

# POSTAL Book Package

# 2023

## GATE • PSUs

### Instrumentation Engineering

#### Objective Practice Sets

#### Sensors and Industrial Instrumentation

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## Introduction to Transducers

## MCQ and NAT Questions

**Q.1** Some of the functional building blocks of a measurement system are:

Primary Sensing Element (PSE)

Variable Conversion Element (VCE), or Transducer  
Data Transmission Element (DTE)

Variable Manipulation Element (VME)

Data Presentation Element (DPE)

The correct sequential connection of the functional building blocks for an electronic pressure gauge will be

- (a) PSE, VME, VCE, DPE, DTE
- (b) PSE, VCE, VME, DTE, DPE
- (c) DTE, DPE, VCE, PSE, VME
- (d) PSE, VCE, DTE, DPE, VME

**Q.2** Which one of the following transducers is classified as an active transducer?

- (a) Metallic strain gauge
- (b) Capacitive microphone
- (c) LVDT
- (d) Piezoelectric transducer

**Q.3** Inverse transducers

- (a) converts electrical energy to any other form of energy
- (b) converts electrical energy to light energy
- (c) converts mechanical displacement into electrical signal
- (d) converts electrical energy to mechanical form

**Q.4** Match **List-I (Transducers)** with **List-II (Measured Quantity)** and select the correct answer using the codes given below the lists:

List-I	List-II
A. Capacitive transducer	1. Pressure
B. Thermocouple	2. Torque
C. Load cell	3. Displacement
D. Diaphragm	4. Temperature

Codes:

	A	B	C	D
(a)	2	4	3	1
(b)	3	1	2	4
(c)	2	1	3	4
(d)	3	4	2	1

**Q.5** Very small displacements are effectively measured using

- (a) LVDT
- (b) Strain gauge
- (c) Thermistor
- (d) Tachogenerator

**Q.6** Which one of the following transducers requires power supply for its operation?

- (a) Thermocouple
- (b) Photovoltaic cell
- (c) Piezoelectric crystal
- (d) Thermistor

**Q.7** Which one of the following transducers is the most suitable for the measurement of linear displacement?

- (a) Strain gauge
- (b) LVDT
- (c) Piezoelectric crystal
- (d) Microphone

**Q.8** Match **List-I (Transducers)** with **List-II (Types of transducer)** and select the correct answer using the code given below the lists:

List-I	List-II
A. LVDT	1. Resistive
B. Strain Gauge	2. Inductive
C. Dielectric Gauge	3. Capacitive
D. Thermocouple	4. Self generating

Codes:

	A	B	C	D
(a)	2	3	1	4
(b)	4	3	1	2
(c)	2	1	3	4
(d)	4	1	3	2

- Q.9** Dynamics of a thermocouple can be modeled as,  
a  
(a) zero order equation  
(b) first order equation  
(c) second order equation  
(d) none of the above

- Q.10** The lower limit of useful working range of a transducer is determined by  
(a) minimum useful input level  
(b) cross sensitivity  
(c) transducer error and noise  
(d) dynamic response of the transducer

- Q.11** Match the contents of **List-I (Transducer)** with the contents of **List-II (Application for which they are used)**:

List-I	List-II
A. Dielectric Gauge	1. Temperature
B. Reluctance pick-up	2. Thickness
C. Pirani Gauge	3. Gas Flow
D. RTD	4. Position

**Codes:**

- | A     | B | C | D |
|-------|---|---|---|
| (a) 2 | 4 | 3 | 1 |
| (b) 3 | 2 | 4 | 1 |
| (c) 2 | 3 | 4 | 1 |
| (d) 1 | 4 | 3 | 2 |

- Q.12** The output voltage of a transducer is connected to an amplifier. The amplifier has an input resistance of 490 kΩ. The output resistance of the transducer if the error in recording of the transducer output is 1% is  
(a) 10 kΩ                      (b) 9.6 kΩ  
(c) 49 kΩ                      (d) 4.9 kΩ

