



Name: Roll No.:

Branch: Signature of Invigilator:

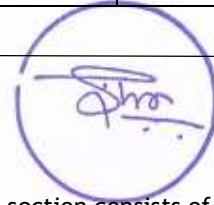
Semester: IVth

Date: 04/05/2022 (MORNING)

Subject with Code: EC259 SENSORS AND TRANSDUCERS

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

CLASS : B. TECH.
BRANCH : ALL

SEMESTER : IV
SESSION: SP/2022

SUBJECT: EC259 Sensors & Transducers

TIME : 2 HOURS

FULL MARKS: 50

INSTRUCTIONS :

1. The question paper contains 30 MCQ questions (Part-A) each of 1 mark and 12 subjective questions (Part-B) each of 2 marks.
 2. Candidates must attempt all questions of (Part-A) and any 10 questions of (Part-B).
 3. The missing data, if any, may be assumed suitably.
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Part-A (MCQs) [Answer All questions]

[30 x 1]

1. Using a voltmeter, the measured value is 18.5 V, while its true value is 19 V. What is the relative error of measurement?
 - a. 0.263
 - b. 0.0263
 - c. 2.63
 - d. 26.3
2. Which of the following represents the static characteristics of sensors is _____?
 - a. Frequency response
 - b. Sensitivity
 - c. Impulse response
 - d. Step response
3. Self-generating type transducers are_____
 - a. Active Transducers
 - b. Passive Transducers
 - c. Inverse Transducers
 - d. Secondary Transducers
4. The process of establishment of a relationship between the input to the instrument and output from the instrument is called as _____.
 - a. Static characterization
 - b. Static sensitivity
 - c. Static accuracy
 - d. Static calibration
5. A _____ is a deviation of the sensor's output at a specified point of the input signal when it is approached from the opposite directions.
 - a. Calibration error
 - b. Hysteresis error
 - c. Non linearity
6. A sensors may be selected based on following parameters _____.
 - a. Environmental factors
 - b. Economic factors
 - c. Static characteristics
 - d. All of these

7. When a semiconductor material is stressed, change in its resistivity depends on the _____.
- Type of material
 - Doping
 - Type of material and doping
 - None of these
8. What is the term used to express the ability of a measuring system to maintain its standard performance?
- Stability
 - Bias
 - Slew
 - Sensitivity
9. Noise contribution in potentiometric transducers are due to _____.
- Contact non-uniformity
 - Thermal motion of molecules
 - Irregularities in the resolution
 - All of these
10. Following transducer is affected by fringe field _____.
- Parallel plate capacitive transducer
 - Hall effect Transducer
 - LVDT
 - Photoelectric Transducer
11. In parallel plate capacitor capacitance can be varied by varying _____.
- Distance between the parallel plate
 - Plate area
 - Dielectric Constant
 - All of these
12. What is piezoelectric effect in a crystal?
- Change in resistance because of temperature
 - Change in frequency because of temperature
 - Current is developed due to force applied
 - Voltage is developed because of mechanical stress
13. An external A/D conversion is not needed in the smart sensor.
- True
 - False
 - May be needed
 - Cannot be said based on the information provided
14. Which of the following represents synthetic piezoelectric substance _____?
- Rochelle salt
 - Tourmaline
 - Quartz
 - None of these
15. When a compressive force is applied to a quartz crystal then _____.
- Negative charges are induced
 - Positive charges are induced
 - No charge is induced
 - Positive and Negative charges are induced

16. When an open circuited pn junction is illuminated then _____
- Resistance increases
 - Resistance decreases
 - Capacitance increases
 - Electron hole pairs are formed
17. Photoconductive transducer is based on
- Change in inductance
 - Change in light
 - Change in resistance
 - Change in temperature
18. At equilibrium Lorentz forces will be _____ of Hall Effect force.
- Double
 - Half
 - Equal
 - No proportionality
19. The stage of internal interfacing between continuous and discrete processing is _____.
- Amplification
 - Filtering
 - Conversion
 - None of these
20. Strain gauge measurement involves _____
- Wheatstone bridge
 - Kelvin bridge
 - De Sauty's bridge
 - Anderson bridge
21. _____ is an attempt to counter all sorts of nonideality in the primary sensor characteristics.
- Amplification
 - Filtering
 - Conversion
 - Compensation
22. Which of the following technique is used for coding digital information in HART protocol _____
- Amplitude shift keying
 - Frequency shift keying
 - Amplitude Modulation
 - Frequency Modulation
23. _____ is intended for soft linearity where sectionalized linearization can be adopted.
- Look up table method
 - Polygon interpolation
 - Cubic spline interpolation
 - Polynomial interpolation

24. HART Technology can help to _____.
- Increase asset productivity and system availability
 - Speed up the troubleshooting time between the identification and resolution of problems
 - Continuously validate the integrity of loops and control/automation system strategies
 - All of these
25. The digital signal in HART protocol is made up of two frequencies _____ and _____ representing bits 0 and 1, respectively.
- 1,200 Hz and 2,200 Hz
 - 120 Hz and 220 Hz
 - 1,200 KHz and 2,200 KHz
 - 1.2 MHz and 2.2 M Hz
26. Which of the following is correct for a digital transducer?
- Measures digital quantity only
 - Gives digital output
 - Doesn't measure analog input
 - None of these
27. In an incremental encoder, by counting the pulses _____ and by timing the pulse width using a clock signal _____ can be determined.
- angular displacement, angular velocity
 - linear velocity, angular displacement
 - angular velocity, angular acceleration
 - angular displacement, angular acceleration
28. Optical fibers are not immune to _____.
- Electric disturbances
 - Magnetic disturbances
 - Ambient light interference
 - Electromagnetic disturbances
29. In which of the following optic fiber sensor the fiber is simply used to carry light to and from an external optical device where the sensing takes place.
- Intrinsic fiber optic sensor
 - Extrinsic fiber optic sensor
 - All fiber optic sensors are simply used to carry light to and from an external optical device
30. What interacts directly with sample in a Biosensor?
- Analyte
 - Electrolyte
 - Transducer
 - None

Part-B (Subjective) [Answer any 10 questions]

[2 marks each]

1. What is a transducer? What do you understand by transduction principle?
2. A thermometer is calibrated 150 °C to 200 °C. The accuracy is specified within $\pm 0.25\%$ of the instrument span. What is the maximum static error?
3. What are the sources of errors in sensor/transducers?
4. What is RVDT (Rotary Variable Differential Transformer)? Compare it with LVDT (Linear Variable Differential Transformer).
5. Explain application of eddy current transducer with an example.
6. Calculate the Gauge factor of a strain gauge if the value of the resistance is 152 ohms which changes by 5 ohms for 5000 micro-strain.
7. Compare photo diode and photo transistor based on its application.
8. One of the advantages of a capacitive transducer is that they have high input impedance hence a small loading effect. Explain what is meant by loading effect in this context.
9. What is importance of device description files in HART (Highway Addressable Remote Transducer) communication?
10. Discuss the components of a smart sensor.
11. What are biosensors? Mention its applications.
12. Compare intensity based, phase based and polarization based fiber optic sensor.

----- 04.05.2022-----



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