

**DIPLOMA IN ELECTRICAL ENGINEERING
(DELVI)**

Term-End Examination

December, 2017

00292

BIEE-035 : CONTROL SYSTEMS

Time : 2 hours

Maximum Marks : 70

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

1. Write *True* or *False* :

$7 \times 2 = 14$

- (a) Open-loop control systems are costlier to build, and difficult to assemble.
- (b) Controlled output is the quantity which is required to be controlled at the desired level.
- (c) A ramp signal is a signal which changes with time gradually in a linear fashion.
- (d) When $\xi = 1$, for a second-order, closed-loop control system, it is known as over-damped system.
- (e) As per Routh's stability criterion, none of the coefficients of the characteristic equation should be missing or zero.

- (f) In a Bode plot, phase angle is plotted against frequency on a non-logarithmic scale.
- (g) Inertia of a servomotor is reduced by reducing the length and diameter of its rotor.

2. (a) Explain the elements of a feedback control system in detail, with a suitable example. 7
- (b) Find the transfer function for the system shown in Figure 1. 7

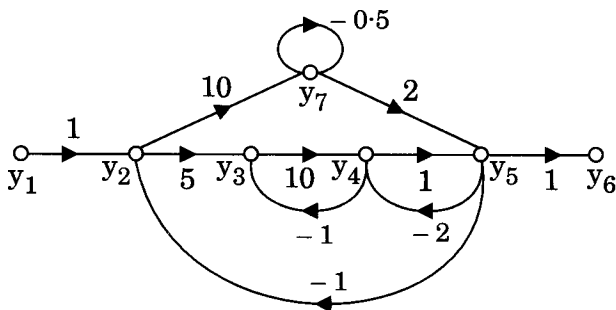


Figure 1

3. (a) The closed-loop transfer function of a unity feedback system is given by

$$\frac{C(t)}{R(t)} = \frac{10}{s^2 + 4s + 5}$$

Determine :

7

- (i) Damping ratio
- (ii) Natural undamped resonant frequency
- (iii) Percentage peak overshoot
- (iv) Expression for error response

- (b) The open-loop transfer function of a feedback control system is

$$G(s)H(s) = \frac{K(s+1)}{s(1+Ts)(1+2s)}$$

Determine K_p , K_v and K_a due to unit positional input if $K = 10$, $T = 4$ unit ramp input and unit parabolic input. 7

4. What is Steady State Response ? What happens to steady state error of a

(a) Type-0 system,

(b) Type-1 system, and

(c) Type-2 system for a unit ramp input ? 14

5. (a) Define Stability of a system. Where should the roots lie on s-plane for the system to be (i) stable, (ii) unstable, and (iii) marginally stable ? 7

(b) Sketch the Bode plot for the transfer function

$$G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

Determine the system gain K for the gain crossover frequency to be 5 rad/sec. 7

6. (a) Draw the schematic diagrams of PI, PD and PID controllers. Also write the equations relating to $u(t)$ and $e(t)$. 7
- (b) Sketch the polar plot of $\frac{1}{s}$ and $\frac{1}{s^2}$. 7
7. Write short notes on any *two* of the following : $2 \times 7 = 14$
- (a) Classification of Robots and Degree of Freedom
- (b) Role of Controllers in the Process Industry
- (c) Comparison of Stepper Motor with DC Servo Motor
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