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Total number of printed pages – 3

B. Tech  
FEEE 6301

**Sixth Semester (Special / Back) Examination – 2013**  
**INDUSTRIAL PROCESS CONTROL AND DYNAMICS**

**BRANCH : EEE, ELECTRICAL**

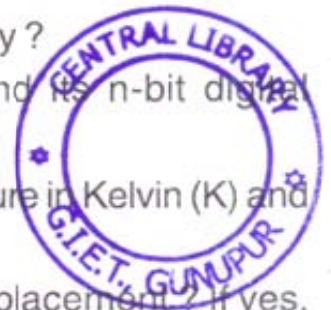
**QUESTION CODE : E 368**

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which is compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2 × 10
- (a) What is the need for filtering and impedance matching in signal conditioning ?
  - (b) State the parameters considered for analysis of Op-Amp with non-ideal response.
  - (c) What is digital signal conditioning ? Why is it necessary ?
  - (d) State the relation between a physical Variable and its n-bit digital representation in a ADC.
  - (e) Given a temperature of 124.5°C. Express this temperature in Kelvin (K) and Fahrenheit (°F).
  - (f) Is the capacitive sensor used for measurement of displacement ? If yes, explain how ?
  - (g) An EM radiation has frequency of  $10^6$  Hz. Find its wavelength.
  - (h) What is the use of final control element in a process control system ? Give one example of it.
  - (i) What do you mean by process lag in a process control loop ?
  - (j) State two features of cascade control scheme.
2. (a) Explain the construction, working principles and characteristics of Resistance-Temperature Detector. Also explain how can RTD be used in signal conditioning. 5
- (b) State and explain Thermoelectric effects. Also discuss the Thermocouple characteristics. 5



P.T.O.

3. (a) A measurement signal has a frequency  $< 1\text{KHz}$ . But there is unwanted noise at about  $1\text{MHz}$ . Design a low-pass filter that attenuates the noise to 1%. What is the effect on the measurement signal at its maximum of  $1\text{KHz}$ ? 5
- (b) The divider of Figure 1 below has  $R_1 = 10.0\text{K}\Omega$  and  $V_s = 5.00\text{V}$ . Suppose  $R_2$  is a sensor whose resistance varies from  $4.00$  to  $12.0\text{K}\Omega$  as some dynamic variable varies over a range. Find
- (a) the minimum and maximum  $V_D$ ,
- (b) the range of output impedance, and
- (c) the range of power dissipated by  $R_2$  5

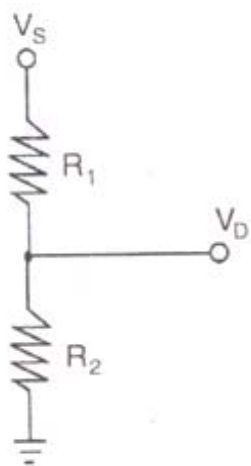


Figure 1

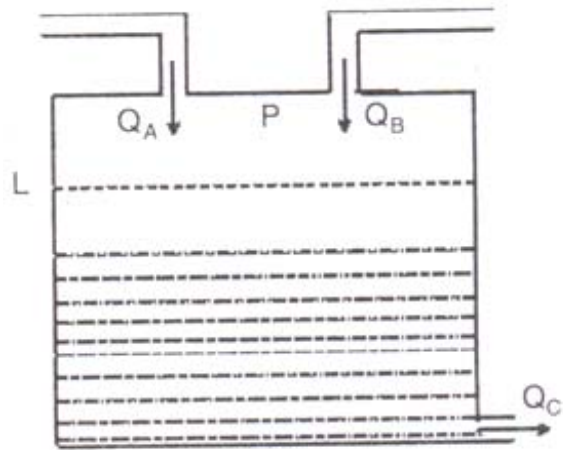


Figure 2

4. (a) A tank shown in Figure 2 above has the following Boolean variables. Flow rates  $Q_A$ ,  $Q_B$  and  $Q_C$ , pressure  $P$  and level  $L$ . All are high if the variable is high and low otherwise. Devise Boolean equations for two alarm conditions as follows : 6
- (i)  $OV =$  Overfill alarm.
- (a) If either input flow rate is high while the output flow rate is low, the pressure is low and level is high.
- (b) If both input flow rates are high while the output flow rate is low and the pressure is low.
- (ii)  $EP =$  Empty alarm.
- (a) If both input flow rates are low, the level is low and the output flow rate is high.
- (b) If either input flow rate is low, the output flow rate is high and the pressure is high.



- (b) State few characteristics of DAC. 5
5. (a) Explain the construction and working principle of Linear Variable Differential Transformer (LVDT). 5
- (b) Explain working principle of a Diaphragm used in pressure sensor. 5
6. (a) Explain the working principle of a Photovoltaic cell with neat diagram. Also discuss the cell characteristics. 5
- (b) State the elements of a final control operation in a process control system. Also explain the final control operation with suitable block diagram. 5
7. (a) Explain the Proportional control and Integral control mode of a continuous controller. 5
- (b) Explain the working principle of Cascade control of a Jacketed CSTR with suitable block diagram. 5
8. Write short notes on any **two** of the following : 5×2
- (a) Bimetal Strips.
- (b) Relay Controller and Ladder diagrams
- (c) Pneumatic controller
- (d) Auctioneering control of Catalytic Tubular Reactors with highly exothermic reactions.

