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BAS-020

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00173

December, 2016

BAS-020 : BASIC CONTROL THEORY

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) Explain the importance of Laplace and Fourier transforms in control theory. *6*

(b) Describe the dynamics of stable and unstable systems with the help of examples. *8*

2. (a) What do you mean by feedback control system ? Distinguish between open-loop and closed-loop control systems with the help of diagrams. *6*

(b) Define and explain the significance of phase margin and gain margin. How can you obtain the values of these margins from BODE plots ? 8

3. Determine whether the characteristic equations given below are having stable or unstable roots : 2×7=14

(a) $\lambda^3 + 6\lambda^2 + 12\lambda + 8 = 0$

(b) $2\lambda^3 + 4\lambda^2 + 4\lambda + 12 = 0$

4. Write short notes on the following : 2×7=14

(a) Routh-Hurwitz Stability Criterion

(b) Signal Conversion and Processing

5. (a) Explain the rules for graphical construction of root locus plot. 7

(b) How does addition of poles and zeroes affect the stability characteristic of a closed-loop system ? Explain. 7

6. (a) Determine the value of k such that the roots of the characteristic equation given below lie on the left of line $s = -1$: 7

$$s^3 + 10s^2 + 18s + k = 0$$

(b) Write a note on 'Proportional Integral Differential (PID) Controller'. 7

7. (a) Develop the transfer function of a control surface servo actuator for the servo based on an electric motor. *10*

(b) Explain the following terms : *4*

(i) Steady state error

(ii) Time delays

8. Sketch the Nyquist plot for the system having open-loop transfer function

$$G(s)\,H(s) = \frac{1 + 4s}{s^2(1 + s)(1 + 2s)}.$$ *14*