

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: 141701**Date: 29/12/2012****Subject Name: Control Theory****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Give one example of an open loop stable system and open loop unstable system. Explain about stability of the system. **07**
- (b) Obtain mathematical model for one electrical system and one mechanical system. Obtain their transfer functions. **07**

- Q.2** (a) Explain about state space modeling and obtain state variable model for dc motor. **07**
- (b) Explain about time constant of first order and second order system. **07**

OR

- (b) Explain about signal flow graph with suitable example. **07**
- Q.3** (a) Find out the output response $c(t)$ of the transfer function shown below for the step input. **07**

$$\frac{C(s)}{R(s)} = \frac{5}{(s+1)}$$

Plot the step response on a graph paper

- (b) Explain about thermal system giving suitable example. Obtain its transfer function. **07**
- OR**
- Q.3** (a) For the second order system with transfer function as given below, obtain Maximum percentage overshoot M_p and peak time T_p . **07**

$$G(s) = \frac{4}{s^2 + 2s + 4}$$

- (b) Explain about liquid level system giving suitable example. Obtain its transfer function. **07**

- Q.4** (a) For the unity feedback control system with **07**

$$G(s) = \frac{K(s+15)}{s(s+2)(s+3)}$$

Determine the range of K for stability using R-H criteria

- (b) For a unity feedback control systems shown below, obtain steady state error for step input. **07**

$$G_1(s) = \frac{10}{s^2 + 14s + 50} \text{ and } G_2(s) = \frac{10}{s(s^2 + 14s + 50)}$$

OR

Q.4 (a) For the unity feedback control system with

07

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

Find the range of K for system that will cause the system to be stable, marginally stable and unstable. Make suitable comments.

(b) State and explain Nyquist Stability criteria. Explain about phase margin and gain margin using Nyquist plot. 07

Q.5 (a) Obtain root-locus plot for the unity feedback system with transfer function. 07

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

(b) Explain about integral action and derivative action on system performance. Can integral action be used alone ? 07

OR

Q.5 (a) Obtain gain crossover frequency and phase crossover frequency for the system having transfer function as shown below using Bode Plots. 07

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$$G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$$

(b) Explain with suitable example, one method for linearization of nonlinear mathematical model. 07
