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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2022

CONTROL ENGINEERING

[Maximum Marks: **100**] [Time: **3** Hours]

PART-A

[Maximum Marks: **10**]

I. (Answer ***all*** questions in one or two sentences. Each question carries ***2*** marks)

1. Write any two advantages of closed loop control system.
2. Define Transfer function.
3. Define Order of a control system.
4. List any four test input signals.
5. Define gain margin. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

II. (Answer ***any five*** of the following questions. Each question carries ***6*** marks)

1. Write short note on Physical model and Mathematical model of systems.
2. State and prove Real Differentiation theorem.
3. Illustrate the basic elements in Mechanical Translational Systems.
4. Describe Mason's Gain formula.
5. Describe static error coefficients.
6. Write the characteristic equation of the second order control system and justify it.
7. Applying Routh -Hurwitz Criterion, determine the relation between K and T so that the unity feedback system whose open loop transfer function given below is stable.

$G(s) = K/s[s(s+6) +T]$ (5 x 6 = 30)

PART-C

[Maximum Marks: **60**]

(Answer ***one*** full question from each Unit. Each full question carries **15** marks)

UNIT – I

III. (a) Write short note on Laplace transform. (4)

(b) Obtain the solution of the differential equation.

$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = 0$; given x(0) = 0 and x'(0)=1 (6)

(c) State and prove Initial value theorem. (5)

OR

IV. (a) Derive the Laplace transform of

1) cos (at) 2) e^{-at} (8)

(b) Find the inverse Laplace transform of F(s) = 1/(s+3)(s^2+3s+2). (7)

UNIT – II

V. (a) Derive the transfer function of Mechanical rotational systems. (5)

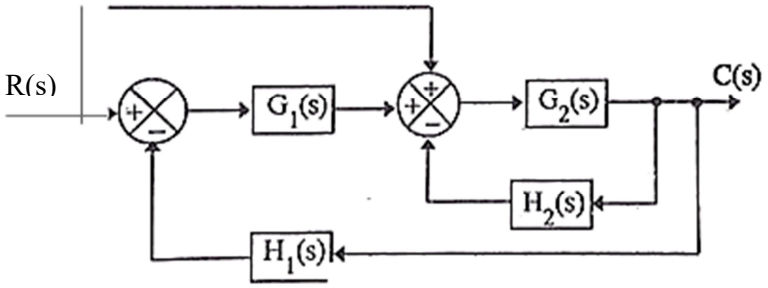
(b) State any six signal flow graph terms. (6)

(c) Derive the transfer function of positive feedback control system. (4)

OR

VI. (a) Describe Force-Voltage analogy. (8)

(b) Determine the overall transfer function of the block diagram shown in fig (l) by block diagram reduction rules.



(7)

Fig.1

UNIT- III

VII. (a) Obtain the time response of first order control system subjected to unit step input. (7)

(b) Obtain steady state error for a Type '0'system subjected to unit step and unit ramp input. (8)

OR

VIII. (a) Write short note on open loop transfer function of closed loop control system. (5)

(b) Define pole and zero. (3)

(c) Describe time response specifications of second order control system. (7)

UNIT - IV

IX. (a) Explain the steps for constructing root locus. (8)

(b) Obtain the bode plot for $G(s) = 1/(1+Ts)$ where G(s) is the open loop transfer function of a unity feedback control system. (7)

OR

X. (a) Determine the stability of the system whose characteristic equation is given by

$s^6+s^5+5s^4+3s^3+2s^2-4s-8=0$ (6)

(b) Sketch the root locus for the open loop transfer function

$G(s) = K/s(s+1)(s+3)$. (9)

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