Exam No: _____

GANPAT UNIVERSITY

B.Tech.(ME) Sem-VI CBCS REGULAR EXAMINATION– APRIL-JUNE 2017

2ME601: 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

Q.1 (a) For LR circuit shown in Fig.1, let R = 100Ω and L = 20H. The voltage is suddenly changed from 0 to 12V. Derive mathematical model of the system. Also determine in how much time output voltage will reach 11.5V. Assume output voltage to be appearing across resistor. **(05)**

(b) For open loop transfer function with unity feedback control system **(05)**

$$G(s)H(s)=\frac{k}{s(1+\tau s)}$$

Determine values of k and τ required so that there are no roots to the right of the line s=-a.

OR

Q. 1 (a) The approximate step response of a second order system is shown in Fig. 2 when subjected to an input of 2u(t), where u(t) is unit step function. Determine open loop transfer function and closed loop transfer functions assuming unity feedback. **(05)**

(b) Draw and explain any four membership functions in Fuzzy logic. **(05)**

Q.2 Draw root locus plot for open loop transfer function **(10)**

$$G(s)H(s)=\frac{k}{s(s+2+2j)(s+2-2j)}$$

OR

Q.2 A robot has an open loop transfer function **(10)**

$$G(s)H(s)=\frac{k}{s(s+3)(s+100)}$$

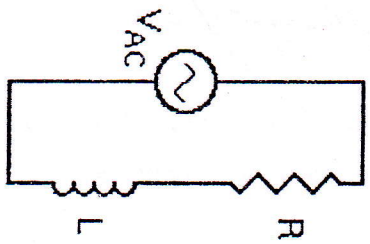
Draw bode plot assuming k = 3000. Determine,

a. Phase crossover frequency
b. Gain margin
c. Gain crossover frequency
d. Phase margin

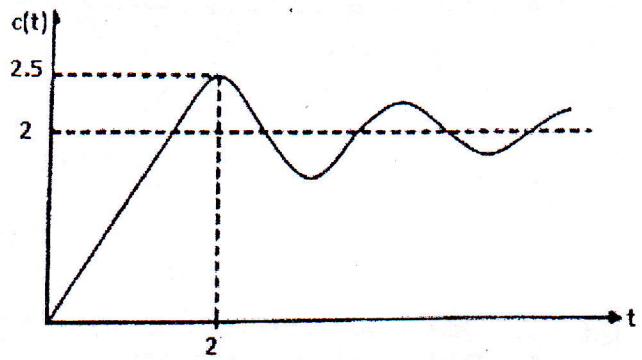
Q.3 (a) Determine stability conditions for following system using Hurwitz criterion. **(05)**

$$D(s)=a_3s^3+a_2s^2+a_1s+a_0$$

(b) Explain effect of PD controller in time domain and frequency domain. **(05)**



[Fig. 1]



[Fig. 2]

SECTION: II

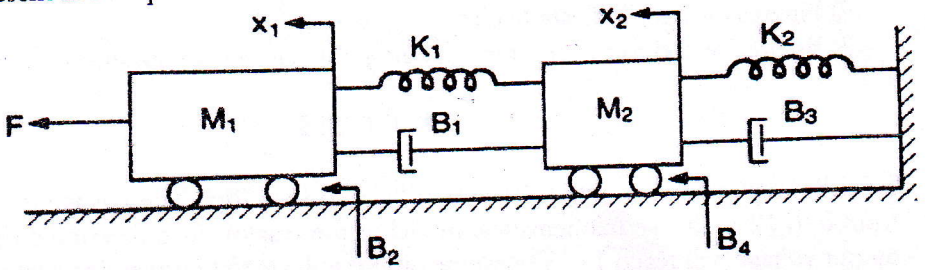
Q.4 (a) Define closed loop control system. Draw its general block diagram and explain function of each block. (05)

(b) Derive equations of motion for basic elements of mechanical translational systems. (05)

OR

Q.4 (a) Explain components of a pneumatic controller. (05)

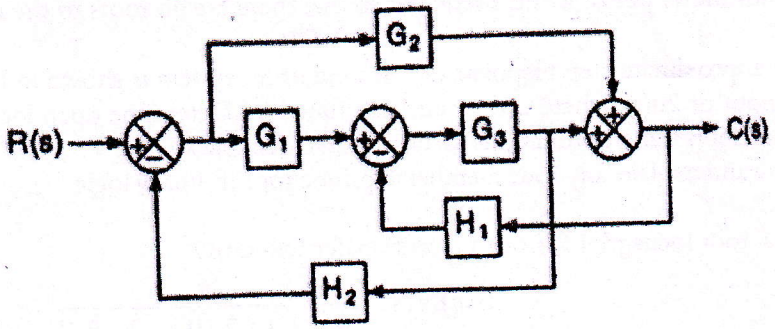
(b) For mechanical translation system as shown in Fig.3, write down differential equations and represent in its equivalent force voltage analogy. (05)



[Fig. 3]

Q.5 (a) Compare Signal Flow Graph and Block Diagram Reduction methods. (05)

(b) Find transfer function of system shown in Fig.4 using Block diagram reduction technique. (05)



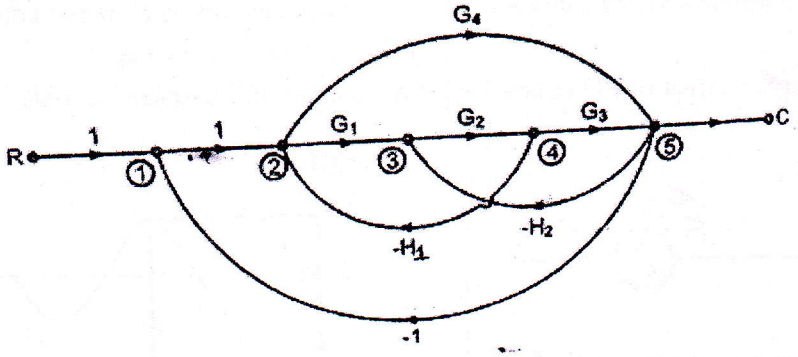
[Fig. 4]

OR

Q.5 (a) Explain the following rules for block diagram reduction. (05)

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
5. Shifting a take-off point after a summing point

(b) Find the transfer function of system whose signal flow diagram is shown in Fig. 5. (05)



[Fig. 5]

Q.6 (a) Draw a hydraulic circuit diagram for manual operation of double acting cylinder. (05)

(b) Explain applications of pneumatic systems for Sequencing. (05)

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