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(Revision – 2015/19)

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

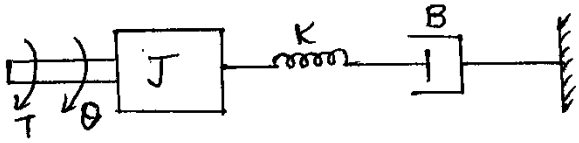
1. Define time variant system.
2. State final value theorem.
3. Define transfer function of a system.
4. Define time constant.
5. Define relative stability. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. Differentiate open loop and closed loop control system with example.
2. Find the Laplace transform of a) e^{at} b) At
3. Derive the transfer function of the following mechanical rotational system.



4. Explain Mason's gain formula.
5. Obtain the time response of first order system to unit step input.
6. Define type of a system with suitable example.
7. Explain a) Gain margin b) Phase margin. (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. Obtain the solution of the differential equation:

(a) $\ddot{y}(t) + 4\dot{y}(t) + 4y(t) = 0; y(0+) = 0; \dot{y}(0+) = 1$ (8)

(b) $\ddot{y}(t) + 3\dot{y}(t) + 2y(t) = 5; y(0+) = 0; \dot{y}(0+) = 0$ (7)

OR

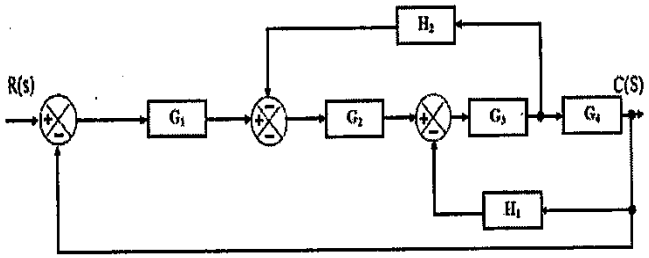
IV. Find the Inverse Laplace Transform of.

(a) $F(s) = \frac{s^2+2s+3}{s^3+6s^2+12s+8}$ (8)

(b) $F(s) = \frac{1}{s^2(s+5)}$ (7)

UNIT – II

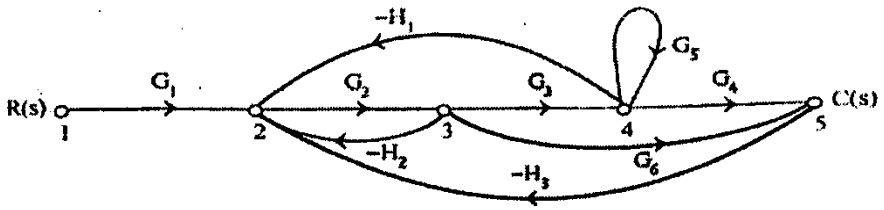
V. a. Using Block Diagram reduction rule obtain the overall transfer function of the system. (8)



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

OR

VI. a. Reduce the signal flow graph and obtain the overall transfer function. (8)



b. Describe Torque-Voltage Analogy. (7)

UNIT- III

VII. a. Draw the transient response of a typical system and mark.

i) Delay time ii) Rise time iii) Peak time iv) Settling time (8)

b. List any three standard test signals used to predict the performance of the system. Draw their graphical representation and write their mathematical expression. (7)

OR

VIII. a. Derive steady state error in terms of Kp, Kv and Ka for Type 0 system. (9)

b. Define

i) characteristic equation ii) damping ratio ii) natural frequency of oscillation. (6)

UNIT - IV

IX. a. Draw the bode plot for $\frac{1}{1+sT}$ (10)

b. Define frequency response of a system and define resonance frequency. (5)

OR

X. a. A unity feedback control system has an open loop transfer function

$G(s) = \frac{K}{s(s^2+4s+13)}$ Sketch the root locus. (10)

b. Determine the stability of the following system. Using Routh Hurwitz criterion.

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

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