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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER - 2025

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. Define Laplace transform.
2. List the basic elements used for modelling mechanical translational system and draw their symbols.
3. Define type number of a control system.
4. Define absolute and relative stability.
5. Prepare the first two rows of Routh 's array for the characteristic equation:

$$s^5 + 5s^4 + 6s^3 + 4s^2 + 2s + 5 = 0$$

(5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. Differentiate between open loop and closed loop control system.
2. Find the Laplace transform of the function: f(t) = cos at.
3. Derive an expression for the transfer function of RLC parallel circuit.
4. State and explain Mason's gain formula.
5. Define the following terms:
   i) Static position error constant.
   ii) Static velocity error constant.
   iii) Static acceleration error constant.
6. Explain Routh Hurwitz stability criterion.
7. List any six advantages of frequency response analysis. (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. State and prove final value theorem. (6)

b. Find the inverse Laplace transform of

$$F(s) = \frac{10(s^2 + 2s + 2)}{(s^2 + 9s + 20)}$$

(9)

OR

IV. a. Explain linear time invariant and linear time variant system. (6)

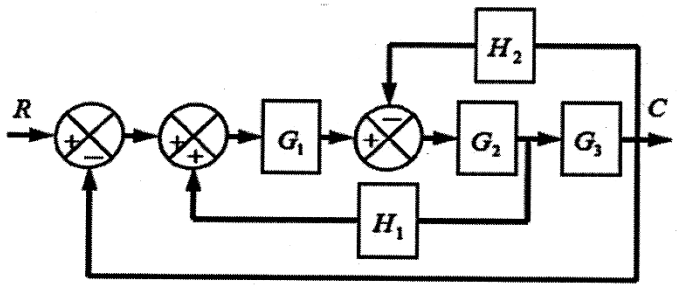
b. Solve the following second order equations by assuming zero initial conditions: (9)

$$x'' + 2x' - 5 = 0$$

UNIT – II

V. a. State any six block diagram reduction rules. (6)

b. Solve the following block diagram using block diagram reduction rules:

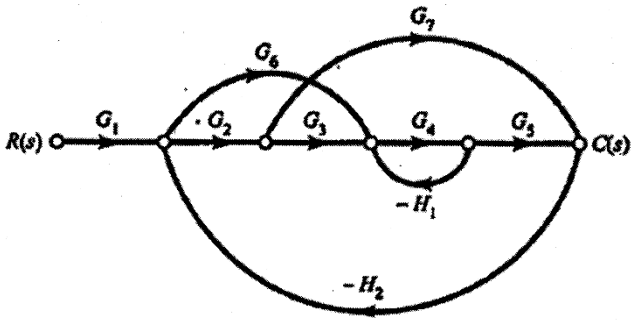


(9)

OR

VI. a. Describe Force-current analogy. (6)

b. Obtain the closed loop transfer function C(s)/R(s) of the signal flow graph by using Mason's gain formula. (9)



UNIT- III

VII. a. Explain the time domain specifications of a control system. (8)

b. Derive the time response of first order system for unit step input. (7)

OR

VIII. a. Explain the standard test inputs used in time response analysis with suitable graph. (8)

b. Derive steady state error for type-2 system for unit ramp input. (7)

UNIT - IV

IX. Plot the root locus of a unity feedback system whose open loop transfer function is:

$$G(s)H(s) = \frac{K}{s(s+1)(s+2)}$$

(15)

OR

X. a. Sketch the Bode plot for the transfer function:

$$\frac{C(s)}{R(s)} = \frac{1}{1+Ts}$$

(9)

b. Define the following terms:

i) Gain Margin, K_g

ii) Phase Margin, γ

iii) Resonant frequency, ω_r (6)

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