Exam No: _____

GANPAT UNIVERSITY

B. TECH SEM- IV (BM&I) REGULAR EXAMINATION, APRIL-JUNE 2016

2BM402: 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 (10)

(a) Only give the list of example of open loop control system. Explain the Open loop control system with block diagram, advantages and disadvantages. 04

(b) Draw the neat diagram mechanical accelerometer and derive the acceleration equation for it. 04

(c) Give the steps to derive the mathematical model of physical system. 02

OR

Q. 1 (10)

(a) Is servomechanism an automatic controlled closed loop control system? Explain it with neat diagram. 04

(b) What is rotational mechanical system? Explain the idealized components used for modeling of translational mechanical system. 04

(c) Enlist all the methods to derive TF. 02

Q.2 (10)

(a) Obtain the mathematical model and TF for system shown in Fig.1 05

(b) With diagram explain all the rules of block diagram reduction techniques. 05

OR

Q.2 (10)

(a) What is signal flow graph? Derive system gain (TF) for signal flow graph shown in Fig.2. 05

(b) With the example of OLC and CLS proves that feedback reduce the parameters variation. 05

Q.3 (10)

(a) Evaluate the sensitivity of transfer function T(s) to variation in parameter K for the value K=1 for the system shown in Fig.3. Also find magnitude $| S^{T}_{K} |$ for ω=5 rad/sec. 04

(b) Explain the synchro transmitter-receiver pair as error detector. 04

(c) Enlist all the benefit of feedback in control system Engineering. 02

SECTION: II

Q.4 (10)

(a) Draw time response for 2nd order control system and indicate all specification. Derive expression of any two specifications. 05

(b) The open loop TF of a unity feedback system is given by $G(s) = K/s(Ts+1)$, Where K and T are positive constant. By what factor should the amplifier gain be reduced so that the peak overshoot of unit-step response of the system is reduced from 60% to 40%? 05

OR

Q.4 (10)

(a) What is the important of steady state Error (SSE)? Derive the SSE equation for type-0, type-1 and type-2 system for all three standard input signals. 05

(b) A unity feedback (negative) system has open loop TF $G(s) = K/s(s+2)$. Calculate the value of gain K so that the closed loop system has a steady state unit ramp error of 0.1. What are the corresponding damping factor and peak overshoot to unit step input. 05

Q.5 (10)

(a) Sketch the root locus plot of unity feedback system with an open loop transfer function $G(s) = K/s(s+4)(s+8)$. 05

(b) Write the stability criterion of Hurwitz and explain construction of Hurwitz determinants and stability from it. 05

OR

Q.5 (10)

(a) Draw the bode plot for the following TF $G(s) = 4(s+0.5)/s(s+0.2)(s+1)$. Find the 1) Gain Margin 2) Phase Margin 3) Gain Cross Over Frequency 4) Phase Cross Over Frequency. 05

(b) For characteristic equation $S^4+5S^3+5S^2+4S+K=0$, using Routh criterion calculate the range of K for the system to be stable. 05

Q.6 (10)

(a) What is system stability? Draw the regions of root location for stable, unstable and limitedly stable systems. 03

(b) Write advantages of root locus over Routh criterion to fin stability. Write first four rules to construct the root locus. 04

(c) What is frequency response? Write the steps to derive frequency response. 03

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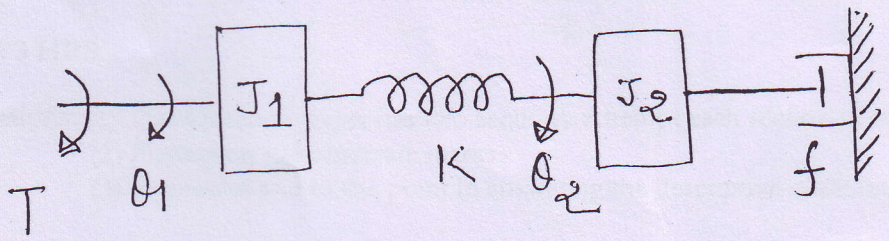

Fig. 1 Q-2 (a)

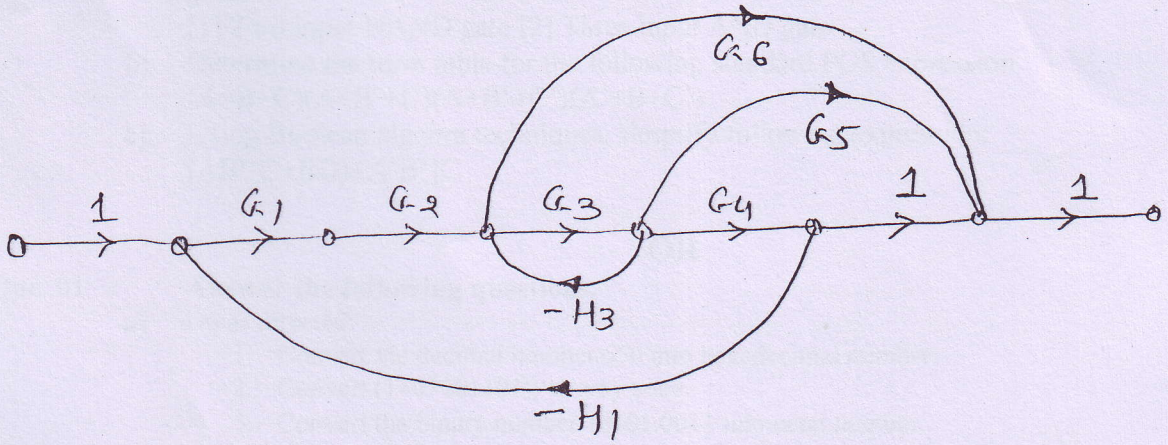

Fig. 2 OR Q-2 (a)

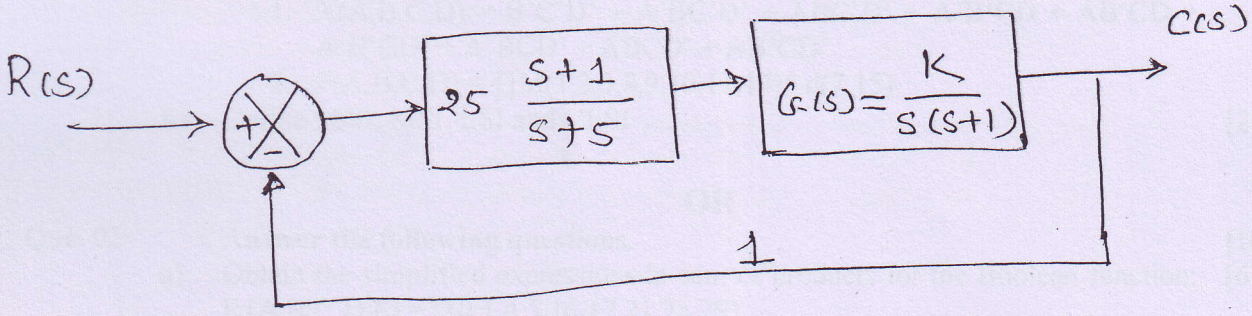

Fig. 3 Q-3 (a)