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B.Tech. DEGREE EXAMINATION, JULY 2022
Fourth Semester

18NTO308T – SMART SENSORS SYSTEMS
(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)

Note:
(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks)
Answer **ALL** Questions

	Marks	BL	CO	PO
1. Which of the following error is caused by a reversal of measured property? (A) Hysteresis (B) Noise (C) Digitization error (D) Quantization error	1	1	1	1
2. Smallest change which a sensor can detect is _____. (A) Accuracy (B) Scale (C) Resolution (D) Precision	1	1	1	1
3. Thermocouple generates output voltage according to _____. (A) Circuit parameters (B) Temperature (C) Humidity (D) Voltage	1	1	1	1
4. _____ does not need any additional energy source and directly generates an electric signal in response to an external stimulus. (A) Passive sensor (B) Direct sensor (C) Active sensor (D) Indirect sensor	1	2	1	1
5. The generation of electric charge by a crystalline material upon subjecting it to stress is _____. (A) Magnetoresistive effect (B) Pyroelectric effect (C) Thermoelectric effect (D) Piezoelectric effect	1	2	1	1
6. Which of the following material cannot be used as hall effect sensors? (A) Gallium Arsenide (GaAs) (B) Silicon dioxide (C) Indium Antimonide (InSb) (D) Indium Arsenide (InAs)	1	2	2	1
7. The typical velocities are _____ for longitudinal waves and _____ for transverse waves. (A) 6000 m/s and 3000 m/s (B) 3000 m/s and 6000 m/s (C) 6000 m/min and 3000 m/min (D) 3000 m/min and 6000 m/min	1	1	2	1
8. In a saw device the resonant frequency being a function of _____ and the acoustic wave velocity of the material. (A) Spacing between the electrode (B) Width of the device (C) Surface area (D) Length of the electrode	1	3	2	1

9. TMR effect can be seen in multiple alternating _____ and thin insulating layer structures. 1 2 2 1
(A) Paramagnetic alloy (B) Antiferromagnetic alloy
(C) Ferromagnetic alloy (D) Diamagnetic alloy

10. In a magnetoresistive sensor, resistance increases with respect to magnetic field which is due to the magnetic field forces electron to _____. 1 2 2 1
(A) Take a longer path (B) Take a shorter path
(C) Disappear (D) Random path

11. Which one if making IR detector become bulky, heavy and expensive? 1 1 3 1,3
(A) Heat sink (B) Cooling system
(C) Power supply (D) Substrate

12. Which measurement is suitable for liquid food samples? 1 2 3 1
(A) Transmission measurements (B) Reflectivity measurements
(C) Scattering measurements (D) Absorption measurements

13. The concentration of deoxygenated and oxygenated hemoglobin can be estimated through _____ of fresh meat. 1 2 3 2
(A) Blood density (B) Blood pH
(C) Blood color (D) Blood smell

14. Mainly, all light detectors are divided into two major groups that are called _____. 1 2 3 1
(A) Magnetic and mechanical (B) Quantum and thermal
(C) Electrical and optical (D) Electrical and mechanical

15. _____ are responsible for the characteristic colour, flavor and aroma in wines. 1 1 3 1
(A) Alcohol compounds (B) Aldehyde compounds
(C) Phenolic compounds (D) Ketone compounds

16. A biosensor in general utilises a _____ that senses the presence of an analyte. 1 1 4 1
(A) Chemical recognition element (B) Electrical recognition element
(C) Biological recognition element (D) Thermal recognition element

17. To measure the glucose in aqueous solutions, which transducer can be used 1 3 4 1
(A) Acoustic sensor (B) Temperature sensor
(C) Mass sensor (D) pH sensor

18. Which one is correct immobilization method? 1 1 4 1
(A) Heating (B) Cross linking
(C) Diffusion (D) Dispersion

19. Enzymes are biological catalysts that promote the transformation of chemical species in _____. 1 1 4 1
(A) Ambient systems (B) Inert systems
(C) Vacuum systems (D) Living systems

20.	The microcontroller is used to measure the _____ from UTI. (A) Amplitude modulated signal (B) Period modulated signal (C) Phase modulated signal (D) Intensity modulated signal	1	2	4	1
21.	Which of the following is the best method for photoresist coating process? (A) Electroplating method (B) Sputtering method (C) Spin coater (D) Thermal evaporator	1	1	5	1
22.	Plasma etching process is often referred as _____. (A) Wet etching (B) Dry etching (C) Chemical etching (D) Anisotropic wet etching	1	1	5	1
23.	The process of planting atoms in to host semiconductor lattice in order to change the electrical characteristics of the host materials is called _____. (A) Adding process (B) Sintering process (C) Etching process (D) Doping process	1	2	5	1
24.	For which layer deposition, electroplating method is utilized in Liga process. (A) Seed layer (B) Structural layer (C) Sacrificial layer (D) Buffer layer	1	1	5	1
25.	Which of the following one belongs to nanomaterial category (A) Silicon (B) Gold (C) Graphene (D) Germanium	1	1	5	1

PART – B (5 × 10 = 50 Marks)
Answer **ALL** Questions

		Marks	BL	CO	PO
26. a.	Write any five static characteristics of a sensor in detail.	10	2	1	1
	(OR)				
b.	Explain piezoelectric effect and pyroelectric effect.	10	2	1	1
27. a.	Describe in detail about the surface acoustic waves (SAW) principle and working of a saw sensor.	10	1	2	1,3
	(OR)				
b.	Explain the construction and working principle of magnetic transistors.	10	1	2	1,3
28. a.	Discuss the basics of visible light colour sensor and high energy photodiodes.	10	2	3	1
	(OR)				
b.	Describe the working of FET devices used for gas and ion sensing.	10	2	3	1
29. a.	Discuss the immobilization principles used for biological receptors.	10	2	4	1
	(OR)				

b. Explain any two biosensors based on bioreceptors with their working principles. 10 2 4 1

30. a. Describe the high aspect ratio LIGA process used for microsystem components in detail with neat schematics. 10 2 6 1,3

(OR)

b. Explain about the creation of clusters and nanocrystalline materials. 10 2 5 1

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