Seat No._____

GANPAT UNIVERSITY
B. TECH. SEMESTER IV ELECTRONICS & COMMUNICATION ENGINEERING
EXAMINATION, MAY / JUNE - 2012
2EC 402: CONTROL SYSTEMS

TIME: 3 HOURS] **[TOTAL MARKS: 70**

INSTRUCTION:-

1. Attempt all questions.
2. Answers to the two sections must be written in separate answer books.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.

SECTION-I

1 (A) Define the following: 4
- (i) Absolutely stable system
- (ii) Unstable system
- (iii) Conditionally stable system
- (iv) Marginally stable system

(B) 5

$$\frac{C(S)}{R(S)} = \frac{10}{S^6 + 2S^5 + 2S^4 + 3S^3 + 5S^2 + 6S + 1}$$

Determine the stability of the system with closed loop transfer function using Routh's criterion. Also determine number of roots in RHP and LHP of s-plane.

(C) The open loop transfer function of a feedback control system is given by, 3

$$G(S)H(S) = \frac{K}{S(S+1)(S+2)}$$

Draw the polar plot.

OR

1 (A) The open loop transfer function of unity feedback system, 4

$$\frac{K}{S(1+0.4S)(1+0.25S)}$$

Find the restriction of K so that the closed loop system is absolutely stable.

(B) 8

$$G(S)H(S) = \frac{K}{S(S+2)(S+4)}$$

Sketch the root locus. Find the value of K at the point where the root loci crosses the imaginary axis. Also determine the frequency. Also determine the value of 'K' so that the dominant pair complex poles of the system has a damping ratio of 0.5.

2 (A) For a unity feedback system, 4

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

Determine the stability using nyquist criterion.

(B) Sketch the bode plot whose open loop transfer function is given below, 7

$$G(S)H(S) = \frac{2(S+0.25)}{S^2(S+1)(S+0.5)}$$

From bode plot determine

(i) Phase crossover frequency.
(ii) Gain crossover frequency.
(iii) Gain margin and Phase margin.
(iv) Stability of the system.

OR

2 (A) For unity feedback system, 8

$$G(S) = \frac{40(S+5)}{S(S+10)(S+2)}$$

Draw the bode plot. Find gain margin and phase margin also determine the stability.

(B) How gain margin and phase margin are obtained from bode plot? 3

3 (A) The open loop transfer function of a system is, 8

$$G(S)H(S) = \frac{K}{S(S+2+2j)(S+2-2j)}$$

Draw the complete root locus and comment on the stability of the closed loop system.

(B) Explain Hurwitz criterion for stability. Check the stability of the given system using Hurwitz criterion. 4

$$S^3 + 8S^2 + 14S + 24 = 0$$

SECTION-II

4 (A) Define: control system, manual control system, and servomechanism. Also compare open loop & close loop control systems. 6

(B) Write differential equations for the translator system shown in Fig.1 and obtain F→V analogous electrical circuit for the same. 6

