Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- IV (ELECTRICAL) REGULAR EXAMINATION– APRIL-JUNE 2016

2EE401: Control System Engineering

TIME: 3 HRS **TOTAL MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Que. 1

(A) Check the stability of the following system using Routh criterion. **[03]**

$$s^5 + s^4 + 4s^3 + 24s^2 + 3s + 63 = 0$$

(B) Plot the root locus for following system and comment on stability. **[07]**

$$G(s)H(s) = \frac{k}{s(s^2 + 2s + 25)}$$

OR

Que. 1

(A) Draw the root locus for unity feedback system, whose forward path transfer function. Also comment on the stability of the system **[06]**

$$G(s)H(s) = \frac{K}{s(s + 2)(s + 5)}$$

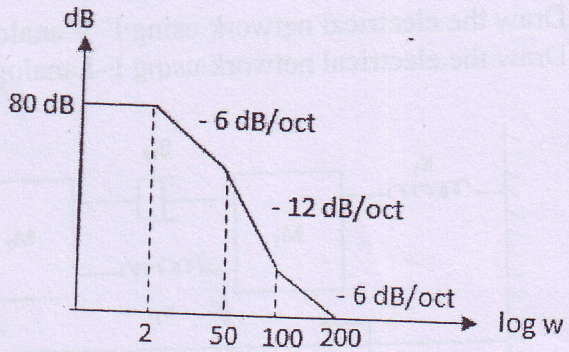
(B) Apply Routh stability criterion and find the value of K for which the system is stable for given characteristics equation. **[04]**

(a) $s^4 + 5s^3 + 5s^2 + 4s + K = 0$

(b) $s^4 + 7s^3 + 10s^2 + Ks + K = 0$

Que.2

(A) Recover the transfer function of the system from the figure shown below. Also obtain the value of system gain. **[05]**



(B) For the following closed loop transfer function, calculate (a) the output c(t) for unit step input, (b) steady state error for unit ramp input, (c) determine K if the error to a ramp input is 0.02. **[05]**

$$\frac{C(s)}{R(s)} = \frac{400}{s^2 + 20s + 400}$$

OR

Que.2

(A) Define (i) type the system (ii) steady state error. **[02]**

(B) For the system having the open-loop transfer function. Determine the stability of the system by plotting the Bode plot of the system. **[08]**

$$G(s)H(s) = \frac{10}{s(s+1)(s+5)}.$$

Q.3 **Attempt Any Two**

(A) Define the following terms

(i) Delay Time (ii) Rise Time (iii) Settling Time (iv) Peak Overshoot

(v) Relative Stability

(B) Using the Nyquist criterion determine the stability of the system whose open loop transfer function is given as

$$G(s)H(s) = \frac{50}{(s+1)(s+2)}$$

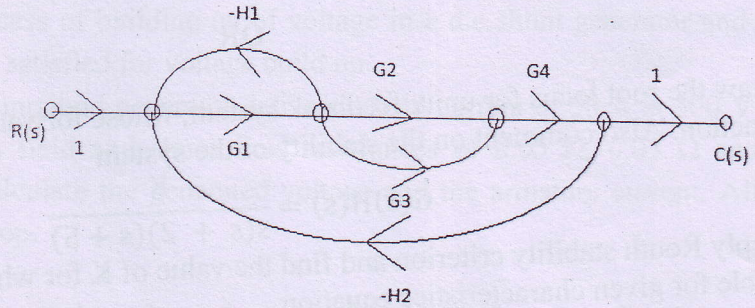
(C) Determine centroid, no of asymptotes, angle of asymptotes, and angle of departures for the unity feedback system shown below.

$$G(s) = \frac{K}{s(s+2+2j)(s+2-2j)}, K > 0$$

SECTION: II

Que.4

(A) The system signal flow graph is shown below. Find the transfer function of the system. **[06]**



(B) Explain F-I Analogy. **[04]**

OR

Que.4

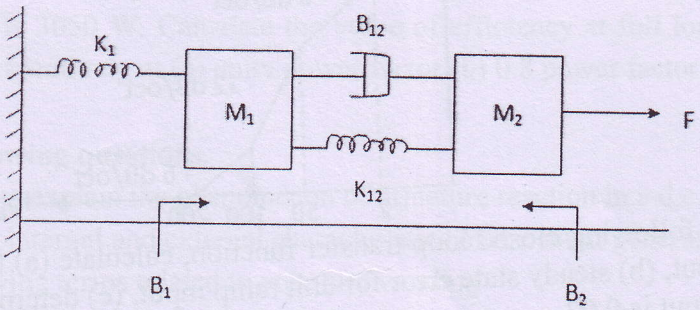
(A) For the system shown in below Figure. **[08]**

(i) Draw the mechanical network

(ii) Write the system equations

(iii) Draw the electrical network using F-V analogy.

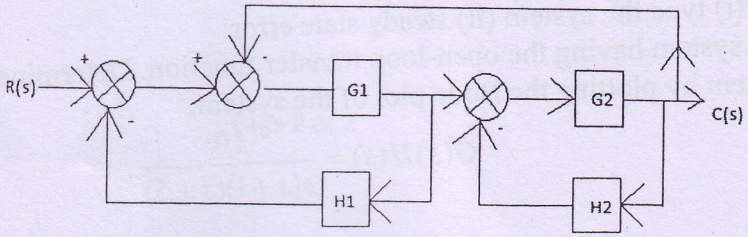
(iv) Draw the electrical network using F-I analogy



(B) What do you mean by a mechanical translation system and mechanical rotational system? **[02]**

Que.5

(A) Obtain the transfer function of the control system whose block diagram is shown in below Figure by block diagram reduction technique. **[06]**



(B) Define Transfer function and discuss its Properties. **[04]**

ue.5

OR

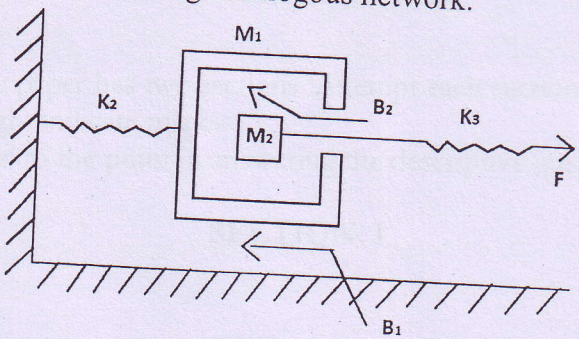
(A) State Mason's gain formula and discuss the steps for solving signal flow graph. [05]

(B) For the system shown in below Fig. [05]

(i) Draw the mechanical network.

(ii) Only draw force current analogous network.

(iii) Only draw force voltage analogous network.



Q.6 Attempt Any Two

(A) Given the system transfer function [10]

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

Find differential equation, consider input x, output y.

(B) What are the advantages and disadvantages of closed loop system over open loop system?

(C) Discuss the procedural steps to design phase lag compensator.

----------**END OF PAPER**----------