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B.TECH. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination, 2019

BAS-020 : BASIC CONTROL THEORY

Time : 3 Hours] **[Maximum Marks : 70**

Note : Attempt **any five** questions. Each question carries **equal** marks. Scientific calculator is permitted. Use of Graph / Semi-log papers are permitted.

1. A unity-feedback control system has an open-loop transfer function : [14]

$$G(s) = \frac{K}{s(s^2 + 4s + 13)}$$

Sketch the root-locus plot. Also determine the following :

(a) Angle of departure of root-loci from the poles.

(b) The value of K and the frequency at which the root-loci cross the jw axis.

2. The maximum overshoot for unity feedback control system having its forward path transfer function as $G(s) = \frac{K}{s(sT+1)}$ is to be reduced from 60% to 20%. The system input is a unit-step function. Determine the factor by which K should be reduced to achieve given reduction. [14]

3. Obtain the frequency response of the following system in a tabular form. The result should include magnitude, gain, phase-angle and frequency : [14]

$$G(s) = \frac{s(s+10)}{0.2s^2+3s+1.25}$$

4. Explain why a derivative controller cannot be used alone without any proportional or integral mode) to control a process. What is the procedure used to reduce the sensitivity of a derivative controller to signal noise ? [14]

5. A sinusoidal signal (0.1 sin 100t) is fed to PI controller. Determine the amplitude and the phase angle of the output signal; given that K_p = 10 and K_i = 0.01. [14]

6. Differentiate between open-loop and closed-loop

systems. Also sketch the Nyquist plot for the system with open-loop transfer function as : [6+8=14]

$$G(s)H(s) = \frac{K(4s+1)}{s(s+1)^4}$$

7. Write short notes on **any two** of the following : [7+7=14]

(a) Dynamics of stable and unstable systems

(b) Transducers, sensors and actuators

(c) Nyquist stability criterion

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