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BIEEE-009

B. Tech. VIEP ELECTRICAL ENGINEERING (BTELVI)

Term-End Examination

June, 2019

BIEEE-009 : DIGITAL CONTROL SYSTEM DESIGN

Time : 3 Hours *Maximum Marks : 70*

***Note** : Attempt any five questions. Each question carries equal marks. Use of scientific calculator is allowed.*

1. (a) Draw the block diagram of any closed loop control system and indicate the following on it : 7

   (i) Plant

   (ii) Command input

   (iii) Controlled input

   (iv) Actuating signal

   (v) Feedback element and control element

(b) A unity feedback control system has a forward transfer function $\frac{25}{s(s+6)}$. Find the resonant peak for the closed loop frequency response. 7

2. (a) Write the stepwise procedure to sketch the polar plot. Suitable example can be assumed to explain. 7

(b) Determine the stability of the system having the following characteristic equation : 7

$$2s^4 + 5s^3 + 5s^2 + 2s + 1 = 0.$$

3. (a) What are the various effects of adding a pole and a zero in the forward path for a second order system ? 7

(b) The characteristic equation of feedback control system is :

$$s^4 + 20s^3 + 15s^2 + 2s + k = 0.$$

Determine the range of 'k' for the system to be stable. 7

4. Sketch the Bode plot for the transfer function : 14

$$G(s) = \frac{1000}{(1 + 0.1s)(1 + 0.001s)}$$

Determine the following :

(i) Phase Margin

(ii) Gain Margin

(iii) Stability of System

5. For the given transfer function obtain state model : 14

$$G(s) = \frac{y(s)}{u(s)} = \frac{k}{s^3 + a_3 s^2 + a_2 s + a_1}.$$

6. (a) What are the basic elements of an "Industrial Automatic Controller" ? 7

(b) The closed loop transfer function is given by : 7

$$G(s) = \frac{s(s^2 + 9s + 19)}{s^3 + 7s^2 + 14s + 8}$$

determine the response of system for unit step input.

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

(a) Controllability and observability

(b) Dead beat controller

(c) Cascade compensators