GUJARAT TECHNOLOGICAL UNIVERSITY

NANO TECHNOLOGY (39)

APPLICATION OF NANOTECHNOLOGY

SUBJECT CODE: 2153903

B.E. 5th SEMESTER

Type of course: Nanotechnology

Prerequisite: Basic knowledge of nanotechnology and engineering science

Rationale: The purpose of this course is to develop understanding of nanotechnology based application in various fields of engineering.

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		
4	0	0	4	70	20	10	0	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**NANOTECHNOLOGY IN ELECTRICAL AND ELECTRONICS INDUSTRY :** Advantages of nano electrical and electronic devices – Electronic circuit Sensors, Actuators, Optical switches, Bio-MEMS – Diodes and Nano-wire Transistors - Quantum optical devices – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Nanoparticle coatings for electrical products	12	20%
2	**NANOTECHNOLOGY IN BIOMEDICAL AND PHARMACEUTICAL INDUSTRY :** Nanoparticles in bone substitutes and dentistry, Implants and Prosthesis, Nanorobotics in Surgery, Photodynamic Therapy, Nanosensors in Diagnosis Drug delivery, Therapeutic applications	13	20%
3	**NANOTECHNOLOGY IN CHEMICAL INDUSTRY :** Nanocatalyts, Smart materials, Heterogenous nanostructures and composites, applications of Molecular Encapsulation, Nanoporous zeolites, Self-assembled Nanoreactors, Organic electroluminescent displays	13	20%
4	**NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY :** Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry - Packaging, Food processing - Food safety and bio-security – Contaminant detection – Smart packaging	13	20%
5	**NANOTECHNOLOGY IN TEXTILES AND COSMETICS : Nanofibre production** – Electrospinning, Controlling morphologies of nanofibers, Tissue engineering application , **Modern textiles**	13	20%

	(Lightweight bulletproof vests and shirts, Colour changing property, Waterproof and Germ proof, Cleaner kids clothes, Wired and Ready to Wear), **Cosmetics,** Formulation of Gels, Shampoos, Hair-conditioners (Micellar self-assembly and its manipulation) Sun-screen dispersions for UV protection using Titanium oxide, Color cosmetics		

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**35**	**5**	**--**	**--**

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. Nanotechnology: A Gentle Introduction To The Next Big Idea By Mark A. Ratner And Daniel Ratner, , Pearson (2003). 10 Nt – 12–13 – Srm – E&T
2. Bharat Bhushan,Springer Handbook Of Nanotechnology, Barnes & Noble (2004).
3. Neelina H. Malsch (Ed.),Biomedical Nanotechnology, Crc Press (2005)
4. Udo H. Brinker, Jean-Luc Mieusset (Eds.), Molecular Encapsulation: Organic Reactions In Constrained Systems,Wiley Publishers (2010).
5. Jennifer Kuzma And Peter Verhage, Nanotechnology In Agriculture And Food Production, Woodrow Wilson International Center, (2006).
6. Lynn J. Frewer, Willehm Norde, R. H. Fischer And W. H. Kampers, Nanotechnology In The Agri-Food Sector, Wiley-Vch Verlag, (2011).
7. P. J. Brown And K. Stevens, Nanofibers And Nanotechnology In Textiles, Woodhead Publishing Limited, Cambridge, (2007).
8. Y-W. Mai,Polymer Nano Composites, Woodhead Publishing, (2006).
9. W.N. Chang,Nanofibres Fabrication, Performance And Applications, Nova Science Publishers Inc, (2009).

Course Outcome:

After learning the course the students should be able to:

1. Understand Basic of nanoelectronic and application of Nano electronic and Nanodevice.
2. Understand application of Nanorobotics and Nano materials in medical field.
3. Understand Nanotechnology in Agriculture, Nanotechnology in Food industry
4. Understand Nanofibre production and it's application in industries.
5. Understand Nanotechnology for Modern textiles and it's application in industries.
6. Understand Nanotechnology for Cosmetics and it's application in industries

List of Open Source Software/learning website:

www.virtual.itg.uiuc.edu

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.