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Total number of printed pages – 2

B. Tech  
PCEI 4305

**Sixth Semester Regular Examination – 2014**  
**INSTRUMENTATION DEVICES AND SYSTEMS - II**

**BRANCH : AEIE, EIE, IEE**

**QUESTION CODE : F 255**

**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) Comment on the values of natural frequency of oscillation and damping ratio of piezoelectric crystal. State whether the values are small or large when suitable for vibration measurement.
- (b) Write basic principle of a Resistive Accelerometer.
- (c) Suggest principle of measurement based on which the float of a level indicator can be tracked.
- (d) Write the factors on which the conductivity of a solution depends.
- (e) What should be the minimum energy of a photon for the operation of a semiconductor photo conductive detector ?
- (f) A black body is a theoretical ideal which can only be approached in practice. Suggest construction of a black body used in laboratory.
- (g) Write the expression of overall attenuation loss in a length of an optical fibre.
- (h) In a pneumatic system, information is carried by the pressure of gas in pipe. What is the speed of pressure signal along the pipe ?
- (i) Write the advantages of a Stepping motor compared to other conventional motors.
- (j) The objective of a process control system is to fill the tank to a certain level with no out flow. Write the event sequence.

P.T.O.

2. (a) Derive the transfer function for a basic piezoelectric force measurement system, comment on steady state sensitivity and dynamic characteristics of the system. 5
- (b) Derive transfer function of an accelerometer consisting of a mass, spring and dashpot. Is it a linear system? If the answer is YES, justify the answer. If the answer is NO, suggest a method of minimizing non-linearity. 5
3. (a) Describe construction and principle of measurement of water level using Displacer principle. 5
- (b) Why buffer solution is used in pH measurement? Describe construction of a pH meter and explain the method of measurement of pH. 5
4. (a) Briefly explain Planck's law and Stefan-Boltzmann's law of black body radiation. How power spectral density changes with temperature? 5
- (b) Distinguish between operations of a LED and Photo Diode. 5
5. (a) Define (i) Refractive Index and (ii) Numerical Aperture. Hence, derive the expression of the Numerical Aperture. 5
- (b) What is Pyrometry? Describe the construction and principle of operation of a Radiation Pyrometer. 5
6. (a) Draw a schematic diagram of a Pneumatic amplifier and explain its operation. Is it direct acting or reverse acting? 5
- (b) Describe basic principle of operation of DC and AC servo motors. 5
7. (a) Describe the architecture and operation of Programmable Logic Controller. 5
- (b) Develop a Ladder Diagram for a motor with the following : 5  
NO START button, NC STOP button, Thermal Overload Limit Switch opens on High temperature, Green Light when Running, Red Light for Thermal Overload.
8. Answer any **two** of the following : 5×2
- (a) Humidity Measurement – Construction and Principle of operation
- (b) Fibre Optic Sensing – Principle of measurement
- (c) Types of Control Valves and their characteristics.