Name: **Enrolment No:**	UPES

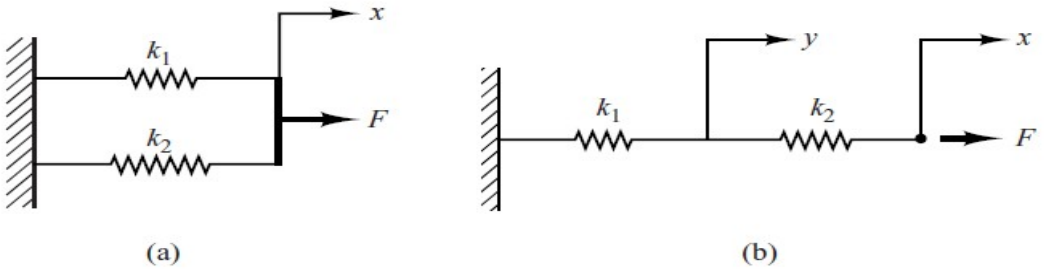
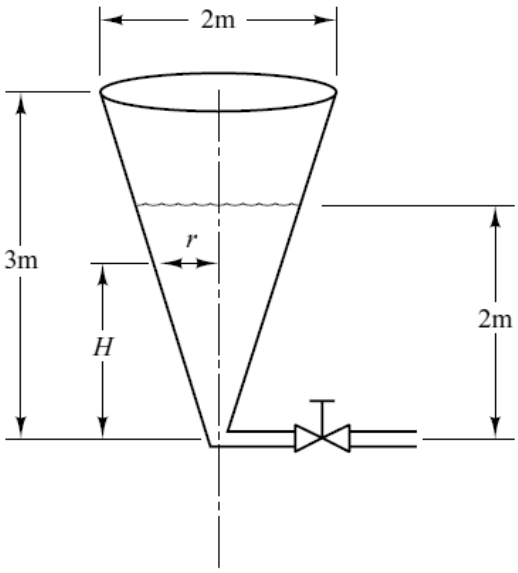
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Course: Process Instrumentation and Control Engineering (GNEG 311) **Semester: VI**
Program: BTech Fires and Safety Engineering
Time: 03 hrs. **Max. Marks: 100**

Instructions: Students are advised to answer questions sequentially and start each answer of a new sheet of paper.

SECTION A
All the questions are compulsory (Max marks 4 x 5 = 20)

S. No.		Marks
Q1	List any five commonly used input signals for control loop testing.	**5**
Q2	Instruments to measure temperature can be divided into separate classes according to the physical principle on which they operate. Under which category a thermistor falls? What are thermistors?	**5**
Q3	Give classifications of industrial controllers. Which controller is best suited for a process which requires frequent shut-down and start-ups and why?	**5**
Q4	Define the following term in connection with a response of a transfer function constructed on a polar plot. i) Phase Crossover Frequency ii) Phase Margin	**5**
	SECTION B **All questions are compulsory (Max marks 4 x 10 = 40)**	
Q5	Derive the expression for unit impulse response of a first order system. How do the response of a first order system to ramp and unit step inputs compares with unit impulse response? ***Or*** For the Transfer Function given, sketch the Bode diagram which shows how the phase of the system is affected by changing input frequency. $TF = \frac{1}{2s+100}$	**10**
Q6	Between a pneumatic and a hydraulic controller which one more accurate? List comparative features of the two types of controllers.	**10**
Q7	Explain the working of a pitot tube with the help of a diagram. What is the mathematical expression used for estimation of velocity using a pitot tube?	**10**
Q8	Obtain the equivalent spring constants for the systems shown in Figures (a) and (b), respectively. k_1 and k_2 are the spring constants, F is the force applied and x and y are corresponding displacements in the two systems. Describe all the simplifying assumptions made in solving the problem.	**10**

		
SECTION-C (2 x 20 = 40) **Answer any two question from this section (Max marks 40)**		
Q9 (a)	Describe the steps involved in constructing a bode plot.	**8**
(b)	Find the Bode log magnitude and phase angle plot for the transfer function $TF = \frac{200(s+20)}{s(2s+1)(s+40)}$	**12**
Q10(a)	Consider the conical water-tank system shown in the figure below. The flow through the valve is turbulent and is related to the head H by $Q = 0.005\sqrt{H}$ Where Q is the flow rate measured in m^3/sec and H is in meters. Suppose that the head is 2 m at t=0.What will be the head at t=60 sec? 	**10**
(b)	Explain liquid level control system with the help of a diagram and define capacitance and resistance of a liquid level control system.	**10**
Q11	Show that the steady-state output of a transfer function system can be obtained directly from the sinusoidal transfer function—that is, the transfer function in which s is replaced by $j\omega$, where ω is frequency.	**20**