Name: **Enrolment No:**	UPES

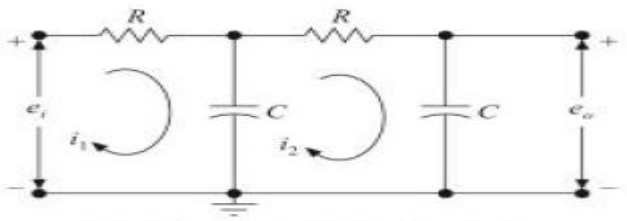
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

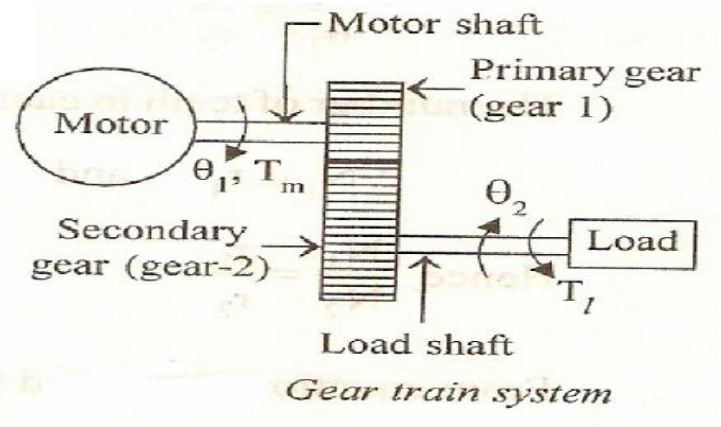
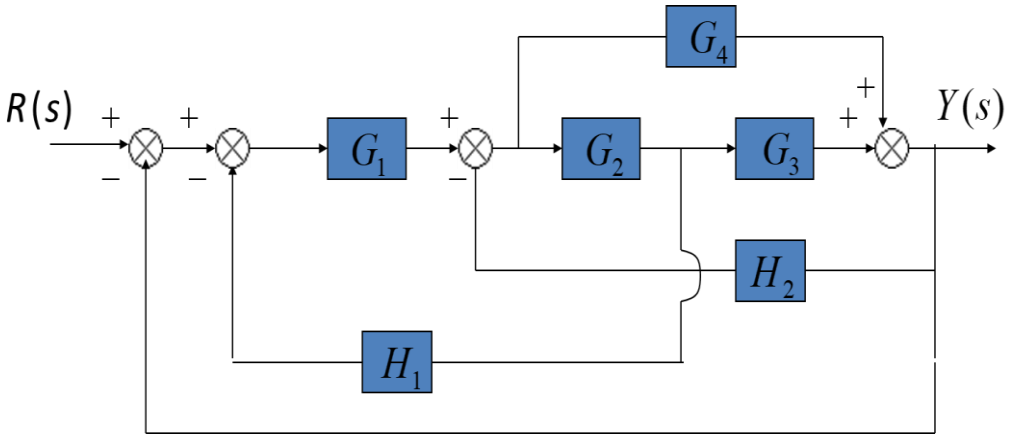
Programme Name: B. Tech (Mechatronics Engineering) **Semester : IV**
Course Name : Instrumentation and Control **Time : 03 hrs.**
Course Code : ECEG 3011 **Max. Marks : 100**
Nos. of page(s) : 03
Instructions: All questions are compulsory.

SECTION A
All questions are compulsory and carry equal marks.

S. No.		Marks	CO
Q 1	What do you mean by control system? How are control system classified?	5	CO1
Q 2	Why negative feedback is preferred in control systems?	5	CO3
Q 3	Distinguish between linear and nonlinear control system.	5	CO1
Q 4	Compare SISO and MIMO system.	5	CO5
Q 5	What do you mean by transient response and steady state response?	5	CO4
Q 6	Define classification of transducers.	5	CO2

SECTION B
Answer all the questions.

