = V_m \sin wt$ to a 10- bit resolution. 10

2. (a) Obtain the inverse z-trasnform of the following:-

$$X(z) = \frac{z(z+2)}{(z-1)^2} \text{ and } X(z) = \frac{z^{-2}}{(1-z^{-1})^3} \quad 10$$

(d) Find the z transform of the following: 10

investigation of such systems. Why is R–H criterion not directly applicable in stability analysis of such system? 10

(b) Discuss Liapunov stability analysis of discrete time systems. 10

4. (a) Derive the necessary condition for the digital control system:

$X(k+1) = AX(k) + Bu(k)$

$Y(k) = (X(k)$, to be controllable. 10

(b) Explain the concept of controllability and observability of discrete time control systems. 10

5. (a) What are advantages of state variable method for analysis of digital control system? Show that the state variable model of a digital control system is given by : $x(k+1) = \phi(1)\, x(k) + Q(1)\, x(k)$

$C(k) = Dx(k) + E\, u(k)$, where all symbols have their usual meanings. 10

(b) Explain the method to find the state transition matrix through z - transform technique. 10

6. (a) What are state observers? State the necessary and sufficient condition for state observation. 10

(b) Discuss the working of a stepping motor and its control action. 10

7. If $G(s) = \frac{36}{s(s+6)}$ and $H(s) = 1$, find Rise time, peak time, peak overshoot and settling time. 20

8. Write notes on:-

(a) Single board controllers

(b) Digital signal processors

(c) Quantization error. 7+7+6