SET A

Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

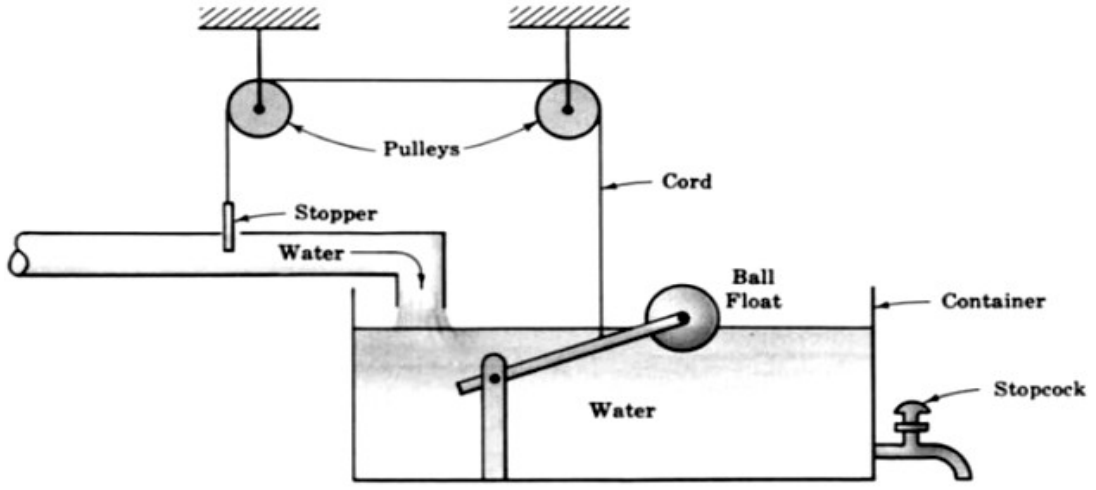
Course: Control System **Semester: IV**
Program: B.Tech. Electronics with specialization in IoT
Time: 03 hrs. **Max. Marks: 100**

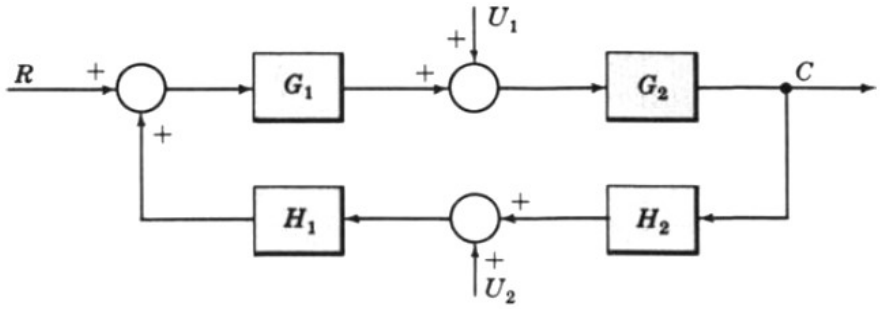
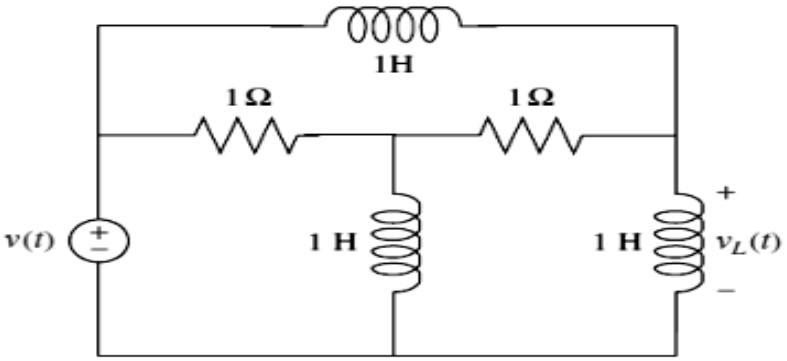
Instructions: Assume any missing data; answers should be clear and concise.

