

GANPAT UNIVERSITY
B.TECH SEM. V - MECHATRONICS ENGINEERING
CBCS REGULAR EXAMINATION NOV/DEC - 2012
2MC-504 CONTROL ENGINEERING

Time: 3 Hours

Total Marks: 70

Instructions:

- 1). All questions are **compulsory**.
- 2). Figures to the **right** indicate full marks.
- 3). Answers to the two sections must be written in **separate** answer books.
- 4). Assume all necessary data.

Section - I

Que:-1 Attempt All.

[12]

- (A) Draw the internal structure of DC servomotor and explain its working.
- (B) Explain detailed classification of control systems.
- (C) Derive equations for Force-Voltage analogy and Force-Current analogy.

OR

Que:-1 Attempt All.

[12]

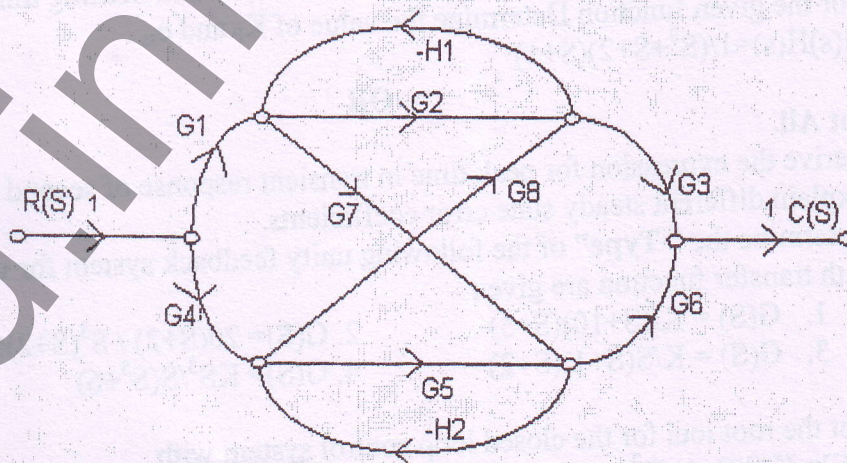
- (A) Explain working principle of 4 stack stepper motor with figure.
- (B) Write short note on Servomechanism.
- (C) Write the two basic principles of motor rotation. Derive torque equation for PMDCM.

Que:-2

- (A) Explain working of Brushless DC motors with all necessary diagrams.
- (B) Using Mason's formula determines $C(S)/R(S)$.

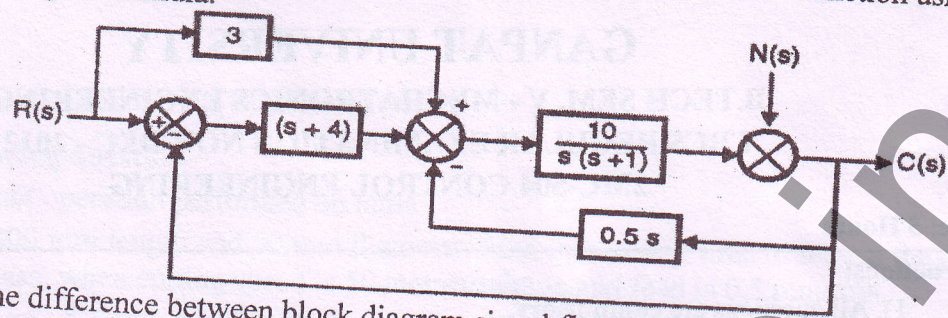
[06]

[05]



OR

Que:-2 (A) Draw the SFG for the following system then determine the transfer function using mason's gain formula.



(B) Give the difference between block diagram signal flow graph methods. [05]

Que:-3 Attempt All.

- (A) Two bikes A and B are parked in line between two walls with their front ends towards right side wall. The bike A's front end is facing bike B's rear end and bike B's front end is facing right side wall. The bike A's rear end is connected to left wall via a rope and a damper which are parallel with each other. The bike B's front end is connected to right wall through one rope. Two bikes are connected with each other through one damper. The bike A is accelerated toward bike B. Write down system equations and derive force-voltage analogy for the same. Assume bike A and B as rigid bodies. [06]
- (B) Prove that for a system with impulse input, the response equals the T.F. Write down the properties of T.F. [04]
- (C) Differentiate between open loop and closed loop control systems. [02]

Section - II

Que:-4 Attempt All.

- (A) What do you mean by time domain analysis and frequency domain analysis? [12]
- (B) Explain the terms delay time, Rise time, Peak time and Settling time.
- (C) For the given function Determine the value of K_p and e_{ss} .
 $G(s)H(s) = 1/(s^2 + s + 2)(s + 1)$

OR

Que:-4 Attempt All.

- (A) Derive the expression for peak time in transient response of second order system. [12]
- (B) Explain different steady state error coefficients.
- (C) Determine the "Type" of the following unity feedback system for which the forward path transfer function are given
1. $G(S) = K/(S+10)(S+5)$
 2. $G(S) = 20(S+2) / S^3(S+2)(S^2+5S+5)$
 3. $G(S) = K/S(S+1)(S+2)$
 4. $G(S) = KS^5/S(S^5+6)$

- Que:-5 (A) Plot the root loci for the closed loop control system with $G(S) = K/S(S+1)(S^2+4S+5)$, $H(s) = 1$ [06]
- (B) Derive the expression for the time response second order system for Under damped case, and Critically damped case. [05]

OR

Que:-5 (A) Draw the bode plot for the transfer function

$$G(S) = 50/S(1+0.20S)(1+0.1S)$$

[06]

(B) Sketch the polar plot of

$$G(S) = 20S/(S+1)(S+10)$$

[05]

Que:-6 Attempt All.

(A) Find out the breakaway points, and intersection points of the given transfer function.

$$G(S) = K/S(S^2+4S+8)$$

[12]

(B) Define K_p , K_v , K_a .

(C) What are the steps to draw Root locus curve.

END OF PAPER