GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3153908

SUBJECT NAME: NANOTOXICOLOGY ANDNANOTECHNOLOGYENGINEERING PRACTICE
B.E. 5th SEMESTER

Type of course: Environmental Study

Prerequisite: Basic knowledge of Nanoscience and Chemistry **,**

Rationale: To make the students understand the impact of nanotechnology and its products on the human health and environment

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)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**Ethics in Nanotechnology and Society Perceptio** Introduction: Background Nanotechnology and Nanoscience Why anotechnology? Pros and Cons of Nanotechnology Ethics in Nanoscience Society and Nano-Science	7	20%
2	**Introduction: Background and Driving Forces** Toxicity of Nanomaterials Toxicity Due to Route of Nanoparticles Exposure Route Mediated Nanoparticles Toxicity to Plants Exposure of Nanomaterials to Plant Roots by Soil Exposure of Nanomaterials to Plant Roots by Artificial Media Route Mediated Nanoparticle Toxicity on Animals Skin Mediated Exposure of Nanoparticles Inhalation Mediated Exposure of Nanoparticles Oral Administration of Nanoparticles Gastrointestinal Exposure of Nanoparticles Nanoparticles Transfer through Body Fluids	9	20%
3	**Influence of Nanomaterials on Human Health** Introduction Immune System Respiratory System Gastrointestinal Tract Cardiovascular System	9	20%

	Nervous System Reproductive System Skin		
4	**Nanotoxicity Evaluation for the Purpose of Nanomaterials Hazard** Nanotoxicity Evaluation Using Experimental Animals: A Review for the Most Common Nanomaterials Silver Nanoparticles Zinc Oxide Nanoparticles Copper Oxide Nanoparticles Titanium Oxide Nanoparticles Gold Nanoparticles Silica Oxide Nanoparticles Carbon Nanotubes	**9**	**20%**
5	***Sensors Used to Evaluate Nanotoxicity*** Introduction Classical Methods for Assessing Nanotoxicity Microscopy Cell Culture Others Nanosensors for Nanotoxicity Nanochemical Sensors Nanobiosensors Chemical Sensors for Nanotoxicity Metal Nanoparticles Detection Metal Oxide Nanoparticles Detection Other Nanoparticles Detection Biosensors for Nanotoxicity Protein Based Biosensors Cellular and Molecular Based Biosensors Microfluidics	**10**	**20%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
Remembrance R Level	**Understanding U Level**	**Application A Level**	**Analyze N Level**	**Evaluate E Level**
27	**22**	**21**	**0**	**0**

Legends: R: Remembrance; U = Understanding; A = Application and above Levels (Revised Bloom's Taxonomy)

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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. NANOTOXICOLOGY TOXICITY EVALUATION, RISK ASSESSMENT AND MANAGEMENT, Edited by Vineet Kumar ,Nandita Dasgupta, Shivendu Ranjan CRC Press,Taylor & Francis Group
2. NANOTECHNOLOGY – TOXICOLOGICAL ISSUES AND ENVIRONMENTAL SAFETY Simeonova P.P, Opopol N, and Luster M.I ,Springer 2006.

Course Outcome:

After learning the course the students should be able to:

1. To notify the learner about the various ethical issues related to nanotoxicology toxicity

2. To have knowledge about Influence of Nanomaterials on Human Health, environmental risks of Nanomaterials

3. To have knowledge about the use of nanotechnology to evaluate nanotoxicity