Exam.Code:0943
Sub. Code: 7065

1129
B.E. (Mechanical Engineering)
Seventh Semester
MEC-702: Automatic Controls

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Use of Calculator is allowed.*

x-x-x

I. Attempt the following:-

a) Why derivate action cannot be used alone.

b) Explain in brief ON-OFF control action.

c) Write the Laplace transform for following input signal

i) Step ii) Ramp iii) Parabolic iv) Impulse

d) Define:-

i) Stability ii) Relative stability

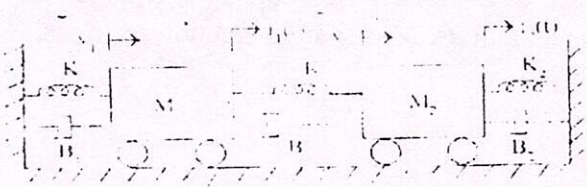
e) Differentiate between Regulators and servo mechanism (5x2)

UNIT – I

II. a) Explain the working of proportional controller.

b) Explain Mason's gain formula with an example. (2x5)

III. a) Write the differential equations governing the mechanical system shown in figure. Also draw the force-voltage and force-current analogous circuit.



b) For a unity feedback system, the open loop Transfer function $G(s) = 4s^2 + 2s + 4$
Determine:-
i) Rise time
ii) Peak time
iii) Maximum overshoot
iv) Settling time (2x5)

P.T.O.

IV. a) Compare PI, PD and PID controller.

b) Explain the working of a temperature control system (Thermal control system). (2x5)

UNIT – II

V. a) Consider the system with characteristic equation is $P(s) = s^3 + s^2 + 2s + 2$. Determine stability of the system using Routh's criteria.

b) The closed loop transfer function of a system is $T(s) = s^3 + 4s^2 + 8s + 16/s^5 + 3s^4 + 5s^2 + s + 3$. Calculate number of poles in the right half-plane and in left-half plane. (7,3)

VI. For the system with the state-space equations, derive an expression for transfer function between output and input

$$\begin{pmatrix} \dot{x}1 \\ \dot{x}2 \\ \dot{x}3 \end{pmatrix} = \begin{pmatrix} -4 & 1 & 1 \\ 0 & 0 & 1 \\ -1 & -4 & -2 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} + \begin{pmatrix} u \end{pmatrix}$$

$$y = \begin{pmatrix} 1 & 0 & 0 \end{pmatrix} \begin{pmatrix} x1 \\ x2 \\ x3 \end{pmatrix}$$

(10)

VII. a) Define:-

i) Poles
ii) Zeros
iii) Order of system
iv) Characteristic equation

b) For the system with transfer function $Y(S)/U(S) = s^2+2s+1/(S^3+7S^2+14s+8)$, write the state-space equations, using partial fraction methods. (2x5)

x-x-x