GUJARAT TECHNOLOGICAL UNIVERSITY

NANO TECHNOLOGY (39)
INDUSTRIAL NANOTECHNOLOGY
SUBJECT CODE: 2183906
B.E.8th SEMESTER

Type of course: The goal of this course is to provide an insight into the fundamentals of ethical, social and political impact of nanotechnology. It will also guide the students to understand how Nanotechnology has broader societal implications and social challenges along with various industrial applications of nanotechnology.

Prerequisite: Basic Knowledge Of Applications Of Nanomaterials, Environmental Issues, Industrail Advancements

Rationale: To make the students understand the industrial demands and to understand the basic knowledge on social, ethical & political impact of nanoscience and nanotechnology

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**INDUSTRIAL APPLICATIONS OF NANOTECHNOLOGY** Nanotechnology in Consumer Products Inventory-Food sector-Agriculture sector-Textiles- Cosmetics-Sports-Health care-Nanotechnology in Electronics-Automobile – National Security -Defense	6	9%
2	**THERMAL INSULATION AND ENERGY SAVINGS** **Thermal Insulation-** -How Insulation Works-R –Values--Types of Insulation- Insulation Materials- Radiant barriers- Moisture Control-Ventilation Calculating requirements- Factors influencing performance **Energy Saving-** -Energy Design for efficiency –Electricity & Fuel-Electronics- Automobile--Planning renewable systems Solar electric systems-Wind electric systems-Hybrid wind and solar - Microhydropower systems	12	28%
3	**INDUSTRIAL ECOLOGY** Material flows in chemical manufacturing - Industrial parks -Assessing opportunities for waste exchanges and by product synergies - Lead Encapsulation- Reduce Carbon Footprint And Green House Gases (GHG)-Leadership In Energy & Environmental Design- LEED For Buildings- Home-Schools	8	15%
4	**NANOTECHNOLOGY IN INDUSTRIAL PRODUCTION & MANUFACTURING**	10	20%

	Nanotechnology in Construction -Cement-Steel-Wood-Glass-Coatings--Fire Protection and detection-Risks in construction. **Nanostructured materials in Manufacturing-** Nanocomposites-Nanocrystals- Nano clays and nanocomposites-Nanocomposite coatings-Nanotubes-Nano catalysts-Nano filters		
5	**INDUSTRIAL LAWS AND ENVIRONMENTAL CONCERNS** Economic Impacts & Commercialization of Nanotechnology-Environmental, Health & Safety Issues- Social & Ethical Implications-Industrial Approach- Sustaining the Impact of Nanotechnology on Productivity, Sustainability, and Equity-The Emerging NanoEconomy: Key Drivers, Challenges & Opportunities. Regulation Of Nanotechnology In Consumer Products –Legal Policy Issues	12	28%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
14	**20**	**14**	**14**	**8**	**-**

Legends: R: Remembrance; U = Understanding; A = Application 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. Mihail C. Rocco and William Sims Bainbridge, "*Nanotechnology: societal implications",* Springer publication, 2011.
2. Ronald sandler, *"Nanotechnology the Social & Ethical Issues",* Woodrow Wilson, 2009.
3. Robert Ayres U., "A Handbook of Industrial Ecology", Edward Elgar publishing, 2002.
4. Paulo Davim," Sustainable manufacturing", Wiley publications 2010.
5. F Allhoff, Patrick Lin, James Moor, John W, "*Nanoethics: The Ethical and Social Implications of Nanotechnology*", Wiley, 2007.

Course Outcome: After learning the course the students should be able to:

1. To acquire the knowledge of various regulatory reactions to nanotechnology outcome
2. To create awareness related to ethical issues in the future nanotechnology research
3. To provide an overview of future technological advancements and increasing role of nanotechnology in each industry

TUTORIAL-

Students will be encouraged to form groups and work upon Industrial Designs

1. Group 1: Protection of Industrial Design in India: Issues and Challenges.
2. Group 2: Dangers of Molecular Manufacturing.

CASE STUDY

Reflections and Suggestions

1. An Exploration of Patent Matters Associated with Nanotechnology
2. Public Perceptions & Education –Awareness of Nanotechnology products in global market
3. Nanotechnology Industrial -Vision, Innovation, And Policy

INDUSTRY VISIT-

Students will be taken to various industries as a part of the study program, to get a real life experience of the course structure.

List of Open Source Learning website:

1. http://energy.gov/
2. http://www.mnre.gov.in/

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.