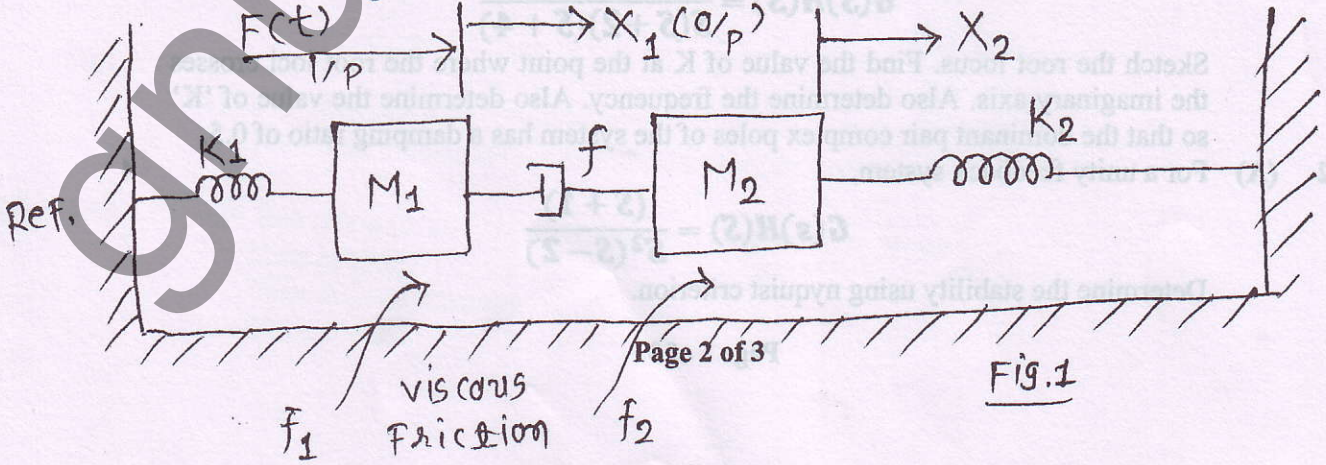

Fig.1

OR

4 **(A)** Explain F(T)→ V and F(T)→ I analogies. **6**

(B) Derive torque differential equations for the gear trains. **6**

5 **(A)** How do we decide the " type" and " order" of the control system? Derive e_{ss} for the +ve feedback control system. **6**

(B) Define: source node, sink node, path, loop and forward path gain for the signal flow graph of a –ve feedback control system. **5**

OR

5 **(A)** Determine overall system transfer function for the signal flow graph shown in Fig.2. **6**

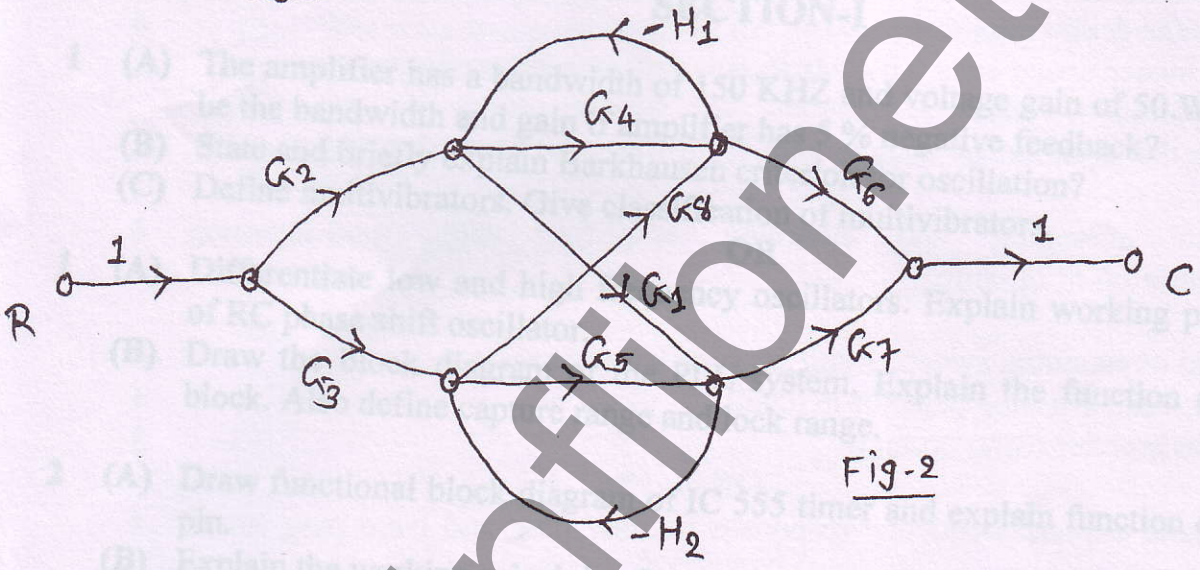

Fig-2

(B) Explain operation of synchro with neat sketch. **5**

6 **(A)** Define K_p, K_v and K_a and derive them for type 0, 1 & 2 systems. **6**

(B) What is transient response? Explain its time domain specifications. **6**

END OF PAPER