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Question Paper Code: 50441

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Electronics and Communication Engineering

EC 6405-CONTROL SYSTEM ENGINEERING

(Common to: Mechatronics Engineering/Medical Electronics)

(Regulations 2013)

Time: Three Hours Maximum: 100 Marks

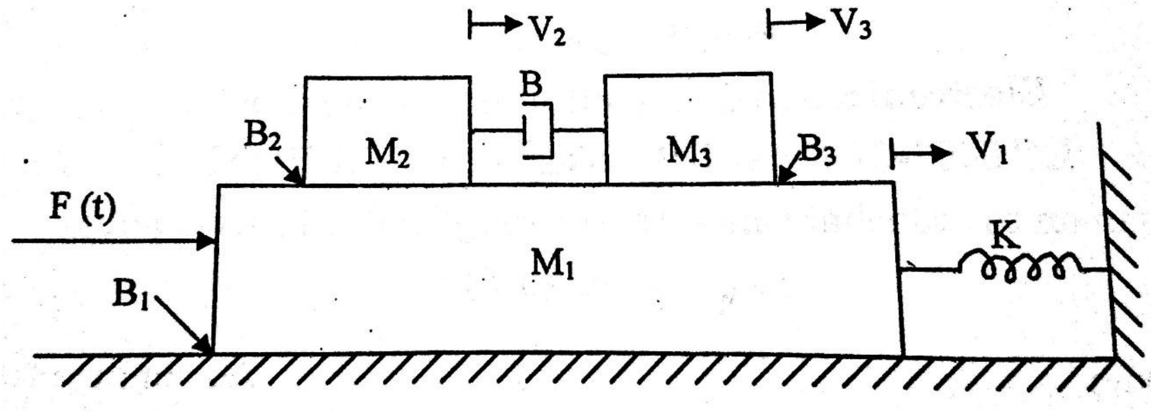
Answer ALL questions

PART-A **(10x2=20 Marks)**

1. Distinguish between open loop system and closed loop systems.
2. Define transfer function and mention its applicability in control system.
3. What are the standard test signals used for time domain analysis?
4. What are generalized error coefficients?
5. What are called constant M and N circles?
6. Why compensation is necessary in feedback control systems?
7. What will be stability of the system when the roots of characteristic equation are lying on imaginary axis?
8. What is Nyquist stability criterion?
9. Write the state model of nth order system.
10. State Shannon's sampling theorem.

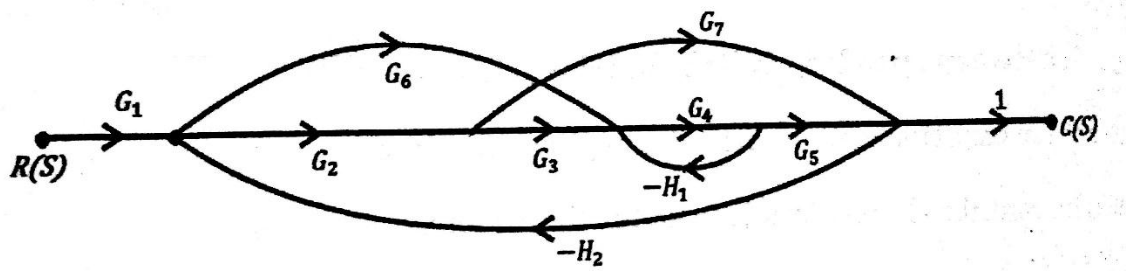
PART-B (5x13=65 Marks)

11. a) Write the differential equations governing the mechanical system shown in figure and determine the transfer function $V_1(S)/F(s)$. **(13)**



(OR)

b) Obtain the closed loop transfer function of the system, by using masons gain formula. **(13)**



12. a) A unity feedback control system is characterized by the following open loop transfer function $G(s) = \frac{4s+1}{S(S+6)}$.Determine its transient response for unit step input and sketch the response. Evaluate the maximum overshoot and the corresponding peak time. **(13)**

(OR)

b) State and explain the effects of P, PI, PID controllers on the system dynamics. **(13)**

13. a) A unity feedback control system has$G(s) = \frac{K}{S(S+4)(S+10)}$. Draw the Bode plot. **(13)**

(OR)

b) The open loop transfer function of a unity feedback system is G(s) = $\frac{K}{S(S+1)}$. **(13)**

It is desired to have the velocity error constant $K_v = 12\ sec^{-1}$ and phase margin as 40°. Design a lead compensator to meet the above specifications.

14. a) Sketch the root locus plot for G(s) H(s) = $\frac{K(S^2-4S+20)}{(S+2)(S+4)}$.Find the gain, K at the point where the locus crosses the imaginary axis. **(13)**

(OR)

b) Draw the Nyquist plot for the system, whose open loop transfer function is G(s) H(s) =$\frac{K(1+0.5S)(1+S)}{(10S+1)(S-1)}$. Determine the range of K for which closed loop system is stable. **(13)**

15. a) The state model is given by $\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\\ \dot{x_3}\end{bmatrix} = \begin{bmatrix}0 & 0 & 1\\ -2 & -3 & 0\\ 0 & 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 2\\ 0\end{bmatrix} u;$ **(13)**

$$y = [1\ 0\ 0]\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$$

Determine whether the system is completely controllable and observable.

(OR)

b) What are sampled data control systems? With an aid of a block diagram show basic elements of a sampled data control system and give functioning of these elements. **(13)**

PART- C **(1x15=15 Marks)**

16. a) Analyze on lead, lag and lead-lag compensators with neat diagram. Also explain their importance. **(15)**

(OR)

b) Define stability. With an example, explain the steps to be followed for Routh-Hurwitz criterion. **(15)**