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

CONTROL SYSTEMS

[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. What is the Laplace transform of unit ramp signal?
2. Find L$\{e^{-2t}Cos3t\}$.
3. Define transfer function.
4. What is absolute stability?
5. Define root focus. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. Compare open loop & closed loop control systems.
2. Explain the types of test signals.
3. Describe force-voltage & force-current analogy.
4. Define:
   a) transmittance b) individual loop c) forward path of a signal flow graph
5. Using Routh criterion, determine the location of the roots of the following characteristics equation $s^4 + 3s^3 + 3s^2 + 2s + 1 = 0$. Also determine the stability of the system.
6. Calculate the angle of asymptotes and centroid for the control system having transfer function, G(s)H(s)=$\frac{K}{s(s+2)(s+4}$
7. Draw the bode plot for the open loop TF, G(s)H(s)=K for K=1, K$>1, K<1$

(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) Derive the transfer functions for the following functions: (6)

i) Cos at ii)e^{at} iii) t

(b) Find $L^{-1}\frac{2s^2-4}{(s+1)(s-2(s-3)}$ (9)

OR

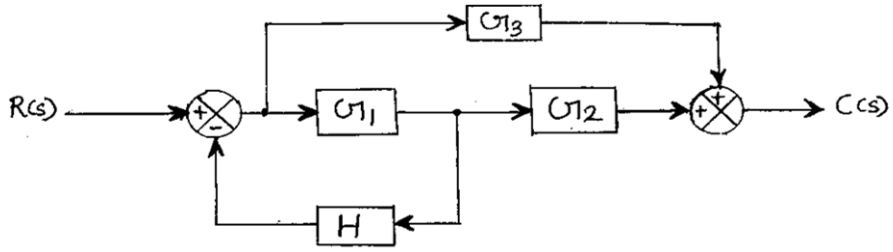
IV. (a) Explain the closed loop control system with block diagram. (6)

(b) Find the Laplace transform of the differential equation given below & Evaluate the time solution of the same. $y^{II} - y = e^{2t}$ given that $y(0^+) = 0\ y^I(0^+) = 1$ (9)

UNIT – II

V. (a) Derive the transfer function for the basic mechanical translational system. (6)

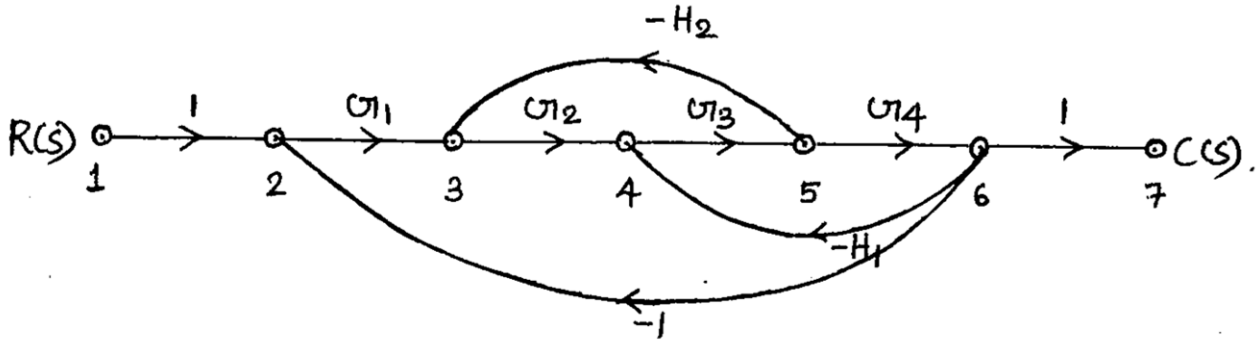
(b) Reduce the block diagram shown in figure & find C(s)/R(s). (9)



OR

VI. (a) Derive the transfer function of RLC series circuit. (6)

(b) Find the overall gain C(s)/R(s) for the signal flow graph given below. (9)



UNIT- III

VII. (a) For a unity feedback control system, the open loop transfer function, $G(s) = \frac{10(s+2)}{s^2(s+1)}$

Find the position, velocity, acceleration error constants. (6)

(b) Using Routh criterion, determine the stability of the following system.

$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ (9)

OR

VIII. (a) Find the response of first order system for unit ramp input. (6)

(b) Define steady state error & derive e_{ss} for type -0, type-1, type-2 system when the input is unit step. (9)

UNIT - IV

IX. (a) Find the magnitude and phase of the integral factor K/s & draw its bode plot. (6)

(b) Write procedure for constructing root locus of a control system. (9)

OR

X. (a) Sketch the root locus for G(s)=$\frac{K}{S(s+4)}$, $H(s) = 1$ (6)

(b) Define the terms:

i) gain margin ii) phase margin

iii) gain cross over frequency iv) phase cross over frequency. (7)

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