

MASTER OF VOCATION
Robotics and Automation
Subject: Automatic Control System
Subject Code: EE-901
Semester: Fourth
July 2022
Theory (External): 70 Marks
Time: 03 Hours

- i. Step signal
 - ii. Ramp signal
 - iii. Impulse signal
 - iv. Parabolic signal
7. Explain Phase and canonical variables.
8. Draw the bode plot of the system $G(s) = \frac{k}{s(s+1)(0.1s+1)}$. Hence obtain the exact plot by doing necessary corrections at corner frequencies
- i. Find the gain margin and, phase margin
 - ii. The value of K for phase margin = 20 degree

END OF PAPER

Instructions to the Students

1. This Question paper consists of two Sections. All sections are compulsory.
2. Section A comprises 10 questions of objective type in nature. All questions are compulsory. Each question carries 2 marks.
3. Section B comprises 8 essay type questions out of which students need to do any 5. Each question carries 10 marks.
4. Read the questions carefully and write the answers in the answer sheets provided.
5. Do not write anything on the question paper.
6. Wherever necessary, the diagram drawn should be neat and properly labelled

Roll Number

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SECTION –A (SHORT/OBJECTIVE TYPE QUESTIONS)
(10x2=20 Marks)

- List the terminologies associated with Signal Flow Graphs.
- Define order of a system.
- Why negative feedback is preferred in closed loop control system.
- Illustrate the terms
 - Loop
 - Non-touching Loop
- Illustrate the terms (i) Mason's Signal Flow Graph Method
- Explain magnitude condition.
- Write the transfer function of the PID controller.
- Write an expression for resonant frequency.
- Define gain margin of a closed loop system.
- List any two advantages of frequency response analysis

SECTION –B (ESSAY TYPE QUESTIONS)
(5x10=50 Marks)

- Derive the mathematical model of an armature controlled DC motor.
- Draw an equivalent signal flow graph of the system shown in fig1.

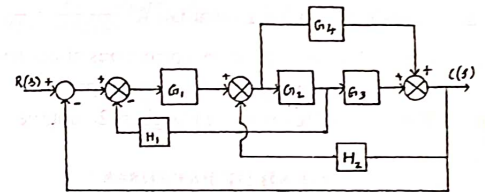


Fig.1

- Find the unit impulse response of the second order system whose transfer function

$$G(S) = \frac{9}{s^2 + 4s + 9}$$
- The open loop transfer function of a uncompensated system is $G(s) = \frac{5}{s(s+2)}$. Design a suitable lag compensator for the system so that the static velocity error constant K_v is 20 sec^{-1} , the phase margin is at least 55° and the gain margin is at least 12 dB .
- Write down the procedure of designing lead-lag compensator using bode plot.
- With the help of graphical representation and mathematical expression explain the following signals: