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

CONTROL ENGINEERING

[Maximum marks: 100] [Time: 3 Hours]

PART – A
Maximum marks: 10

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

1. Define Laplace transform.
2. Define transfer function of a control system.
3. Define the characteristic equation of a control system.
4. State the definition of absolute stability of a system.
5. Write the Laplace transform of 'At'. (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 and closed loop systems.
2. Describe the transfer function of mechanical translational system.
3. Describe unit step and ramp standard signals using neat figures.
4. Explain the three conditions of stability, marginal stability and instability in the first column of Routh Array.
5. Explain the Laplace transform of sinat and cosat.
6. Describe the impulse response of first order system.
7. List any four 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 the final value theorem of Laplace transform. (7)

(b) Obtain the inverse Laplace transform of the following transfer function, T(s)=5/s(s+2)(s+3) (8)

OR

IV. (a) Explain Linear time invariant systems with an example. (6)

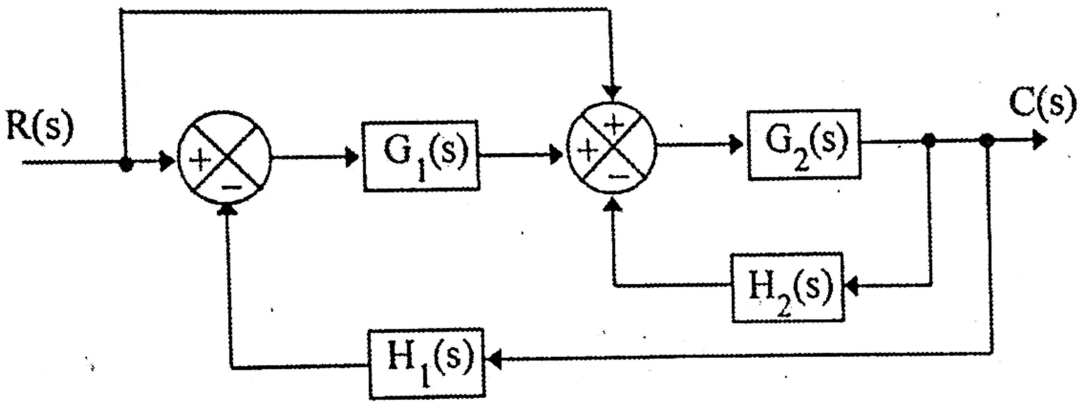
(b) Obtain the time solution of the differential equation

$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 12e^t$. Given that y(0+)=0 and y'(0+)=6 (9)

UNIT – II

V. (a) Derive the transfer function of series RLC circuit. (7)

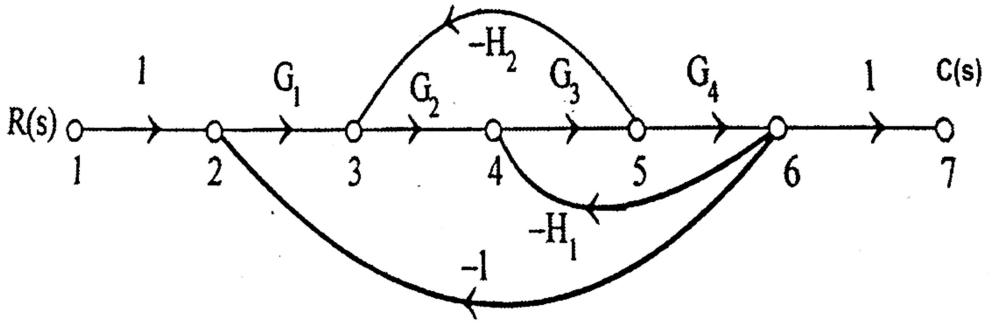
(b) Obtain the overall transfer function C(s)/R(s) for the block diagram. (8)



OR

VI. (a) Explain poles and zeros of transfer function with an example. (6)

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



UNIT - III

VII. (a) Describe the step response of a first order system with a neat figure. (7)

(b) Derive the expression for static error in terms of Kp, Kv, Ka for a type 1 system subjected to unit step and ramp inputs. (8)

OR

VIII. (a) Explain static position and static velocity error coefficient. (6)

(b) Obtain the step response of an underdamped second order system. (9)

UNIT – IV

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

(b) With necessary steps draw the bode plot of the function

G(s)= 1/s (7)

OR

X. (a) The characteristic polynomial of a system is given by

$s^5 + s^4 + 2s^3 + 2s^2 + 11s + 10 = 0$. Determine the location of roots on the s-plane and hence the stability of the system. (8)

(b) Explain Gain margin and Phase margin. (7)
