TEE-602 83

Even Semester Examination – 2017

B.TECH. (VIth Semester)

CONTROL SYSTEM

Time : 3 Hours **Max. Marks : 100**

Note: Attempt all questions, the marks assigned to each question is indicated at question itself.

Q1. Attempt any **FOUR** questions **[4 x 5]**

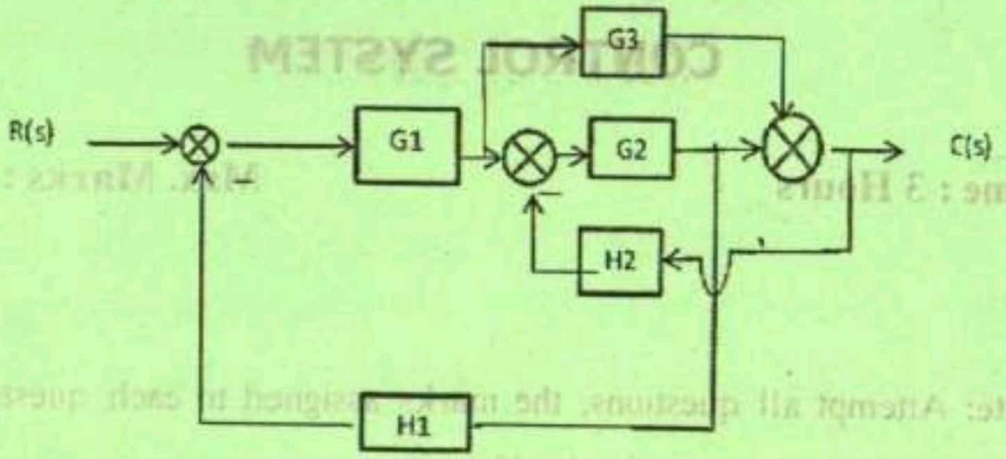
(i) Compare open loop and closed loop control system with suitable example.

(ii) Explain with example, the use of control system concepts to engineering fields.

(iii) A System is represented by relation given below:

$$X(s) = \frac{R(s).100}{(s^2+2s+50)}$$ if r (t) =1, find the value of x (t) when t →∞

(iv) Draw the signal flow graph for the system whose block diagram is shown below. Also find the overall transmittance using Mason's Gain formula.

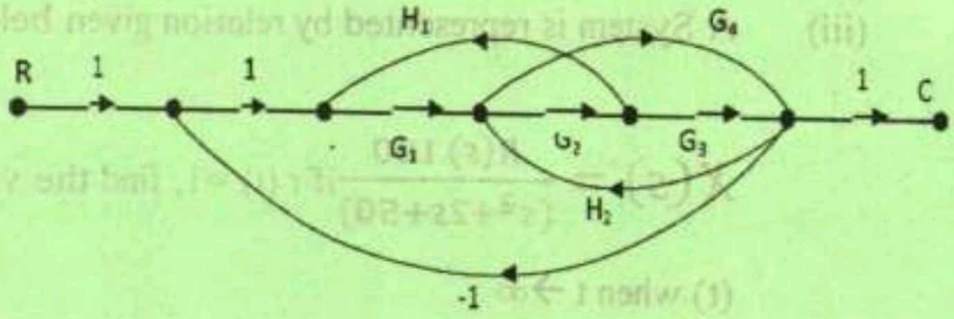


(v) Write short note on:

(a) Servomechanism

(b) Mason's Gain formula

(vi) Obtain C/R ratio for a system whose signal flow graph is represented by following figure:



Q2. Attempt any **FOUR** questions **[4 x 5]**

(i) Define the various standard input test signals for transient analysis.

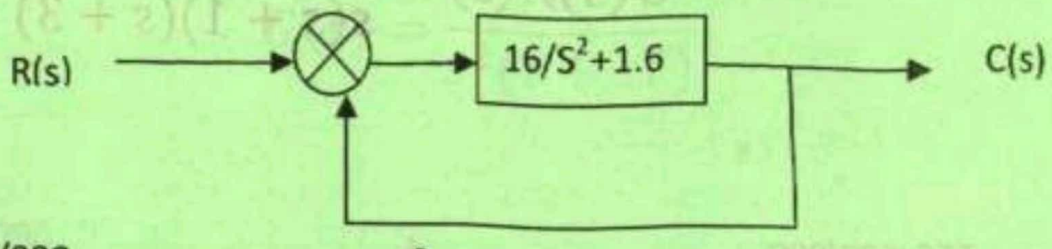
(ii) Obtain the expression for rise time & maximum overshoot for the second order control system subjected to unit step function.

(iii) What is the difference in characteristics of PD,PI& PID controller.?

(iv) The overall transfer function of unity feedback control system is given by $\frac{C(s)}{R(s)} = \frac{10}{s^2+6S+10}$ Find (a) Kp (b) Kv (c) Ka.

(v) Define delay time, rise time and peak time.

(vi) A unity feedback control system is shown below, by using derivative control the damping ratio is made to be 0.8. Determine the Td and compare the rise time with derivative control and without derivative control.



Q3. Attempt any **TWO** questions **[2x 10]**

(i) Write short notes on

(a) A.C servomotor

(b) stepper motor

(c) synchros

(ii) Using Routh-Hurwitz criterion, determine the relation between K and T so that unity feedback control system whose open loop transfers function given below is stable.

$$G(s) = \frac{K}{s\{s(s+10) + T\}}$$

(iii) Draw the root locus plot for a system having open loop transfer function as:

Determine (a) Gain Margin and (b) Phase margin for k=6.G

$$G(s)H(s) = \frac{K}{s(s+1)(s+3)}$$

Q4. Attempt any **TWO** questions **[2x 10]**

(i) What are the following? Explain with examples:

(a) Gain margin

(b) Phase margin

(c) Polar plots

(ii) Sketch the Bode plot for the transfer function given below:

$$G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

From the Bode plot determine: (a) the phase crossover frequency (b) the gain crossover frequency (c) gain margin (d) phase margin (e) stability?

(iii) Discuss the Nyquist stability criterion. Also sketch the Nyquist plot and determine the stability of a unity feedback control system:

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

Q5. Attempt any **TWO** questions **[2x 10]**

(i) What is the basic concept of control system compensation? What are the various types of compensation schemes used in control systems?

(ii) Compare the characteristics of phase lead and phase lag networks. Also Derive the relation between ϕ_m and α for lead compensator.

(iii) The open loop transfer function of a unity feedback control system is given by,

$$G(s) = \frac{K}{s(1+0.2s)}$$

Design a phase lead compensator such that the system will have $K_v=10$ and P.M.$=50^0$

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