King Fahd University of Petroleum & Minerals

Electrical Engineering Department
EE434 (Industrial Instrumentation)

Final Examination, Jun 7th , 2007
B59-Room 2001

Exam time : 7:00pm -9:30 Am

Problem #1	
Problem #2	
Problem #3	
Problem #4	
Problem #5	
Total	

Problem # 1

1) Mention some applications where will you use the following sensors:

- Thermocouples

- Infrared sensor

- Hall effect sensor
- A bellows

2) List four reasons for using ultrasound sensors

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3) List four criterion for selecting level sensors

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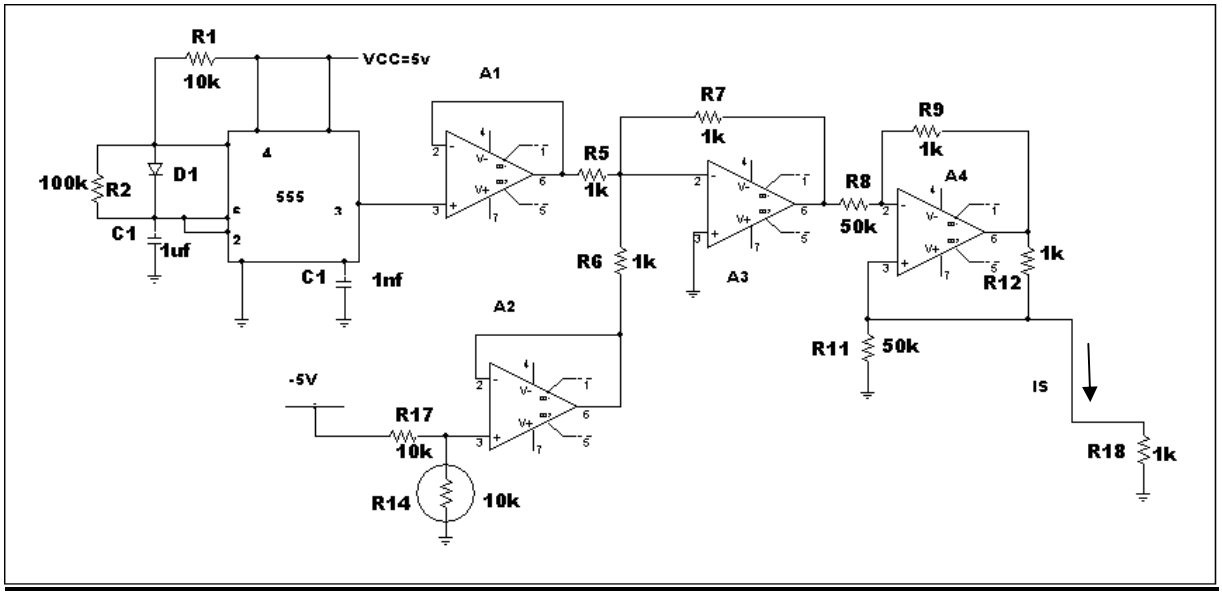
Problem # 2

A sensor outputs a range of 20.0 to 250mV in **a noisy environment**. Develop signal conditioning so that this becomes 0 to 5V to be digitized using A/D converter. **Make sure the input circuit has a very high input resistance**. The supply voltage available is ±12V

Problem # 3

Explain the operation of the circuit shown indicating the function of each stage (A1, A2, A3 and A4 in addition to the 555 timer). Sketch the output signal I_O. If c_1 is a humidity sensor (c_1 increases with humidity) and R_{14} is an RTD temperature sensor sketch effect of temperature and humidity on the output signal.



Problem # 4

A four newly purchased oil tanks are placed in a refinery. Point level sensors are installed and each will give ON or OFF signal (binary 0 or 1). There is only one pair of wires that can be used to transferee the signal from all level sensors all the way to the control room.

Draw the system block diagram that can be used to solve this problem. Make sure that the operator knows at any instant of time the status of the oil level in each tank.

Problem # 5

A link type load cell (four strain gages are used) with elasticity E =30,000 psi, ν = 0.3, and fatigue strength S_f = 80,000 psi. The cell is excited by 10 volt DC supply if the ratio of the output voltage to the supply voltage at maximum load is $\left(\frac{vo}{vs}\right)_{max}$ = 3.75mv/v.

1. Find the gage factor GF.
2. Write the expression for the sensitivity of the cell. Shwo how one can improve the sensitivity of the cell