TED (15) – 5043 Reg. No. .....

(REVISION — 2015) Signature .....

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2017

CONTROL SYSTEMS

[*Time* : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

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

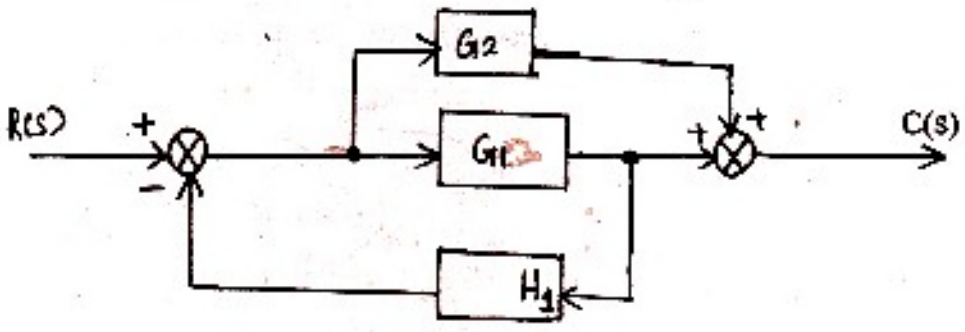
1. Find the Laplace transform of the function e^{at}.
2. Define transfer function of a control system.
3. Define 'forward path' in a signal flow graph.
4. State Routh Hurwitz criterion.
5. What is a root locus ? (5×2 = 10)

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 systems.
2. What is Laplace Transform ? Explain the use of Laplace Transform in control systems.
3. Describe Force-Voltage and Force-Current analogy.
4. Draw the signal flow graph for the system whose block diagram is shown below. Determine the overall transfer function.



Marks

5. Briefly explain about absolute stability, relative stability and marginal stability.
6. Find the time response of a first order system for unit ramp input.
7. Find the magnitude and phase of the integral factor $\frac{k}{s}$ and draw its Bode plot. (5×6 = 30)

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

Unit — I

III (a) Find the Laplace Transform of the differential equation given below and hence evaluate the time solution of the same given that $y(0^+) = 0$ and $y'(0^+) = 6$. 9

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 12e^t.$$

(b) State the differentiation and integration theorems of Laplace transform. 6

Or

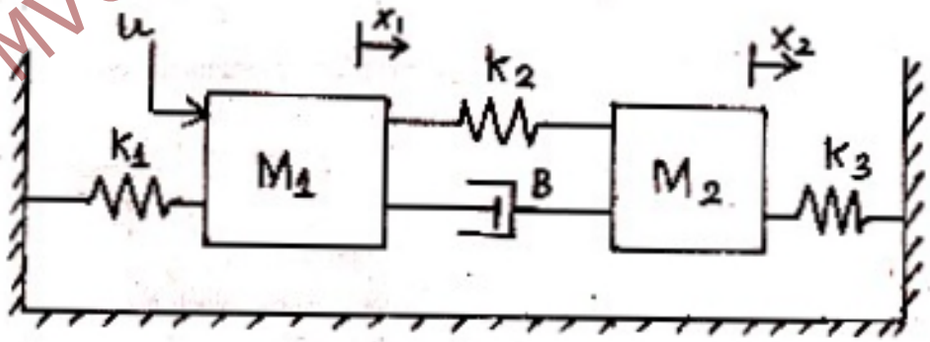
IV (a) Obtain the inverse Laplace transform of the function. 9

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

(b) Briefly explain about linear time variant and linear time invariant system. 6

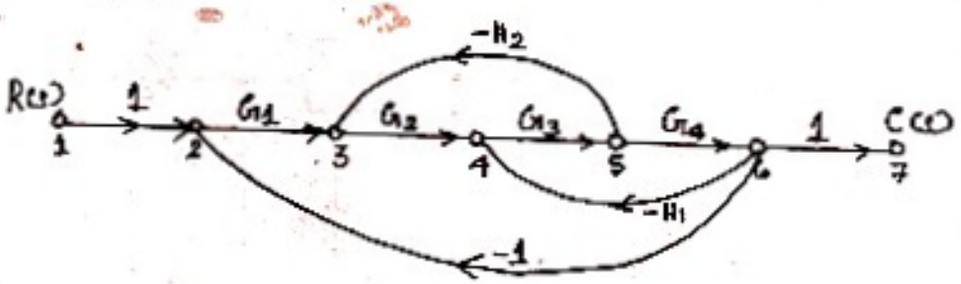
Unit — II

V (a) Obtain the transfer function $X_2(s)/U(s)$ of the mechanical translational system shown.



8

(b) Find the overall transfer function C(s)/R(s) for the signal flow graph shown below.

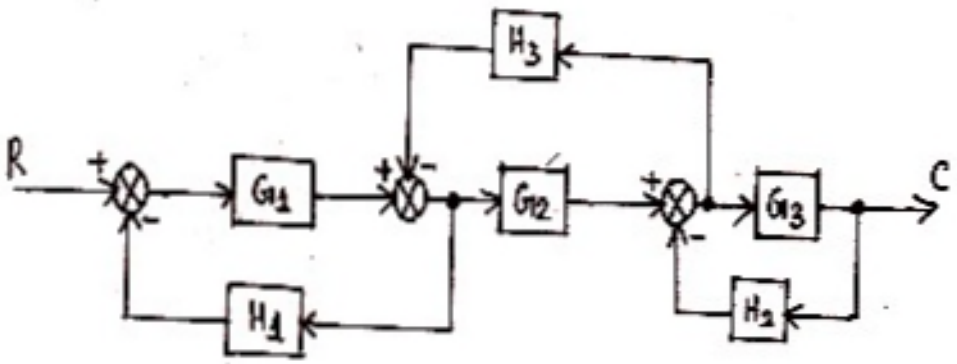


7

Or

Marks

VI (a) Using block diagram reduction method determine the overall transfer function of the block diagram shown below.



8

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

UNIT — III

VII (a) For a unity feedback control system the open loop transfer function is

$G(s) = \frac{10(s+2)}{s^2(s+1)}$

Find : (i) the position, velocity and acceleration error constants.

(ii) the steady state error when the input $R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$ 9

(b) Write the procedure to construct a Routh array that have a row of all zeros. 6

OR

VIII (a) Use Routh stability criterion to determine the stability of the system whose characteristic equation is $s^5+1.5s^4+2s^3+4s^2+5s+10$. 9

(b) Define static error coefficients such as static position, velocity and acceleration error coefficients. 6

UNIT — IV

IX (a) Write short notes on :

(i) Gain cross over frequency (ii) Phase cross over frequency

(iii) Phase margin (iv) Gain margin 8

(b) Describe the importance of root locus. 7

OR

X (a) Explain about Bode plot and its basic factors. 8

(b) Sketch the root locus of the unity feedback system whose open loop transfer function is $G(s) = \frac{(s+8)}{(s+1)}$ 7