Student Exam No: _____

GANPAT UNIVERSITY

B.TECH SEM. V - MECHATRONICS ENGINEERING

REGULAR EXAMINATION NOV/DEC - 2011

MC-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]**

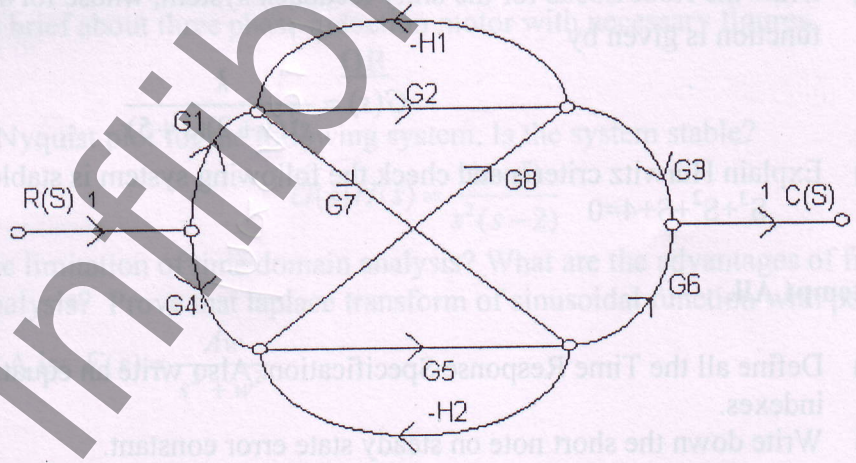
(A) Explain the Any application of the servomechanism.

(B) The open loop transfer function of unity feedback system is given by

$$G(s) = \frac{ks(3s+1)}{(s^2+2s+3)}$$

Determine the value of K the Closed loop system to be stable.

(C) Using Mason's formula determines C(S)/R(S).



OR

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

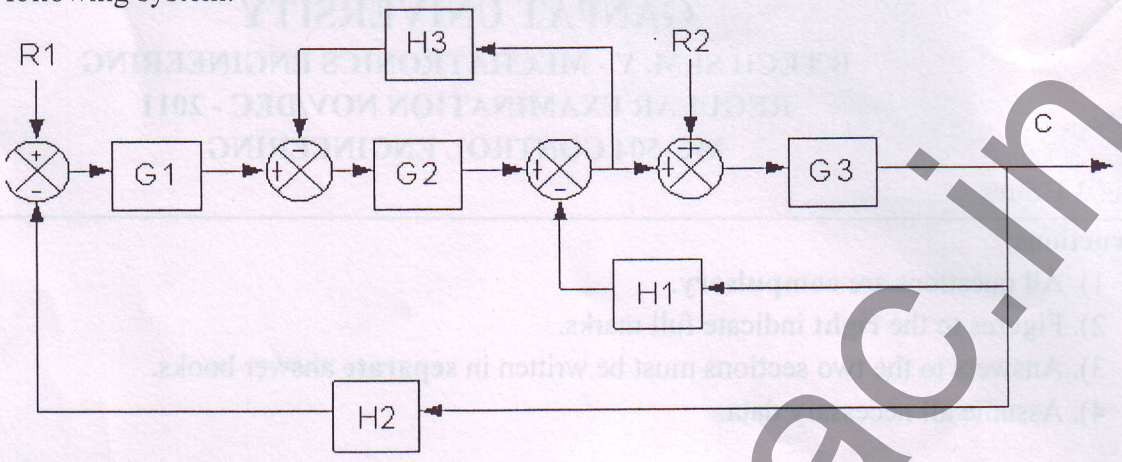
(A) Give the classification of the control system.

(B) The open loop transfer function of unity feedback system is given by

$$G(s) = \frac{k}{s(s+2)(s^2+4s+5)}$$

Determine the value of K the Closed loop system to be stable.

(C) Using Block diagram reduction technique determine Transfer function of the following system.



Que:-2 **(A)** Draw the Root Locus for the unity feedback system, whose forward Path Transfer function is given by **[08]**

$$G(s) = \frac{k}{s(s^2 + 15s + 54)}$$

(B) By Hurwitz criteria find the stability for given system **[03]**

$S^4+8S^3+18S^2+16S+5=0$

OR

Que:-2 **(A)** Draw the Root Locus for the unity feedback system, whose forward Path Transfer function is given by **[08]**

$$G(s) = \frac{k}{s^2(s+2)(s+5)}$$

(B) Explain Hurwitz criteria and check the following system is stable or not? **[03]**

$S^3+S^2+S+4=0$

Que:-3 **Attempt All.** **[12]**

(A) Define all the Time Response Specification. Also write an equation of all performance indexes.

(B) Write down the short note on steady state error constant.

(C) A second order control system is represented by transfer function given below

$$\frac{Q(s)}{T(s)} = \frac{1}{(Js^2 + Fs + K)}$$

Where Q(S) is proportional output and T is input torque. A step input 10 N-m is applied to a system and test the results are as follows.

1. Peak overshoot 6%
2. Peak time 1 sec.
3. The steady state output is 0.5 radian.

Determine the values of J, K and F.

Section - II

Que:-4 **Attempt All.** **[12]**

(A) Explain working of AC servomotor and its control.

(B) Explain all the Frequency domain specifications with diagram.

(C) Write down properties, advantages and disadvantages of transfer function.

OR

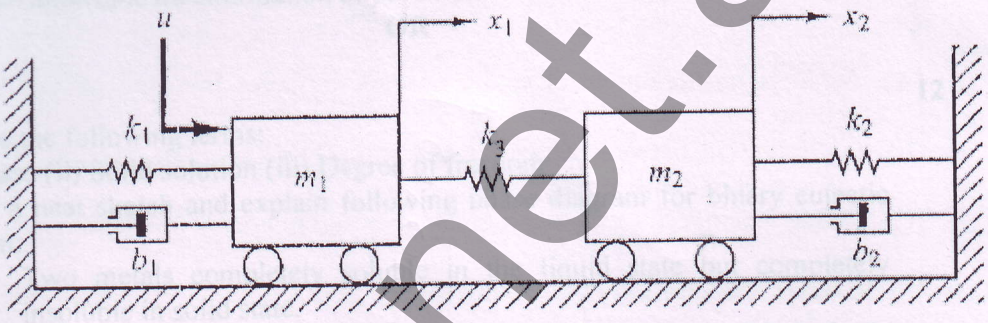
Que:-4 **Attempt All.** **[12]**

(A) Describe the Permanent Magnet and Hybrid Stepper motor with figures.

(B) Write down steps for solving Bode plots. What are the advantages of the same?

(C) Explain about PMDCM with necessary equations and draw torque-speed curves.

Que:-5 **(A)** Obtain the transfer functions $X_1(S)/U(S)$ and $X_2(S)/U(S)$ for the system shown below by drawing FBD. Find out Force-Current analogy for the same. **[06]**



(B) Explain in brief about three phase induction motor with necessary figures. **[05]**

OR

Que:-5 **(A)** Draw the Nyquist plot for the following system. Is the system stable? **[06]**

$$G(s)H(s) = \frac{(s+1)}{s^2(s-2)}$$

(B) What is the limitation of time domain analysis? What are the advantages of frequency domain analysis? Prove that laplace transform of sinusoidal function with peak amplitude A is: $F(s) = \frac{Aw}{s^2 + w^2}$ **[05]**

Que:-6 **Attempt All.** **[12]**

(A) Explain working of Synchronous motor.

(B) Explain the Poles & Zeros of Transfer function with an appropriate example.

(C) Discuss various configurations of DC motors.

END OF PAPER