Student Exam No. _____

GANPAT UNIVERSITY

B. Tech. Semester: V Mechatronics Engineering

Regular Examination Nov – Dec 2015

2MC504 Control Engineering

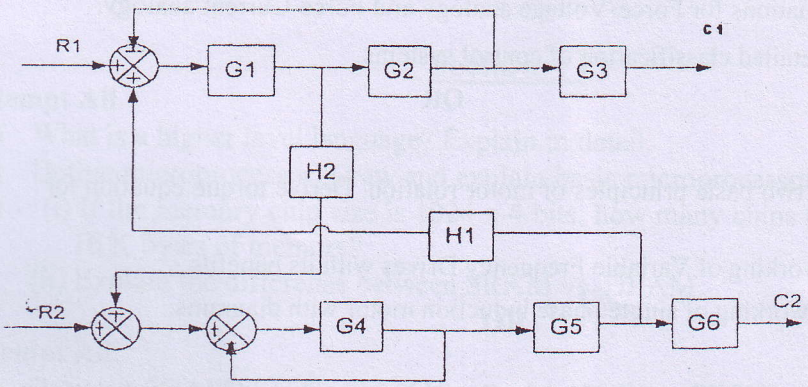
Time: 3 Hours **Total Marks:** 70

Instruction: 1. Figures to the **right** indicate full marks.
2. Answers to the two sections must be written in **separate** answer books.
3. Assume all necessary data.

Section - I

Que. – 1 Attempt all. 12

A Find the transfer function **C1/R1** and **C2/R2** for following block diagram. 4



B Derive the expression for static error coefficients for unit step, unit ramp and unit parabolic input. Also describe the disadvantages of static error coefficients. 4

C Discuss with an appropriate example the two special cases of routh's criterion for stability. 4

OR

Que. – 1 Attempt all. 12

A For $G(s) = 20\ (s+1) / s^2\ (s+2)\ (s+5)$, determine error constants and steady state error for input, $r\ (t) = 1 + 3t + t^2/2$. 4

B Describe the classification of control system based on stability. 4

C Discuss about the unit step response of a first order system. 4

Que. – 2 Attempt all. 11

A Describe with all necessary expressions the relation between steady state error and the type of system. 6

B Draw a polar plot for given transfer function: 5

$$G(s) = 50 / (s+10)$$

OR

Que. – 2 Attempt all. 11

A Derive the expression for unit impulse response of second order system for Under damped, Critically damped and over damped case. 6

B Describe the steps to construct a bode plot in detail. 5

12

Que. – 3 Attempt any three.

A Deduce the stability for given characteristic equation using Hurwitz's criterion. 4

$$S^4 + 12\,S^3 + 16\,S^2 + 12\,S + 5 = 0$$

B The response of a control system after applying unit step input is 4

$$c(t) = 1 + e^{-20t} - 4\,e^{-20t}$$

Find the time domain specifications.

C Explain in detail all the standard test signals with its need. 4

D Explain the general method to draw root loci with appropriate rules. 4

Section – II

12

Que. – 4 Attempt all.

A Prove that for a system with impulse input, the response equals the T.F. Write down the properties of T.F. 4

B Derive equations for Force-Voltage analogy and Force-Current analogy. 4

C Explain detailed classification of control systems. 4

OR

12

Que. – 4 Attempt all.

A Write the two basic principles of motor rotation. Derive torque equation for PMDCM. 4

B Explain working of Variable Frequency Drives with its benefits. 4

C Describe working of single phase induction motor with diagrams. 4

11

Que. – 5 Attempt all.

A Two cars A and B are parked in line between two walls with their front ends towards right wall. The car A's front end is facing car B's rear end and car B's front end is facing right side wall. The car A's rear end is connected to left wall via a rope and a damper which are parallel with each other. The car B's front end is connected to right wall through one rope. Two cars are connected with each other through one damper. The car A is accelerated toward car B. Write down system equations and derive force-voltage analogy for the same. Assume car A and B as rigid bodies. 6

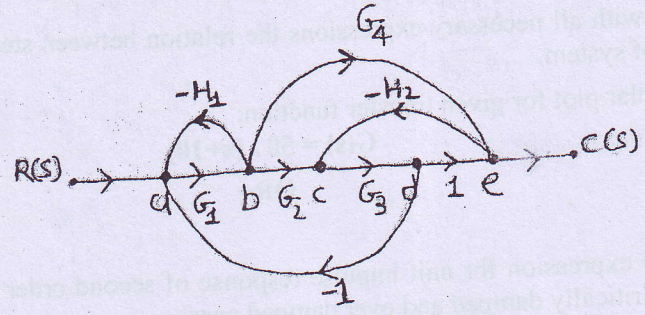
B What is SFG? Write down Mason's Gain formula and steps to solve it. 5

OR

11

Que. – 5 Attempt all.

A Using Mason's formula determines C(s)/R(s) for SFG shown below: 6



B What is LVDT? Explain its working with diagram. 5

12

Que. – 6 Attempt all.

A Derive equations for basic elements of translational motion of mechanical systems. 4

B Define control system, accuracy, sensitivity and stability. 4

C Write short note on Servomechanism. 4

END OF PAPER