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Total number of printed pages – 3

B. TECH
PCEI 4305

Sixth Semester Examination – 2013

INSTRUMENTATION DEVICES AND SYSTEMS - II

BRANCH : AEIE/ICE/IEE/EIE

QUESTION CODE : A 196

Full Marks – 70

Time : 3 Hours



*Answer Question No. 1 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) Is piezoelectric crystal an elastic element ? Write the transfer function showing dynamic relation between deformation of the crystal and the force applied on it.
 - (b) An accelerometer consists of mass, spring and damping. Write conditions for which deflection of the seismic mass will be under damped, critically damped and over damped.
 - (c) Floats are used in mechanical level measurement. Write Archimedes's principle explaining conditions for which a substance floats.
 - (d) Why electro-chemical sensing elements are ion selective rather than ion specific ?
 - (e) Draw Volt - Ampere characteristics of Photo Diode to measure optical radiation.

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- (f) What will happen to the wave length at which power spectral density for a black body radiator has a maximum value, if the temperature of the black body increases ?
- (g) Define "Numerical Aperture" for step-index fibre.
- (h) Write the ranges of pneumatic signal in psi and Pascal units.
- (i) Write principle of operation of a Solenoid valve.
- (j) Write the names of various relays available according to its OPEN or CLOSED conditions during un-excited state.
2. (a) Draw equivalent circuit and derive transfer function of a piezoelectric system with ideal charge amplifier and recorder. How crystal capacitance, cable capacitance and capacitance of the charge amplifier affect steady state sensitivity ? 5
- (b) Draw schematic diagram of a Resistive Accelerometer with Strain Gauge which senses displacement of the mass and explain its operation. 5
3. (a) Suggest a method of water level measurement of a closed tank. Draw schematic diagram and explain the method of measurement. 5
- (b) Draw schematic diagram and equivalent electrical circuit of a capacitive level indicator. Derive the relationship between liquid level and measured capacitance. 5
4. (a) Write the materials used for making LEDs. Draw circuit diagram and explain the operation of LED. Suggest a method of changing Luminous Intensity of the LED. Draw a graph showing relationship between Relative Luminous Intensity and Wave Length of radiation. 5
- (b) Describe principle of operation of a Photo Resistive Detector. Write the materials used for making Photo Resistive Detectors. Show the relationship between Resistance and Total Power. 5
5. (a) What is Pyrometry ? Describe construction and principle of operation of a Radiation Pyrometer. 5
- (b) With suitable Ray Diagram, explain propagation of Optical Signal in Single Mode Fibre, Multi Mode Fibre and Graded Index Fibre. 5



6. (a) Describe construction and operation of a Flapper/Nozzle system. Is it a reversible process ? Justify. 5
- (b) Describe construction and operation of a Stepping motor. 5
7. (a) List various types of control vales used as final control element. Explain their characteristics. 5
- (b) Develop a Ladder Diagram for a motor with the following: NO START button, NC STOP button, Thermal Overload Limit Switch opens on High temperature, Green Light when Running, Red Light for Thermal Overload. 5
8. Answer any two : 5×2
- (a) Liquid Conductivity measurement.
- (b) Fibre Optic sensing – Principle of measurement.
- (c) Programmable Logic Controller – Architecture and operation.

