Total No. of Printed Pages:2

SUBJECT CODE:- 323
FACULTY OF ENGINEERING AND TECHNOLOGY
T.E.(EEP/EE/EEE) Examination Nov/Dec 2015
Control System Engineering
(Revised)

[Time: Three Hours] **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

N.B i) Attempt any three questions from each section.
ii) Q. no 1 and Q. no 6 are compulsory.
iii) Solve any two from remaining questions from each section.

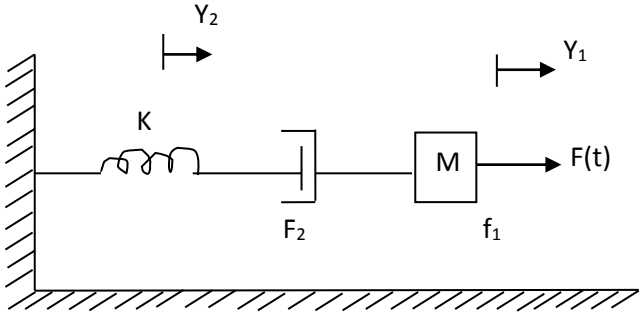
Section A

Q.1 Attempt any five from the following 10

a) Distinguish between linear and non-linear control system.
b) Name the components of block diagram
c) What is signal flow graph?
d) Define damping ratio.
e) List the time domain specification.
f) What are type-0, type-1 and type-2 system?
g) What are static error constant? What is their significance?
h) What does the term 'Stability of control system' imply?

Q.2 a) With the help of example compare open loop and closed loop system. 08
b) Explain in detail the various block reduction rules. 07

Q.3 a) For the mechanical system shown in fig(1) draw the force voltage and force –current analogous circuits. 08



Fig(1)

b) The response of a servomechanism is. $G(t) = 1 + 0.2e^{-60t} - 1.2e^{-10t}$ when subject to a write step input. Obtain an expression for closed loop transfer function. Determine the undamped natural frequency and damping ratio. 07

Q.4 a) A unity feedback system has $G(s) = \frac{K(S+1)}{S^2(S+2)(S+5)}$ using Routh Hurwitz criteria. Find range of K for the closed loop system to be stable. 08

b) With the help of neat sketch explain the time domain specifications. 07

Q.5 a) Write steps for solving signal flow graph using Mason's gain formula. 08
b) Explain potentiometer as an error detector. 07

SECTION-B

Q.6 Attempt any five from the following. 10

a) What do you mean by centroid? How is it located?
b) How will you find the gain K at a point on roof locus?
c) What are asymptotes? How will you find the angle of asymtotes?
d) Define
   i. State vector
   ii. State space
e) What is bode plot?
f) What is breakway and break in point?
g) What is gain margin and phase margin?
h) What do you mean by angle of departure?

Q.7 A unity feedback control system has an open loop transfer function. 15

$G(S) = \frac{K}{S(S^2+4S+13)}$ sketch the roof locus.

Q.8 Plot the Bode diagram for the following transfer function and obtain the gain and phase cross-over frequencies. 15

$$G(S) = \frac{10}{S(1+0.4S)(1+0.1s)}$$

Q.9

a) Obtain state space representation of transfer function. $G(S) = \frac{(S+4)}{(S^3+6S^2+11S+6)}$ 08

b) Find state transition matrix $\emptyset(t)$ of the following system. $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}3 & 0\\ 0 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u$ where u>0 07

Q.10 Given the system.

a) $\dot{x}(t) = Ax(t) + Bu(t), y(t) = Cx(t)$ Where $A = \begin{bmatrix}0 & 1\\ -1 & -3\end{bmatrix} B = \begin{bmatrix}1\\ 2\end{bmatrix} C = [1 \quad 1]$ Determine the state and output controllability. 08

b) Test the observability of the system desorbed by . $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}1 & 1\\ -3 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u,$ 07

$$y = [1 \quad 0]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$