No. of Printed Pages : **4**

BAS-020

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B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2012

BAS-020 : BASIC CONTROL THEORY

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **seven** question in all. Question no.1 is **compulsory.** Use of scientific calculator is **permitted.** All the questions carry **equal** marks.*

1. Choose the correct or the best alternative in the following : **5x2=10**

(a) The system with the open - loop transfer function on $G(s) = \frac{1}{S}(1 + S)$ is :

(i) type 2 and order 1

(ii) type 1 and order 1

(iii) type 0 and order 0

(iv) type 1 and order 2

(b) Area under a unit impulse function is :

(i) infinity (ii) zero

(iii) unity (iv) none of these

(c) While forming Routh's array, the situation of a row of zeros indicates that the system :

(i) has symmetrically located roots

(ii) is not sensitive to variations in gain

(iii) is stable

(iv) unstable

(d) A system has 14 poles and 2 zeros. Its high frequency asymptote in its magnitude plot having a slope of :

(i) -40 d b/decade

(ii) -240 d b/decade

(iii) -280 d b/decade

(iv) -320 d b/decade

(e) A lay compensator is basically a :

(i) high pass filter

(ii) band pass filter

(iii) low pass filter

(iv) band elimination filter

2. Consider the closed - loop system as shown in Fig. 1. Determine the range of K for which the system is stable. **10**

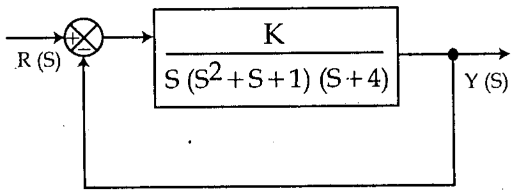

Fig. 1

3. A unity - feedback system is characterized by the open - loop transfer function. **10**

$$G(s) = \frac{1}{S(0.5S + 1)(0.2S + 1)}.$$

(a) Determine the steady - state errors to unit - step, unit ramp and unit parabolic inputs.

(b) Determine rise time, peak time, peak overshoot and settling time of unit - step response of the system.

4. Sketch the Nyquist plot for a feedback system with open - loop transfer function. **10**

$$G(s)H(s) = \frac{K(1 + 0.5S)(S + 1)}{(1 + 10S)(S - 1)} \quad ; K > 1$$

Find the range of values of K for which the system is stable.

5. Determine the stability of the system as shown in fig. 2 for the two cases : **10**

(a) k = 10 and

(b) K = 100 using Bode plots.

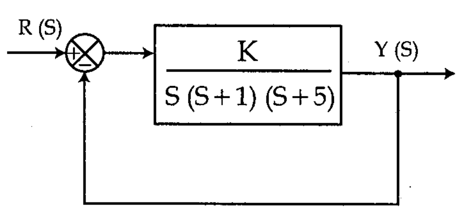

Fig. 2

6. Consider a feedback system with the characteristic equation : **10**

$$1+\frac{K}{S(S+3)(S^2+2S+2)}=0\ ;\ K\geq 0$$

sketch the root locus plot.

7. Define the following terms : **6+4**

(a) (i) bounded - input, bounded - output (BIBO) stability

(ii) asymptotic stability

(b) State the conditions under which asymptotic stablility of a linear time invariant system ensures BIBO stability and vice versa.

8. Consider a plant with transfer function. **10**

$$G(s)=2/S\,(S+1)\,(S+5)$$

Design a feedback system to meet the following specifications : velocity error as small as possible, damping ratio = 0.707, ts < 4.5 second.

9. Write short notes on **any two** of the following : **2x5=10**

(a) Gain Margin and Phase Margin

(b) Proportional integral Controller

(c) Actuators and Sensors