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BAS-020

B.Tech. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

00433 **December, 2018**

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) Determine the stability of the system whose characteristic equation is given by

$$2\lambda^3 + 4\lambda^2 + 4\lambda + 12 = 0.$$ *6*

(b) Differentiate between the following : *2×4=8*

(i) Classical and Modern Control theories

(ii) Stable and Unstable systems

2. (a) Given the 4^{th} order characteristic equation

$$\lambda^4 + 6\lambda^3 + 11\lambda^2 + 6\lambda + k = 0.$$

For what value of k will the system be stable ? *8*

(b) Describe in brief the PID Controller. *6*

3. Given the loop transfer function

$$G(s)\,H(s) = \frac{k}{s(s+3)(s+10)}.$$

(a) Sketch root locus plot for G(s) H(s).

(b) Add a simple pole, (s + 2), to G(s) H(s) and examine the resultant root locus.

(c) Add a simple zero, (s + 2), to G(s) H(s) and examine the resultant root locus. *14*

4. Define the following : *7×2=14*

(a) Transfer function

(b) Poles and zeroes

(c) Routh's criterion

(d) Root locus plot

(e) Compensator

(f) Gain and Phase margin

(g) Closed loop system

5. Write short notes on any ***two*** of the following : *2×7=14*

(a) Stability Augmentation

(b) Synchros

(c) Autopilot

(d) Sensors

6. (a) The single degree of freedom pitching motion of an airplane was shown to be represented by a second-order differential equation. The equation is given as

$$\ddot{\theta} + 0{\cdot}5\ \dot{\theta} + 2\ \theta = \delta_e$$

where θ and δ_e are in radians.

Estimate the time rise, peak overshoot and settling time for step input of the elevator angle of 0·1 rad. *10*

(b) Define peak overshoot and settling time. *4*

7. (a) Write a note on 'Computer Electronic Design Aspects'. *5*

(b) Explain forward path compensation with the help of an example. *4*

(c) Explain 'Roll Altitude Autopilot' with the help of an example. *5*