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A23- P0105

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2023

CONTROL ENGINEERING

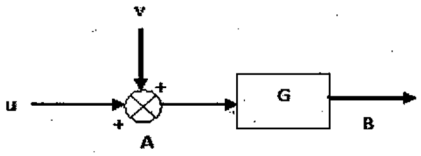
[Maximum Marks: **100**] [Time: **3** Hours]

PART-A

[Maximum Marks: **10**]

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

1. Define Linear time invariant system.
2. Define a pole.
3. Transfer the summing point from position A to position B.



4. Define steady state response.
5. Define a centroid in root locus. How a centroid is calculated. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. List any three advantages and disadvantages of closed loop control system.
2. Derive the transfer function of a simple mechanical translational system.
3. Derive the time response of a typical first order system subjected to ramp input.
4. List the steps to plot root locus.
5. Find the Laplace transform of $f(t)=e^{-at}$.
6. Define the following terms
   i) Damping ratio
   ii) Natural frequency
   iii) Under damped system
7. Explain any three of the standard test input signals with suitable graph. (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. Compare Open loop and Closed loop Control system (6 points each) (6)

b. Find the laplace inverse of $F(s)=\frac{(s+2)}{(s+1)(s^2+6s+10)}$ (9)

OR

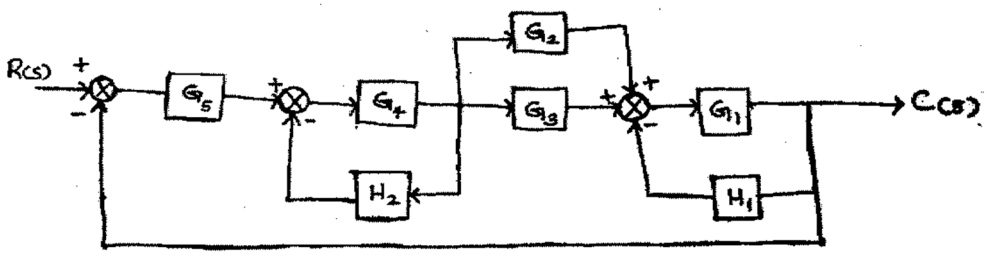
IV. a. State and prove initial value theorem. (6)

b. Solve the differential equation $\ddot{x} + 2\dot{x} + 4x = 3$ *given* $x(0) = 0, \dot{x}(0) = 0$ (9)

UNIT – II

V. a. State and explain Masons Gain Formula. (6)

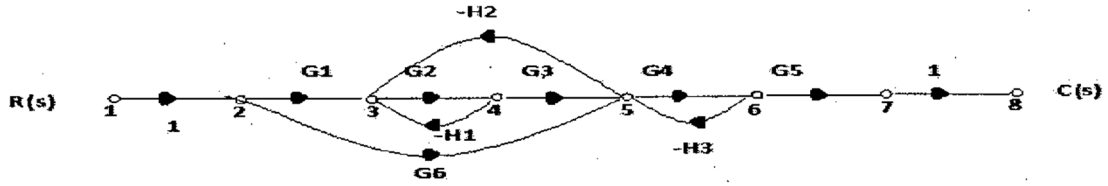
b. Find the overall transfer function of the given block diagram using block diagram reduction rules. (9)



OR

VI. a. Define analogous systems. List at least four analogous elements in force current analogy. (6)

b. Find the overall transmittance of the given signal flow graph. (9)



UNIT- III

VII. a. Explain Peak time and Maximum Overshoot and give the equations. (6)

b. For a unity feedback control system the open loop transfer function is $G(s)=\frac{(s+2)}{s^2(s+1)}$.

Find the velocity error constant and the steady state error when the input is unit parabolic signal. (9)

OR

VIII. a. The overall transfer function of a unity feedback system is given by $\frac{C(s)}{R(s)} = \frac{16}{s^2+4s+16}$

determine Rise time and Peak time. (6)

b. Determine the steady state error for a type 1 system subjected to

i) Step input

ii) Ramp input

iii) Parabolic input (9)

UNIT - IV

IX. a. Draw the bode plot for the transfer function $\frac{C(s)}{R(s)} = 1 + Ts$ (6)

b. Using Routh Criterion determine the stability of the system represented by the characteristic equation $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$. Comment on the location of the roots. (9)

OR

X. a. Explain

i) Phase cross over frequency

ii) Gain margin (6)

b. Plot the root locus of a unity feedback control system which has an open loop transfer function $G(s) = \frac{K}{(s+3)(s+5)}$ (9)

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