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Total No. of Pages : 03

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B.Tech. (ANE) (Sem.–6)

AUTOMATIC FLIGHT CONTROL

Subject Code : ANE-321

Paper ID : [A1227]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a) Distinguish between negative feedback *vs.* positive feedback closed loop system.

b) What is open loop control system? Explain with example.

c) How does the location of poles of a transfer function effects the stability?

d) Draw the block diagram of closed loop unity feedback system, clearly labeling transfer function, feedback control function, actuator dynamics and reference input.

e) Give example of a system, *i.e.* give transfer function which can be stabilized using integral control.

f) Explain the condition under which a polynomial is called '*Hurwitz*'.

g) What is peak time and rise time of a system?

h) Draw block diagram of displacement autopilot.

i) Explain the relation between automatic flight controls and instrument landing system.

j) How coordination can be obtained in eliminating sideslip turn?

SECTION-B

2. Distinguish between following types of systems, along with a typical governing equation of each type :

   a) SISO and MIMO.

   b) Linear and non-linear system.

3. Consider a first order system with governing equation as :

$$A\frac{dy(t)}{dt} + y(t) = u(t)$$

   Design a system with settling time of 2 seconds.

4. Transfer function of liner time invariant system is $\frac{s+2}{s+3}$. Calculate magnitude and phase of sinusoidal transfer function at frequency 2 rad/s.

5. The open loop transfer function of negative feedback closed loop system is :

$$\frac{k(s+4)}{(s^2+4s-6)}$$

   Where k is non-negative real valued parameter.

   a) How many asymptotes will be there?

   b) The point of intersection between asymptotes, (calculate all such points) Comment on break-in and break-out points if any.

6. In context of yaw orientation control system answer the following :

   a) Draw block diagram of the yaw orientation control system for toot locus analysis.

   b) Derive expression of transfer function of the same.

SECTION-C

7. A closed loop control with unity negative feedback system having governing equation as given below is designed using proportional controller :

$$\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} - 6y(t) = u(t)$$

   a) For what value of K_p above system will be stable.

   b) Calculate the steady state tracking error for unity step reference input.

8. For the given open loop transfer function :

$$G(s)H(s) = \frac{k}{(s+3)(s-1)}$$

Calculate :

a) Locate the parts of the real axis that lies on the real axis.

b) Determine the asymptotes of the root loci.

c) Determine the break-away and break-in points.

d) Sketch the root locus.

9. In context of pitch orientation control system answer the following :

a) Draw root locus for complete pitch orientation control system for low angles of attack.

b) Draw root locus for complete pitch orientation control system for high angles of attack.

c) Explain major differences between the same.