SECTION A (20 marks)
All questions are compulsory

S No	Question statement	Marks	CO
Q 1	Differentiate between an **open – loop** and a **closed – loop** system.	**5**	**CO 1**
Q 2	Explain the significance of **mathematical modeling** for control system design.	**5**	**CO 2**
Q 3	Define the following terms: **BIBO Stability** with respect to a control system.	**5**	**CO 3**
Q 4	Differentiate between a **Servo** and a **Regulator** control system.	**5**	**CO 4**

SECTION B (40 marks)
All questions are compulsory. Internal choice is given in question 5

Q 5	Figure 1 shows a simple automatic control system using mechanical components (for water level control); the objective of the system is to fill a container with water if it is emptied through a stopcock at the bottom, which is operated manually. The "ball float" floats on the water and as the ball gets closer to the top of the container, the stopper decreases the flow of water. When the container is filled completely, the stopper shuts off the flow of water. In this system identify (a) system, (b) set-point, (c) controller, (d) Actuator, and (e) the feedback element. Also draw the block diagram for the system.  Figure 1. Water level Control System	**10**	**CO 1**

	OR For the following block diagram determine the output ***C*** due to U_1, U_2 and ***R***  Figure 2. Block Diagram for ques 5		
Q 6	For the electrical circuit in figure 3, obtain the transfer function.  Figure 3. Electrical network	**10**	**CO 2**
Q 7	For a general second order system comment on the effect of adding an **open loop zero** (in Left Half of S Plane) to the system.	**10**	**CO 3**
Q8	Using **Routh array**, comment on the stability of the following transfer function: $T(s)=s^8+3s^7+10s^6+24s^5+48s^4+96s^3+128s^2+192s+128$	**10**	**CO 4**
	SECTION-C (40 marks) **All questions are compulsory. Internal choice is given in question 10**		
Q 9	Consider a system having transfer function as: $G(s)H(s)=\frac{80(s+5)}{s^2(s+50)}$ Sketch a bode plot for the above system and determine: a) Gain cross over frequency b) Phase cross over frequency c) Gain margin d) Phase margin	**20**	**CO 4**
Q 10	Consider a system having transfer function as: $F(s)=\frac{k(s+1)}{s^2(s+9)};k\geq 0$ Sketch a root locus for the above system and comment on the stability. **OR** Consider a system having transfer function as: $F(s)=\frac{k}{s(s+1)(s+3)(s+4)}$ Sketch a root locus for the above system and comment on the stability.	**20**	**CO 4**

	OR A unity feedback system has the following forward transfer function: $$G(s)=\frac{10(s+20)(s+30)}{s(s+25)(s+35)}$$ Find the **steady state error** for the inputs: $15u(t)$ and $tu(t)$.		
Q 7	For a general second order system comment on the effect of adding an **open loop pole** (in Left Half of S Plane) to the system.	**10**	**CO 3**
Q 8	Consider a third order system with the following characteristic equation: $s^3+7s^2+25s+39=0$ Comment on the stability of the system when the designer wants the roots to lie on the left of $s=-1$. Use **Routh array** to analyze the stability of the system.	**10**	**CO 4**
	SECTION-C (40 marks) **All questions are compulsory. Internal choice is given in question 10**		
Q 9	Consider a system having transfer function as: $G(s)H(s)=\frac{8(s+4)}{(s-1)(s-2)}$ Sketch a bode plot for the above system and determine: a) Gain cross over frequency b) Phase cross over frequency c) Gain margin d) Phase margin	**20**	**CO 4**
Q 10	Consider a system having transfer function as: $F(s)=\frac{k}{s(s+2)(s^2+2s+2)}$ Sketch a root locus for the above system and comment on the stability. **OR** Consider a system having transfer function as: $F(s)=\frac{k(s^2+2s+10)}{s^2(s+2)}$ Sketch a root locus for the above system and comment on the stability.	**20**	**CO 4**