Exam.Code:0943
Sub. Code: 33881

2124

B.E. (Mechanical Engineering)
Seventh Semester
MEC-702: Automatic Controls

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt <u>five</u> questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.***

x-x-x

1 Attempt the following

a Define the static and dynamic systems, give example for each type.

b Write the Laplace transform for Impulse input signal.

c What are the advantage of having signal flow graph using Mason's gain formula?

d Define:
i. Stability, ii. Relative stability

e Calculate error at corner frequency to the term $(1 + j\omega T) \pm N$. 5*2

Part A

2 a Figure 1, shows a gas pressure system. Volume of the vessel = 1.2 m^3, Gas temp. = 257°C, Gas resistance $R_1 = 1.8 \times 10^5$ NS/Kgm^2, Find the transfer function of the system relating 'p' and 'm', 'p' being the pressure in the vessel and 'm', the inflow mass flow rate. Gas constant $\bar{R} = 297$ J/Kgk. 5

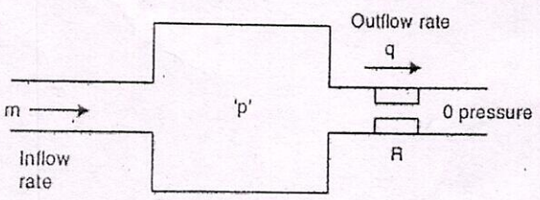

Fig. 1

b What is feedback? What type of feedback is preferred for control system? 5

3 a Determine the transfer function C / R from the block diagram as shown in Fig. 2 5

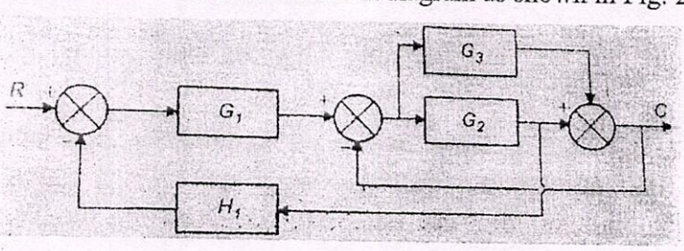

Fig. 2

b What are the basic elements of mechanical rotational systems? Write its force balance equation. 5

4 a A unity feed-back control system has its open-loop transfer function given by 5

$G(s) = \dfrac{(4s+1)}{4s^2}$, Determine an expression for the time response, when the system is subjected to Unit impulse input function.

P.T.O.

(b) A second order control system is represented by $\frac{\theta_0(s)}{T(s)} = \frac{1}{(Js^2+fs+K)}$, transfer function. 5

Where θ_0 is the proportional output and T is the input torque. A step input of 10 Nm is applied to the system and test results are given; $M_p = 6\%$, $t_p = 1$ sec and the steady state value of the output is 0.5 radian. Determine the values of J, f and K.

Part B

5 (a) The closed loop transfer function of a system is $T(s) = (S^3 + 4S^2 + 8S + 16) / (S^5 + 3S^4 + 5S^2 + S + 3)$. Calculate number of poles in the right and left half-plane 5

(b) Find the condition for the stability of forward transfer function of a unity feedback system $G(s) = K(s^2 + 1)/(s + 1)(s + 2)$. 5

6 (a) Explain input signals applied for time response control system. 5

(b) What do you mean by virtual instrumentation? Why is Virtual Instrumentation necessary? 5

7 (a) Write the Steps to Create a Sub-VI. 5

(b) Explain the potentiometer error detector with circuit diagram. 5

x-x-x