



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3153905

SUBJECT NAME: NANOTECHNOLOGY AND ENVIRONMENT

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 environment

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		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	ENVIRONMENTAL RISKS OF NANOMATERIALS 1.1 Introduction 1.2 Routes of NMs into the Water Environment 1.3 Hazardous Effects of NMs on Human and Animal Health 1.4 Risk Management	7	19%
2	TOXICITY AND HEALTH HAZARDS OF NANOMATERIAL 2.1 Introduction 2.1.1 Toxicity of Environmental Contaminants at the Organismal Level 2.1.2 Molecular Modeling of Interaction of Carbon-based MN with Cell Membranes 2.2 Methods 2.2.1 Determination of the Potential Toxicity of Fullerenes (C60) Using Microbiotests 2.2.2 Impacts of C60 on Microbial Degradation of Organic Matter in Sediment Slurries 2.2.3 Model Development for the Assessment of MNs' Ability to Cross Cell Membranes 2.3.1 Experimental Assessment of the Toxicity of C60 Using Microbiotests and Sediment Indigenous Microorganisms 247 2.3.2 Modeling Results	9	16%
3	NANOSTRUCTURED CATALYSTS TIO₂ NANOPARTICLES FOR WATER PURIFICATION: 3.1 Background of TiO ₂ as a Semiconductor Photocatalyst 3.2 Photocatalytic Mechanism, General Pathways, and Kinetics 3.3 Intrinsic Photocatalytic Activity 3.4 Reaction Variables 3.5 Photocatalytic Degradation of Specific Waterborne Pollutants.	9	21%



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4	NANOPARTICLES FOR TREATMENT OF ARSENIC: 4.1 Introduction 4.2 Environmental Chemistry of Arsenic 4.3 Treatment of Arsenic Using Nanocrystalline TiO ₂ 4.4 Treatment of Arsenic Using Nanoparticles Other Than TiO ₂	9	23%
5	NANOMEMBRANES 5.1 Introduction 5.2 Nanomembranes in Drinking Water Treatment 5.3 Nanomembranes in Seawater Desalination	10	21%

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
17	22	21	10	0

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. NANOTECHNOLOGIES FOR WATER ENVIRONMENT APPLICATIONS
American Society of Civil Engineers (ASCE) Publications by Tian C.Zhang, Zhiqiang Hu,
Rao Y. Surampalli, R.D.Tyagi, Keith C.K.Lai and Irene Mc.Lao (chapter 1,3,4,5)
2. NANOSCIENCE AND NANOTECHNOLOGY, ENVIRONMENTAL AND HEALTH IMPACTS
Edited by Vicki H. Grassian Wiley & Sons, (Chapter no. 2)
3. NANOTECHNOLOGY IN WATER PURIFICATION APPLICATIONS
Caister Academic Press by T.Eugene, Michele de
Kwaadsteniet, Marelize Botes and J.Manuel Lopez-Romero.
4. ENVIRONMENTAL APPLICATIONS OF NANOMATERIALS-SYNTHESIS, SORBENTS
AND SENSORS,
ditedby Glen E Fryxell and Guozhong Cao, Worldscibooks, UK
5. ENVIRONMENTAL NANOTECHNOLOGY,
Mark Wisener, Jeo Yues Bolteru, 2007, McGraw Hill.



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6. NANOTECHNOLOGY – TOXICOLOGICAL ISSUES AND ENVIRONMENTAL SAFETY
Simeonova P.P, Opopol N, and Luster M.I ,Springer 2006.
7. NANOSCIENCE AND NANOTECHNOLOGY – ENVIRONMENTAL AND HEALTH
IMPACTS, Grassian V.H,John Wiley & Sons, 2008.
8. NANOTECHNOLOGY AND ENVIRONMENT ,
Sellers.K, Mackay.C, Bergeson.L.L,Clough S.R, CRC Press, 2009.
9. NANOTECHNOLOGY FOR ENVIRONMENTAL DECONTAMINATION ,
Andreescu.S.E, Hanming.D, 2011, McGrawHill

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Course Outcome:

After learning the course the students should be able to:

1. To notify the learner about the various ethical issues related to nanotechnology
2. To know about nanostructured catalysts for water purification.
3. To have knowledge about nanoparticles for treatment of arsenic, environmental risks of Nanomaterials

List of Open Source Software/learning website:

<http://www.nanotech-now.com/academic.htm#study>