Student Exam No: _____

GANPAT UNIVERSITY

B.TECH SEM. V - MECHATRONICS ENGINEERING
CBCS REGULAR EXAMINATION NOV/DEC - 2013
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) Which motor is used in the fan of your class room? Explain its working in detail.
(B) Write short note on servomechanism.
(C) Describe working of Stepper motor with figures.

OR

Que:-1 Attempt All. **[12]**

(A) What are the elements of Translational mechanical system? Derive their equations.
(B) Explain the requirements of a good control system.
(C) Define closed loop control system. Draw its general block diagram and explain with appropriate example.

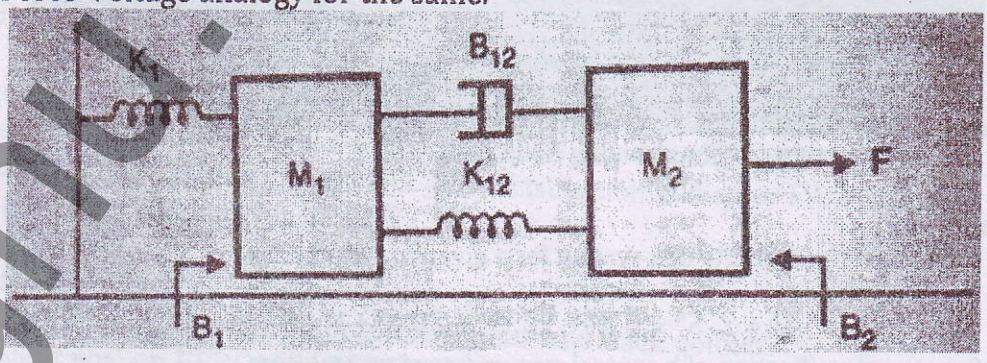
Que:-2 (A) Draw the Root Locus for the unity feedback system, whose forward Path Transfer function is given by **[06]**

$$G(s) = \frac{k}{s(s+6)(s+9)}$$

(B) How does a servo motor rotate? How is it different from stepper motor? **[05]**

OR

Que:-2 (A) Draw the FBD and Nodal diagram for the shown below. Derive system equations and Force-Voltage analogy for the same. **[06]**



(B) What is a SFG? Explain the theory used to solve SFG with its steps. [05]

Que:-3 Attempt All. [12]

(A) Compare block diagram and SFG.
(B) Explain various configurations of DC motors.
(C) Explain the basic principle of rotation of motor. Derive torque equation for PMDCM.

Section – II

Que:-4 Attempt All. [12]

(A) Discuss about the special cases of routh's stability criterion.
(B) Explain the various time domain specifications with figure.
(C) Discuss the various types of standard test signals with diagram.

OR

Que:-4 Attempt All. [12]

(A) Briefly explain about damping factor and natural frequency of oscillation with figure.
(B) The control system having unity feedback,

$$G(s) = 20/\ s(1+4s)(1+s)$$

Determine: 1. Different static error coefficients,
2. Steady state error if input,

$$r(t) = 2 + 4t + t^2/2$$

(C) Explain the unit impulse response of a first order system.

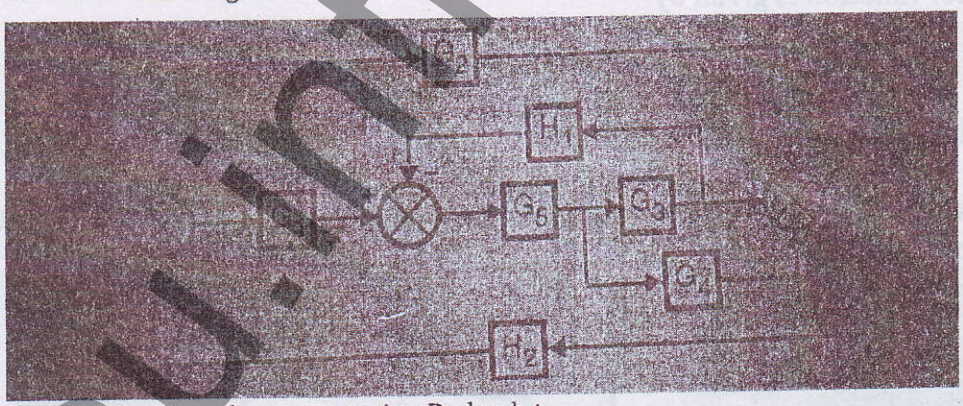
Que:-5 (A) Draw the Polar Plot of [06]

$$G(s) = \frac{100}{(s+3)(s+4)(s+5)}$$

(B) Derive the equation for time response of a second order system subjected to impulse input for $\xi > 1$ and $\xi = 1$. [05]

OR

Que:-5 (A) Solve the following and find the transfer function. [06]



(B) Explain the steps for constructing Bode plot. [05]

Que:-6 Attempt All. [12]

(A) Determine the stability of a system for a given function,

$$S^6 + 2.S^5 + 8.S^4 + 12.S^3 + 20.S^2 + 16.S + 16 = 0$$

(B) Give the classification of a control system based on stability.
(C) Explain the following rules for block diagram reduction:
1. Shifting a summing point before a block
2. Shifting a summing point after a block
3. Shifting a take off point before a block
4. Shifting a take off point after a block