d) Define controllability and observability. Give conditions the check controllability and observability of a given system.

OR

The state equation of a system are given below :

$\dot{x}_1 = x_1 + x_2 + 4$

$\dot{x}_2 = -x_2$

Check for controllability.

Unit-V

5. a) Which commands are used to plot root locus in MATLAB.
   b) How the use SIMULINK software for control system?
   c) Write a program in matlab to plot root locus of the open loop transfer function of a feedback system is

$$G(s)H(s) = \frac{k}{s(s+4)(s^2+4s+20)}$$

   d) What do you mean by Nyquist stability criterion? Explain.

OR

Draw the Bode plot for a system having

$$G(s)H(s) = \frac{100}{s(s+1)(s+2)}$$

Find :

i) Gain margin
ii) Phase margin
iii) Gain cross over frequency
iv) Phase cross over frequency

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Total No. of Questions : 5] *[Total No. of Printed Pages :4*

Roll No.....

EI/IC-605

B.E. VI Semester

Examination, December 2016

Control Systems

Time : Three Hours

Maximum Marks : 70

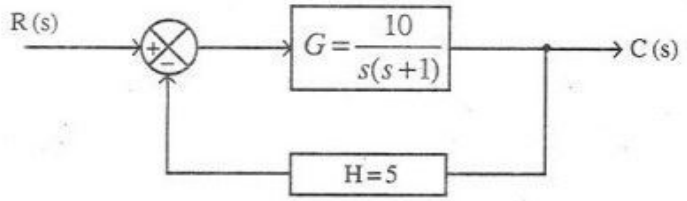
Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

Unit-I

1. a) Define open-loop and close loop control system.
   b) What is the basic difference between linear control system and non-linear control system?
   c) For the transfer function $G(s) = \frac{1}{2}\frac{(s^2+4)(1+2.5s)}{(s^2+2)(1+0.5s)}$

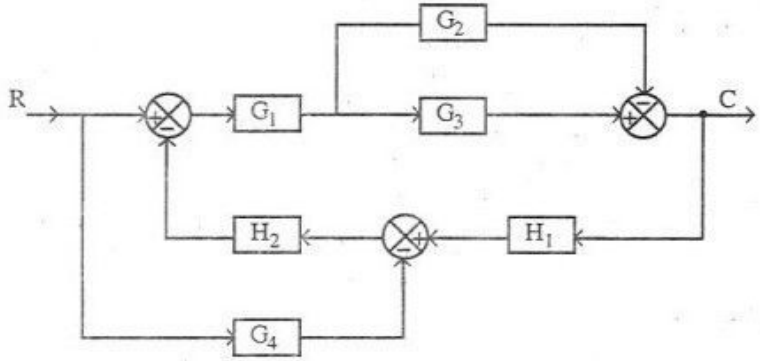
Plot the poles and zeros in s-plane and determine the value of the transfer functions at $s = 2$.

   d) The block diagram of a position control system is shown in figure. Determine the sensitivity of closed loop transfer function T with respect to G and H, the forward path and feedback path transfer functions respectively for $\omega = 1$ rad/sec.



OR

Draw a signal flow graph and evaluate the closed-loop transfer function of a system whose block diagram is given below.



Unit-II

2. a) How the control of the effects of disturbance signals by use of feedback?
   b) Define first order and second order control system.
   c) Explain the various Input Test signals.
   d) The closed loop transfer functions of a negative unity feedback control system is given by $\frac{C(s)}{R(s)}=\frac{10}{s^2+4s+5}$

   Determine the damping ratio, undamped natural frequency and maximum overshoot for an unit step input.

   OR

   Derive the transfer functions of an armature controlled D.C. servomotor.

Unit-III

3. a) Write down the conditions of stability of linear systems
   b) A closed loop control system has the characteristic equation given by :

   $s^3+4.5s^2+3.5s+1.5=0$

   Investigate the stability using Routh-Hurwitz criterion.
   c) Explain Polar plots.
   d) A feedback control system has an open-loop transfer functions :

   $$G(s)H(s)=\frac{k}{s(s+3)\left(s^2+2s+2\right)}$$

   Find the root locus as k is varied from 0 to ∞.

   OR

   Briefly explain the co-relation between time and frequency response of a second order system.

Unit-IV

4. a) Define following :
   i) State variables ii) State
   iii) State vector iv) State space
   b) What is the co-relation between state models and transfer function?
   c) For the electrical network shown in fig. determine the state model. Consider i_1 i_2 and v_c as state variables. The output variable are i_1 and i_2.