Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

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[Total No. of Questions: 09]
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Program: B.Tech. (Scheme 2018)
Semester: 4th
Name of Subject: Linear Control Systems
Subject Code: PCEC-109
Paper ID: 16225
Scientific calculator is allowed
Detail of allowed codes/charts/tables: Graph paper and semi-log graph paper

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part C has Two Questions Q8 and Q9. Both are compulsory but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A

[Marks: 02 each]

Q1.

a) Define Nyquist criteria.

b) Cite the limitations of phase lag compensation.

c) State the necessity of compensation in control systems.

d) Distinguish between break away and break in points.

e) Explain the effect of location of poles on the stability of a system.

f) Examine the stability by Hurwitz criterion: $s^3 + s^2 + s + 4 = 0$

Part – B

[Marks: 04 each]

Q2. Identify the input and output of an automatic refrigerator. Is it open loop or closed loop control system? Justify.

Q3. Explain the following: (a) Nichol's chart (b)Lag compensation

Q4. Discuss in detail about tachogenerators. Also, write atleast two applications each of DC and AC tachogenerator.

Q5. Compute the transfer function T(s) $= \frac{Y(s)}{R(s)}$ for the system shown in Fig 1.

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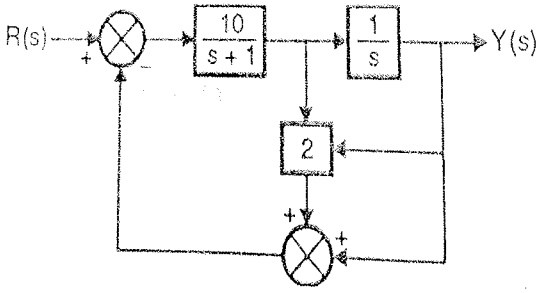

Fig 1

Q6. With the aid of suitable examples, differentiate:

(a) Open loop and Closed loop systems

(b) Linear and Non-linear systems

Q7. A second order control system has $F(s) = s^2 + 2.4s + 9$. If a step input is applied to it, determine the time domain specifications.

Part – C

[Marks: 12 each]

Q8. A unity feedback system has $G(s) = \frac{k}{s(s+2)(s^2+2s+5)}$

(a) Compute the value of k, for a unit ramp input if it is desired $e_{ss} \leq 0.2$

(b) Determine e_{ss} if input $r(t) = 2 + 4t + \frac{t^2}{2}$

OR

Compute the gain of the system shown in Fig 2 by using Mason's gain formula.

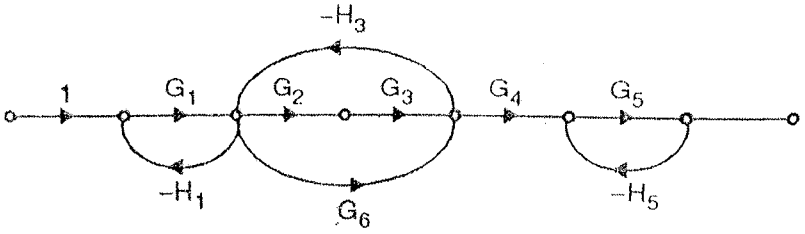

Fig 2

Q9. Plot the root locus for the unity feedback system with $G(s) = \frac{K}{s(s+6)(s+9)}$

OR

The open loop transfer function of uniform feedback system is $G(s) = \frac{K}{s(s+1)}$. It is desired to have the velocity error constant $k_v = 12\text{sec}^{-1}$ and phase margin as 40°. Design a lead compensator to satisfy the given requirements.

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