

GUJARAT TECHNOLOGICAL UNIVERSITY

NANO TECHNOLOGY (39) NANOSENSORS AND TRANSDUCERS SUBJECT CODE: 2183904 B.E.8th SEMESTER

Type of course: Nanotechnology, materials science and Electronics.

Prerequisite: Synthesis of nano materials – II, Electrical and Optical Properties of Nanomaterials

Rationale: To make students understand the use of nanotechnology-based electronic devices in the sensor base field, the challenges to prepare nanotechnology-based electronic sensor for industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	Introduction to sensing system and nanotechnology: Introduction to nano sensor, nano sensing systems. Future scope of Sensor in industries. Future requirement of nanotechnology in sensing.	12	16
2	Opportunities of nanotechnology in sensing: Enhancement of sensitivity, Enhancement of specificity, Nano-photonics based sensing, Nano-electronics based sensing	12	17
3	High impact of nanotechnology in sensing: Impact of Nanotechnology sensing in Medical health and wellness. Impact of Nanotechnology sensing in environment monitoring. Impact of Nanotechnology sensing in agriculture and food industries. Impact of Nanotechnology sensing in energy, transportation and national securities.	14	25
4	Nanotechnology based transducer for sensing: Introduction. Electro Transduction: One dimensional nanostructure based sensor, Liquid and gas sensor array, Label free biological sensor, Carbon nano tubes, metal oxide and ceramic materials, conducting polymers, surface chemistry, Electromagnetic transduction, Spectroscopy transduction, magnetic transduction, mechanical transduction.	14	25
5	Processing of Sensing device: Introduction, Fabrication, Designing and modeling, Foundries, Standardization, Packaging, Work force and Road map.	12	17

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	40	10	10	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Reference Books:

1. Environmental Applications of Nanomaterials: Synthesis, Sorbenis And Sensors, Imperial College Press, By Glen. E. Fryxell Guozhong Cao.
2. Emerging Nanotechnology, Discovery Publication House Pvt. Ltd., M. P. Arora.
3. Nanofabrication: Principles, Capabilities And Limits, Springer (India) Pvt. Ltd., Zheng Cui.
4. Nanotechnology-Enabled Sensors, Springer US;1 edition, Kourosh Kalantar-zadeh, Benjamin Fry

Course Outcome:

1. Students get awareness of different types of sensor and their applications in various fields of industries.
2. Students aware of limitation of current useful sensor in industries.
3. Students understand the role of nanotechnology in high sensing sensor
4. Students understand the nanotechnology based different sensors and their application in various industries.

List of Experiments:

1. Preparation of thin film using spin coater.
2. Preparation of thin film using dip coater.
3. Preparation of thin film using spray drying technique.
4. Characterization of thin film.
5. Analysis of properties of prepared thin film.

Design based Problems (DP)/Open Ended Problem:

Open Ended /design based project: Apart from above experiments a group of students (Maximum Three) has to undertake one open ended problem/design problem. **(Students are free to select any area of science and technology may be based on their branch to define the project)**

Aims:

1. To provide experience in laboratory based experimentation, data recording and analysis and drawing of conclusions.
2. To develop report writing skills for scientific material
3. To develop the ability to undertake investigations where, as part of the exercise, the goals and methods have to be defined by the investigator.
4. To develop skills in literature searches and reviews.

Major Equipment:

1. Spin coater.
2. Dip Coater.
3. Spray dryer.

List of Open Source Software/learning website:

<http://nptel.ac.in/courses>

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.