

Reg. No.

**B.Tech. DEGREE EXAMINATION, NOVEMBER 2018**  
Fourth/Fifth/Sixth Semester

**EC1105 – SENSORS AND TRANSDUCERS**

*(For the candidates admitted during the academic year 2013 - 2014 and 2014 -2015)*

Note:

- (i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45<sup>th</sup> minute.  
(ii) **Part - B and Part - C** should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

**PART - A (20 × 1 = 20 Marks)**

Answer ALL Questions

1. The smallest change in input a transducer can sense  
(A) Precision (B) Accuracy  
(C) Sensitivity (D) Resolution
2. Which one is an active transducer?  
(A) RTD (B) Thermocouple  
(C) Strain gauge (D) LVDT
3. Load cell is a transducer which measures  
(A) Force (B) Strain  
(C) Temperature (D) Pressure
4. Which of the following is a digital transducer?  
(A) Thermistor (B) LVDT  
(C) RTD (D) Encoder
5. Gauge factor of a strain gauge represents  
(A) Accuracy (B) Dead zone  
(C) Sensitivity (D) Permittivity
6. Hall effect transducers can be used to measure  
(A) Sound (B) Power  
(C) Pressure (D) Rotational angle
7. The EDDM current sensors follow  
(A) Faraday's law of induction (B) Gauss' law  
(C) Coulomb's law (D) Ampere's circuital law
8. The magneto resistive effect in ferromagnetic material is  
(A) Anisotropic (B) Geometrical  
(C) Isotropic (D) Linear

9. ☒ RVDI type of electrical transformer used for measuring angular displacement.  
(B) LVDT  
(C) Synchro  
(D) Resolver
10. The coil dissipation factor  $D_c$   
(A)  $D_c = \frac{R_c}{\omega L}$   
(B)  $D_c = \frac{R}{\omega_o}$   
(C)  $D_c = \frac{Z_c}{\omega L}$   
(D)  $D_c = \frac{R_c}{\omega CL}$
11. To avoid eddy current loss, the core in LVDT is made of  
(A) Silica sheets  
(B) Single sheet  
(C) Stacked stamped sheets  
(D) Without sheets
12. The variation of inductance can be measured using  
(A) AC bridge circuits  
(B) RC circuit with AC excitation  
(C) RC circuit with DC excitation  
(D) LC circuit with AC excitation
13. Equalization of steady pressure on both sides of the diaphragm to prevent it from bursting is  
(A) Leakage effect  
(B) Damping effect  
(C) Hysteresis effect  
(D) Oscillation effect
14. The capacitors fringing effects are reduced by  
(A) Sensitivity factor  
(B) Guard ring  
(C) Permittivity  
(D) Varying distance between two plates
15. The resistance ratio change depends on \_\_\_\_\_ in radiation sensors.  
(A) Illumination  
(B) Materials  
(C) Input voltage  
(D) Illumination and materials
16. GM counter can measure  
(A) Alpha rays  
(B) Alpha and beta rays  
(C) Gamma rays  
(D) Alpha, beta and gamma rays
17. An example of naturally occurring piezoelectric sensor is  
(A) Silicon dioxide  
(B) Lithium sulphate  
(C) Barium titanate  
(D) Rochelle salt
18. The overall film sensor sensitivity depends on  
(A) Porosity  
(B) Resistivity  
(C) Thickness of the material  
(D) Temperature
19. The surface acoustic devices are used to  
(A) Sense change in frequency due to gas  
(B) Sense gas due to change in frequency  
(C) Sense gas with respect to time  
(D) Sense gas absorption and deposition of material
20. The radiation wavelength of lithographic galvano forming abforming -LIA is  
(A) 6 to 10 nm  
(B) 0.1 to 2 nm  
(C) 10 nm to 20 nm  
(D) 3 nm to 5 nm

**PART - B (5 × 4 = 20 Marks)**  
**Answer ANY FIVE Questions**

21. What are the parameters required to choose a good transducer?
22. Classify active and passive transducers with suitable examples.
23. How can strain developed on a strain gauge be measured using a full-bridge configuration?
24. Explain the working principle of RVDI using necessary diagrams.
25. Write about the different modes of deformation in piezoelectric materials.
26. Explain the principle to measure temperature using fiber opticsensors.
27. Write a note on the oxygen level sensors.

**PART - C (5 × 12 = 60 Marks)**  
**Answer ALL Questions**

28. a. Explain the static and dynamic characteristics of transducers.  
(OR)  
b. Discuss in detail the classification of errors.
29. a. Derive the relation between the resistance and voltage due to the effect of magnetic field in anisotropic magneto resistive sensors.  
(OR)  
b. Explain about the working of strain gauge and explain its various types. Derive the expression for the gauge factor.
30. a. Describe the working of frequency modulating oscillator and DC circuit for dynamic capacitance variation.  
(OR)  
b. Explain the LVDT operation using necessary diagrams. Draw its hysteresis loop.
31. a. Explain the operation of a photovoltaic cell with suitable diagram and draw the V-I characteristics.  
(OR)  
b. Write in detail about the electrochemical cell and explain how it works as a sensor.
32. a. Write the fabrication steps of thin and thick film technology and state their differences.  
(OR)  
b. Enumerate on the "on-board" automobile sensors with suitable diagrams.

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31. a. Explain how to measure the temperature and liquid level using fiber optics sensor with diagram.

(OR)

b.i. Write about piezoelectric sensor and its deformation modes.

(8 Marks)

ii. Using piezoelectric sensor measure acceleration.

(4 Marks)

32. a. Write in detail the on-board automotive sensor.