- Q.13** In a seismic pickup, damping factor  $\xi$  is to be doubled without changing natural frequency  $\omega_n$ . This can be achieved by  
(a) Double damping  
(b) Quadruple seismic mass  
(c) Quadruple spring constant  
(d) Double seismic mass and spring constant

**Multiple Select Questions (MSQs)**

- Q.14** Signal conditioning of transmitters signal is important for faithful production of an output. Which of the following is/are performed in signal conditioning circuit :  
(a) Amplification              (b) Calibration & Zeroing  
(c) Filtering                      (d) Controlling

- Q.15** A Hall effect transducer is used to measure  
(a) Power  
(b) Current  
(c) Displacement  
(d) Minority carriers in a semiconductors

- Q.16** For a seismic transducer natural frequency has to be increased. This could be achieved by  
(a) Increasing damping  
(b) Increasing spring constant  
(c) Increasing seismic mass  
(d) Decreasing damping

- Q.17** Which of the following devices are non-contact type level transmitters :  
(a) Ultrasonic level meters  
(b) Vibrating tuning fork  
(c) Guided wave radar  
(d) Nuclear level meters

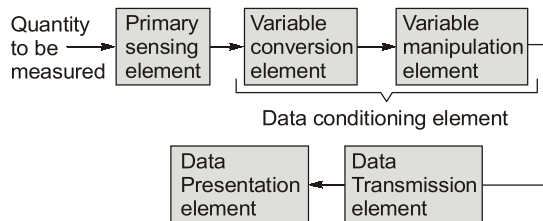
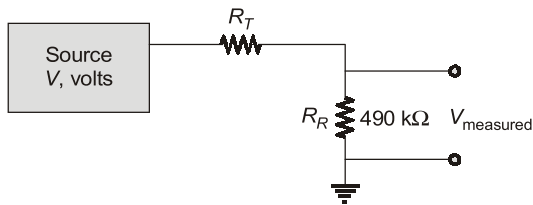


**Answers Introduction to Transducers**

1. (b)      2. (d)      3. (a)      4. (d)      5. (a)      6. (d)      7. (b)  
 8. (c)      9. (b)      10. (c)      11. (a)      12. (d)      13. (a)      14. (a, b, c)  
 15. (a, b, c, d)    16. (b, c)      17. (a, d)

**Explanations Introduction to Transducers****1. (b)**

Functional elements of a measurement system are shown below:

**12. (d)**

For no error –  $R_R$  (Recorder resistance) should be very high and  $R_T$  (Transducer resistance) should be very low

$$V - \frac{490}{490 + R_T} \times V$$

$$\frac{\quad}{V} \times 100 = 1$$

$$\frac{V(490 + R_T) - 490 V}{(490 + R_T)V} \times 100 = 1$$

$$(490 + R_T - 490) 100 = 490 + R_T$$

$$100 R_T = 490 + R_T$$

$$99 R_T = 490$$

$$R_T = \frac{490}{99} \text{ k}\Omega = 4.9 \text{ k}\Omega$$

**13. (a)**

We have

$$\xi = \frac{B}{2} \sqrt{KM}$$

and

$$\omega_n = \sqrt{KM}$$

So, since  $\omega_n$  is constant,  $\sqrt{KM}$  is constant.

So, to double damping factor  $\xi$  we need to double damping  $B$ .

**16. (b, c)**

$$\omega_n = \sqrt{KM}$$

So,

$$\omega_n \propto \sqrt{K}$$

and

$$\omega_n \propto \sqrt{M}$$

So, to increase  $\omega_n$ , we need to increase either seismic mass as spring.

**17. (a, d)**

- (i) Guided wave radar has sensor tube which touches the liquid.
- (ii) Vibrating tuning fork changes its natural frequency of oscillation when liquid comes in contact.