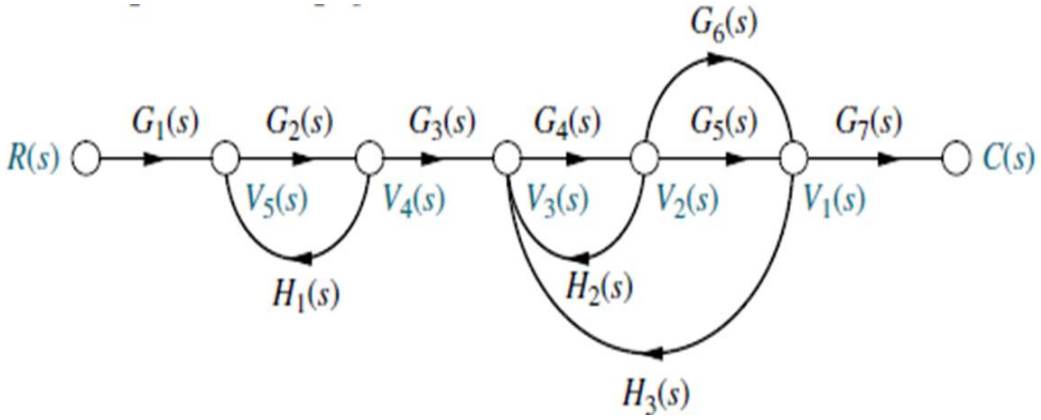
Q 1	Derive transfer function of blow circuit RC circuit. 	10	CO3
Q 2	A) What are type 0, type 1 and type 2 systems? B) Consider the following transfer functions. – Determine • Whether the transfer function is proper or improper • Poles of the system • zeros of the system	10	CO4

	• Order of the system $G(s)=\frac{(s+3)^2}{s(s^2+10)}$ $\qquad$ $G(s)=\frac{s^2(s+1)}{s(s+10)}$		
Q 3	Derive mathematical model of gear system specified in below figure.  *Gear train system*	**10**	**CO5**
Q 4	Find the transfer function of the following block diagram  	**10**	**CO4**
Q 5	Consider the signal flow graph below and identify the following a) Input node. b) Output node. c) Forward paths. d) Feedback paths (loops).	**10**	**CO3**

e) Determine the loop gains of the feedback loops.

f) Determine the path gains of the forward paths.

g) Non-touching loops

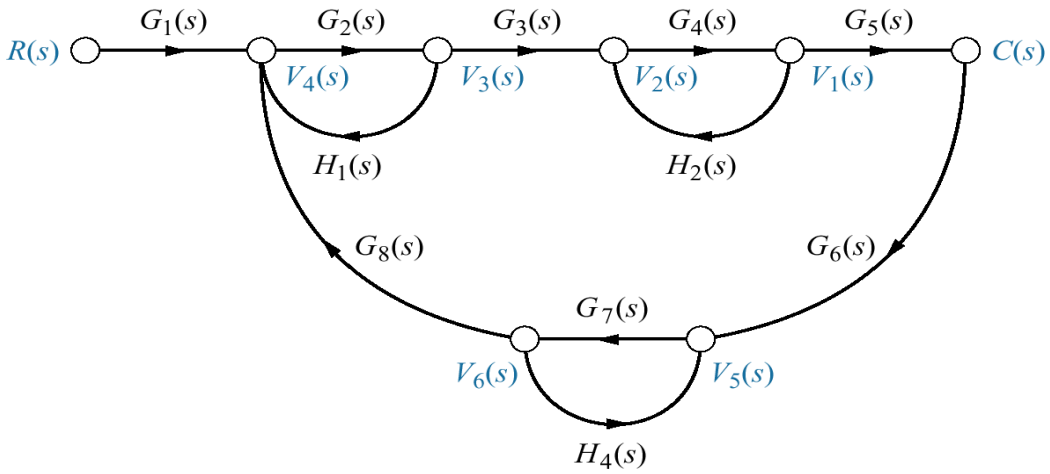


SECTION-C

Answer all the questions.

Q 1

Find the transfer function, C(s)/R(s), for the signal-flow graph in figure below. [20]



(20)

CO5

OR

A) Explain working of LVDT transducer with neat diagram. Also, write briefly the application, advantages and disadvantages of LVDT transducer. [10]

B) The characteristics equation of a feedback control system is given by [10]

$$S^4 + 20S^3 + 15S^2 + 2S + K = 0$$

a. Determine the range of values of K for the system to be stable.

b. Can the system be marginally stable? If so, find the required value of K and the frequency of sustained oscillation.