(OR)

b. With neat block diagram explain the home automation system and the various sensors used in it.

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Reg. No.

**B.Tech. DEGREE EXAMINATION, NOVEMBER 2018**  
3<sup>rd</sup> to 7<sup>th</sup> Semester

15EC226E – SENSORS AND TRANSDUCERS  
(For the candidates admitted during the academic year 2015 – 2016 to 2017-2018)

Note:  
(i) Part - A should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45<sup>th</sup> minute.  
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Time: Three Hours

Max. Marks: 100

**PART - A (20 × 1 = 20 Marks)**  
Answer ALL Questions

- The gauge factor is defined as  
(A)  $\frac{\Delta L / L}{\Delta R / R}$  (B)  $\frac{\Delta R / R}{\Delta L / L}$   
(C)  $\frac{\Delta R / R}{\Delta D / D}$  (D)  $\frac{\Delta R / R}{\Delta P / P}$
- An inverse transducer converts  
(A) Mechanical energy to electrical energy (B) Electrical energy to light energy  
(C) Electrical energy to mechanical energy (D) Mechanical energy to light energy
- The smallest change in input that a transducer can sense is known as  
(A) Sensitivity (B) Resolution  
(C) Precision (D) Accuracy
- \_\_\_\_\_ is a kind of variable resistance transducer.  
(A) Resistive potentiometer (B) (L.VDT) linear variable differential transformer  
(C) Varactor (D) Capacitive sensor
- Microphone is a sensor which converts \_\_\_\_\_ to electrical energy.  
(A) Light energy (B) Sound energy  
(C) Mechanical energy (D) Heat energy
- An element that senses a variation in input energy to produce a variation in another or same form of energy is called  
(A) Electrode (B) Displacement  
(C) Sensor (D) Transducer
- The complete failure in the normal operation of sensor is called \_\_\_\_\_  
(A) Wear out (B) Noise  
(C) Leakage current (D) Breakdown

8. Which current is induced in an electrically conducting material due to the magnetic field?  
(A) Leakage current (B) Eddy current  
(C) Conventional current (D) Drift current
9. Serrated plate capacitive sensors is used to measure \_\_\_\_\_  
(A) Change in inductance (B) Change in resistance  
(C) Change in capacitance (D) Change in impedance
10. The dielectric materials do not have \_\_\_\_\_ permittivity.  
(A) Infinite (B) Finite  
(C) Zero (D) Non-zero
11. Material used for piezoelectric sensor is \_\_\_\_\_.  
(A) Silicon (B) Germanium  
(C) Rochelle salt (D) Gallium arsenide
12. Which type of sensor used for detecting shaft position engine speed?  
(A) Temperature (B) Angle  
(C) Position (D) Magnetic
13. Which material characteristics is very close to that of human eye?  
(A) Selenium (B) Cadmium  
(C) Silicon (D) Copper oxide
14. The photovoltaic cell consists of a layer of \_\_\_\_\_ on metal disc.  
(A) Semiconductor (B) Insulator  
(C) Conductor (D) Non-metal
15. Gas sensing and enzyme substrate types are the two major subgroups under \_\_\_\_\_.  
(A) Ion selective (B) Molecular selective  
(C) Metal electrode (D) Reference electrode
16. The detector used for x-ray and nuclear radiation is \_\_\_\_\_.  
(A) Pressure (B) Temperature  
(C) Geiger-muller counter (D) Avalanche photo diode
17. Sensor which are produced through thick film deposition are used for sensing \_\_\_\_\_.  
(A) Light (B) Position  
(C) Displacement (D) Temperature
18. Resistor, capacitor conductors are example for microsystem dimension  
(A)  $> 30 \times 10^{-3} m$  (B)  $< 30 \times 10^{-3} m$   
(C)  $\mu m$  (D)  $cm$
19. MEMS stands for \_\_\_\_\_.  
(A) Micro electrical mechanical system (B) Micro electro mechanical system  
(C) Mini electro mechanical system (D) Mini electrical mechanical system

20. Sensors used for spin-dry system in washing machine is  
(A) PZT ceramic (B) Optical sensor  
(C) POT (D) Strain gauge

**PART - B (5 × 4 = 20 Marks)**  
**Answer ANY FIVE Questions**

21. State the Hall effect sensor.
22. Write a note on eddy current sensor.
23. Write short notes on synchros.
24. Compare thin film and thick film sensor.
25. Brief about Marneucci effect and Villari effect.
26. Write any one type of radiation detector.
27. Explain about electrical characterization of sensor with diagram.

**PART - C (5 × 12 = 60 Marks)**  
**Answer ALL Questions**

28. a. The following values were obtained from the measurements of the value of a resistor:  
147.2  $\Omega$ , 147.4  $\Omega$ , 147.9  $\Omega$ , 148.1  $\Omega$ , 147.1  $\Omega$ , 147.5  $\Omega$ , 147.6  $\Omega$ , 147.4  $\Omega$ , 147.6  $\Omega$  and 147.5  $\Omega$ . Calculate  
(i) Arithmetic mean  
(ii) Deviation from the mean  
(iii) Average deviation  
(iv) Standard deviation  
(v) Variance and  
(vi) Probable error
- b. Write about the classification of sensor. (OR)
29. a. Describe the working principle and construction of different types of strain gauge. (OR)  
b. Explain magnetostrictive sensor based on the principle and their types with a suitable diagram.
30. a. Explain the circuit diagram and operation of capacitive proximity sensor. (OR)  
b. Describe the working principle and construction of LVDT and how it is used to measure displacement with a neat diagram.