

**B.Tech. (AEROSPACE ENGINEERING)  
(BTAE)**

**Term-End Examination**

**December, 2014**

00315

**BAS-020 : BASIC CONTROL THEORY**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt seven questions in all. Use of scientific calculator is permitted. All questions carry equal marks.*

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1. (a) The Laplace transform of the error signal in a control system is expressed by a relation

$$E(s) = R(s) \frac{s}{s^2 + 6s + 25}.$$

Calculate the steady state value of the error

if  $r(t) = t$ .

5

- (b) Compare open-loop and closed control system with suitable examples.

5

2. (a) Obtain a mechanical circuit diagram for the mechanical system as shown in Figure 1.

6

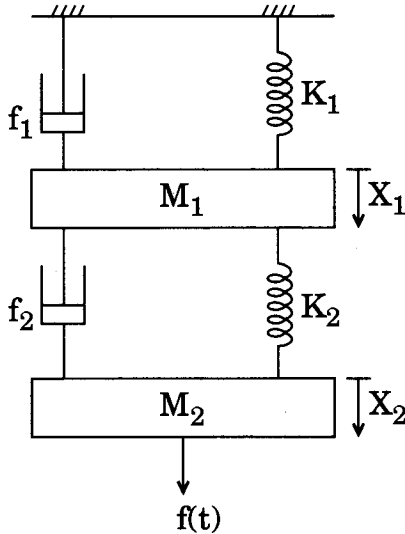


Figure 1

- (b) Draw the circuit diagram of a two phase AC servo-motor and its torque-speed characteristics.

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3. The overall transfer function of a control system is given by  $\frac{C(s)}{R(s)} = \frac{16}{s^2 + 1.6s + 16}$ .

It is desired that the damping ratio be 0.8. Determine the derivative rate feedback constant  $K_t$  and compare rise time, peak time, maximum overshoot and steady state error for unit ramp without derivative feedback control.

10

4. (a) Using Routh-Hurwitz criterion determine the relation between K and T so that unity feedback control system whose open-loop transfer function given below is stable.

$$G(s) = \frac{K}{s[s(s+10)+T]} \quad 5$$

- (b) Give an example of a feedback system with a pair of complex-conjugate poles and a finite zero. Discuss the effects of variation of the location of the zero relative to the poles. 5

5. Using Nyquist criterion investigate the stability of a closed-loop control system whose open-loop transfer function is given below :

$$G(s)H(s) = \frac{K}{s(sT_1+1)(sT_2+1)} \quad 10$$

6. (a) Write the salient features of root locus plot and also explain the procedure for plotting root locus. 6

- (b) Define the following terms : 4

(i) Phase margin

(ii) Gain margin

7. Sketch the Bode plot for the open-loop transfer function for the unity feedback system given below and assess stability.

$$G(s) = \frac{50}{(s+1)(s+2)} \quad 10$$

8. (a) Explain the working of AC servo-motors in control system. 5
- (b) Explain synchros and its types. 5
9. Write short notes on any *two* of the following:  $2 \times 5 = 10$
- (a) Proportional integral differential controller
- (b) Sensors and actuators
- (c) Static and dynamic variables
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