

National Institute of Technology, Hamirpur (H.P.)

Branch : ECE(Dual Degree) Semester : 5th
 Course Name : Control Systems Course Code : ECD-315

Name of the Examination: B.Tech End Semester Examination December 2020

Note: Attempt all questions

Time: 02 Hour Maximum Marks: 50

The guidelines to be strictly adhered by the students while doing/conducting End Semester Examination.

1. The students must join the respective Google Meet Links at least 10 minutes prior to the start of Exam and must keep the camera ON till the submission of the answer sheets.
2. Each student is required to write his/her Name, Roll no, Subject name and Subject code on top of first sheet and put his/her signature with date at bottom of each sheet of the answer booklet.
3. After examination time is over, the students are given extra 15 minutes to scan and upload their duly signed answer sheets and send back on **Email id: veenanaresh@gmail.com** Any further delay in submission of paper by a student may lead to deduction in marks or the rejection of the whole answer booklet.
4. If you are found guilty of indulging in unfair means, strict action as per Institute rules shall be initiated against you.
5. The student shall retain the hardcopies of their answer sheets with them and handover the same to the undersigned while they come back in the Institute Campus.

Note: Attempt all questions. All questions carry equal marks.

- Q.1 (a) Distinguish between open loop and closed loop system. Explain control over system dynamics by the use of feedback.
 (b) Explain Gain Margin and Phase Margin with respect to Nyquist plot. Also explain concept of controllability and observability for a system. (5+5)

- Q.2 (a) For the unity feedback system having open loop transfer function

$$G(s) = \frac{K(s+2)}{s(s^3+7s^2+12s)}$$

Determine (i) Type of system (ii) Error constants K_p , K_v , K_a and (iii) steady- state error for unit parabolic input. (5+5)

- (b) Determine the stability of a system having following characteristic equation:

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0. \text{ Also find the frequency of sustained self-oscillations.}$$

- Q.3 (a) A unity feedback control system has $G(s) = \frac{K}{s(s+2)(s+5)}$. Sketch the root locus and show on it

(i) breakaway point (ii) line for $\zeta=0.5$ and value of K for this damping ratio (iii) the frequency at which root locus crosses the imaginary axis and the corresponding value of K. (5+5)

- (b) Determine the canonical state space model of the system, whose transfer function is

$$T(s) = \frac{2(s+5)}{(s+2)(s+3)(s+4)}$$

- Q.4 Use Nyquist criterion to investigate closed loop stability of a system having

$$G(s)H(s) = \frac{(s+0.25)}{s^2(s+1)(s+0.5)} \quad (10)$$

- Q.5 Write short note on any **TWO** of the following:

- (i) Synchro as an error detector
 - (ii) Stepper motor
 - (iii) A.C. Servomotor
 - (iv) PID Controller
- (10)