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SF-7111

B. E. - III (Sem. VI) (Electrical) Examination

May / June - 2011

Control System - II

Time : **3** Hours] [Total Marks : **100**

Instruction :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 3 (SEM. 6) (ELECTRICAL)

Name of the Subject :

☛ CONTROL SYSTEM - 2

☛ Subject Code No. : 7 1 1 1 ☛ Section No. (1, 2,.....) : NIL

Seat No. :

Student's Signature

(2) Attempt all question.
(3) Figure to right indicate full marks.
(4) Assume suitable data wherever necessary.

1 (a) Attempt all questions : **10**

(i) If the root locus lies only on the negative real axis then time response is _____.

(ii) For the openloop transfer function as $G(s)H(s)=K/s(s^2+4s+5)$ the number of break away points is/are_____.

(iii) The lag-compensation has _____ nearer to origin.

(iv) The maximum phase lead is contributed by aphase lead network at _____ corner frequency.

(v) The open loop transfer function of system is $G(s)H(s)=K/s(s^2+1)$ the angle of departure of root locus branches from open loop poles located on imaginary axis are given by _____.

(b) A unity feedback control system has an open open loop transfer function. **10**

$G(s)=K/s(s+4)$

Draw the root locus and determine the value of K, if the damping ratio ζ is to be 0.0707.

2 (a) Realize a lead compensator using passive elements and obtain its transfer function. Draw the bode diagram, pole and zero map of same. 7

(b) The open loop transfer function of unity feedback control system by G(s)=K/s(1+0.2s). Design a suitable compensator such that the system will have $k_v = 10$ and P.M = 50°. 8

OR

2 (a) What are PID controller ? Derive the transfer function for the same. Compare a lead lag compensator with PID compensator. 7

(b) Design a phase lead compensation network for a system having open loop transfer function given below such that the system will have acceleration error coefficient $K_a = 100\ sec^2$ and suitable phase margin for astable operation. 8

$G(s)\,H(s) = K / s^2 (1 + 0.05\ s)$

3 Attempt any two : 15

(a) A lead compensator speeds up the transient response.

(b) Write the short note on any one pole placement technique.

(c) Effect of addition of pole and zeros on root locus.

4 Answer the following questions :

(1) Define : 10

(a) Positive definitiveness

(b) Negative definitiveness

(c) Semi positive definitiveness

(d) Semi negative definitiveness

(e) Indefinitiveness

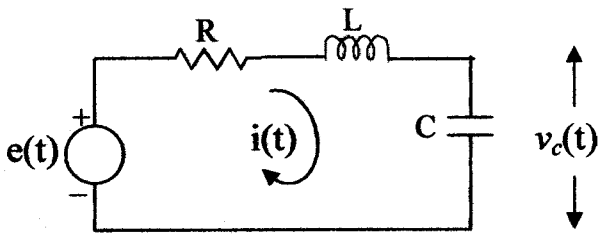
(2) Define state transition matrix and list the properties of state transition matrix. 3

(3) Explain advantages of state variable analysis. 3

(4) What do you mean by eigenvalues and eigenvectors ? 3

(5) State space technique can be used for non linear, time variant systems also. (True or false) 1

5 (a) Determine the state model of the following system and also draw state diagram. 7



(b) With usual notations, derive equation for time domain solution of state equation. 8

OR

5 (a) Explain the procedure to obtain diagnonalization of matrix A. 5

(b) Obtain time response of the system given by 10

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$

where $u(t)$ is unit step occurring at $t = 0$ and $x^T(0) = [1\ 0]$

6 Attempt any three : 15

(i) Discuss Liapunov's stability theorem.

(ii) Explain controllability and observability with suitable example.

(iii) What is decomposition ? Explain each method of decomposition in brief.

(iv) For the system represented by following state space matrices, evaluate transfer function $Y(s)/U(s)$.

$$A = \begin{bmatrix} -3 & 1 \\ -2 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 2 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 \end{bmatrix}$$

(v) Obtain eigenvalues and eigenvectors of the following state model.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}$$