Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: B.Tech. Mechanical | **Semester : VIII**

Course Name : Automatic Control | **Time : 03 hrs**

Course Code : MECH4005 | **Max. Marks : 100**

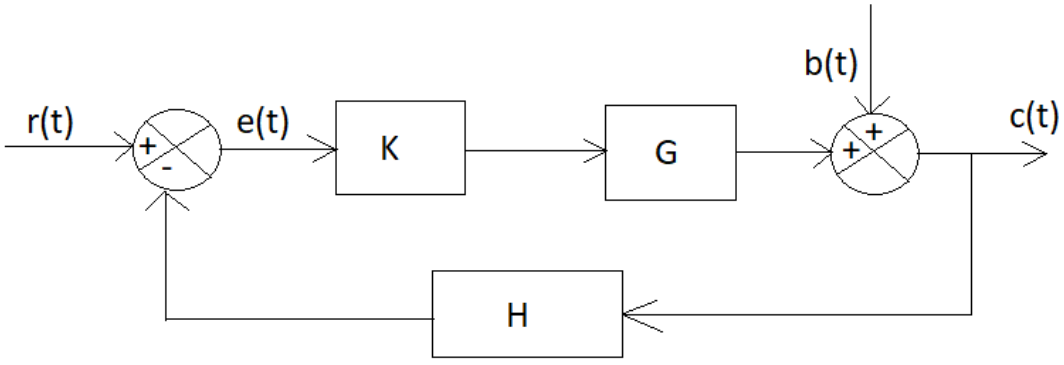
Nos. of page(s) : 02

Instructions: Assume any missing data.

SECTION A

S. No.		Marks	CO
Q 1	Describe the procedure to perform the frequency response analysis of a control system.	**5**	**CO1**
Q 2	Derive the general expression for output, *c(t)* from a typical feedback system having inputs- *r(t)* and *b(t)*. The controller gain may be taken as K in general and the feedback system is designed for a first order system.	**5**	**CO2**
Q 3	Discuss the concept of stability of control systems using Nyquist plot.	**5**	**CO3**
Q 4	A system is having the characteristic equation: $s^3 - 4s^2 + 2s + 7 = 0$. Using Routh's criterion state whether the system is stable or unstable. Find out the roots of the equation mathematically and then interpret your results.	**5**	**CO3**
Q 5	Compare between various types of control systems.	**5**	**CO1**
Q 6	Discuss the significance of transient and steady-state analyses of control systems.	**5**	**CO2**

SECTION B

Q 7	Draw a typical polar plot for open loop frequency for a first order system. Assume the parameters of the control system yourself.	**10**	**CO1**
Q 8	Describe the rectangular plot for a second order system.	**10**	**CO1**
Q 9	For the system shown in Fig. 1 below, find out the steady state error due to unit ramp reference input. Take $K = \frac{100}{D+10}$, $G = \frac{1}{5D+1}$, b(t) = 0 and H = 1.  Fig. 1: A closed loop system	**10**	**CO2**

Q 10	Describe the mathematical model of a field-controlled DC motor.	**10**	**CO2**
Q 11	Consider the diagram shown in Fig. 1. Taking K = 25, b(t) = 0 and $G = \frac{1}{D(D+2)}$, draw the polar plot also for the first case.	**10**	**CO4**
SECTION-C			
Q 12	Prepare the Nyquist plot for a control system with open loop transfer function of $GH(s) = \frac{10}{(s+1)s}$ and find if the system is stable or not.	**20**	**CO4**