# GANPAT UNIVERSITY

### B.Tech. Semester: IV Biomedical & Instrumentation Engineering
### Regular Examination May/June-2013
### 2BM402: Control System Engineering

**TIME: 3 Hours**                                                 **Total Marks: 70**

**Instruction:** 
1. Write the answer of each section in separate answer sheet.
2. Figure to the right indicates full marks.
3. Assume suitable data if necessary.

## SECTION-I

**Que-1**                                                      **12**

(a) Draw the general block diagram of closed loop control system and explain one of the automatic control system.

(b) For given electromechanical system shown in Fig.1 derive TF $X_{(s)}/E_{(s)}$.

**OR**

**Que-1**                                                      **12**

(a) What is gear trains system? Derive the mathematical Equation of gear trains system referred to shaft1.

(b) Using block diagram reduction technique derive the TF of the system shown in Fig.2

**Que-2**                                                      **11**

(a) How the time response specifications are important? Draw time response of $2^{nd}$ order control system and define all specifications.

(b) The open loop TF of a servo system with unity feedback is $G_{(s)}=10/s(0.1s+1)$. Evaluate the static error constants $K_p$, $K_v$ and $K_a$ for the system.

**OR**

**Que-2**                                                      **11**

(a) How steady state error constants are important? For type-0, type-1 and type-2 system derive steady state error constants.

(b) Derive the Transfer Function of field control DC motor and draw its block diagram.

**Que-3**                                                      **12**

(a) Write short note on A.C servo motor.

(b) What do you mean by sensitivity? Derive the formula for sensitivity w.r.t change in G and change in H.

(c) What is signal flow graph? Explain all the terms of signal flow graph.

**Que-4**      12

(a) Write statement of Routh stability criterion. Discuss the problem associated with Routh criterion and its remedial solution.

(b) For unity feedback control system draw root locus and determine stability of $G(s)=K/S(S^2+4S+13)$

**OR**

**Que-4**      12

(a) For the given characteristics equation determine the range of K for the system to be stable using Routh criterion

1) $S^4+4KS^3+13S^2+36S+K=0$    2) $S^4+20KS^3+5S^3+10S+15=0$

(b) Write the advantages of Root Locus. Explain all the rules of Root locus construction technique.

**Que-5**      11

(a) What is frequency response? Give advantages of frequency response over time response.

(b) Draw the bode plot for the given TF and determine the stability of the system $G(s)=75(1+0.2S)/S(S^2+16S+100)$

**OR**

**Que-5**      11

(a) Draw the POLAR plot of the following TF
(1) $G(s)=1/S(1+S)(1+2S)$

(b) Discuss all the factor of TF to draw bode plot and discuss all the factor in detail.

**Que-6**      12

(a) Define the Transfer Function. Give all the characteristics of TF.

(b) Define (1) gain cross over frequency (2) phase cross over frequency
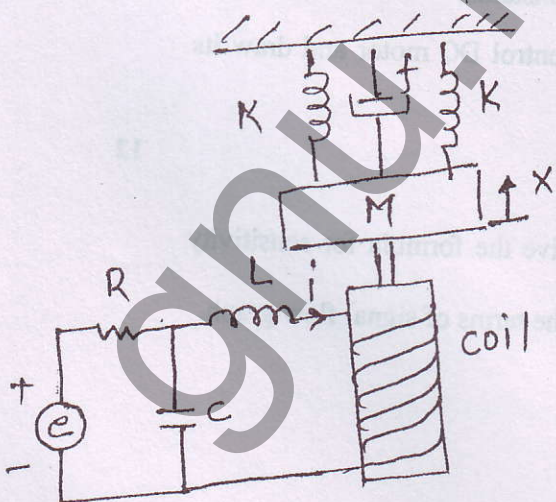(3) Gain Margin        (4) Phase Margin



Fig. 1 Que.1 (b)
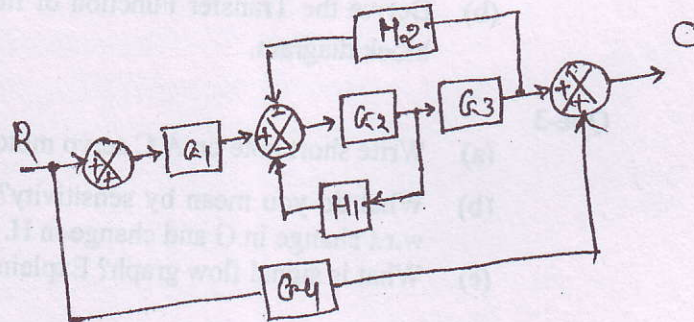
Fig. 2 Que.1 (b) OR