

Course Code	18NTO301T	Course Name	APPLICATIONS OF NANOTECHNOLOGY	Course Category	O	Open Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Nanotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning	Program Learning Outcomes (PLO)
CLR-1 : <i>Acquire knowledge on environmental applications of nanotechnology</i>		1 2 3	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
CLR-2 : <i>Understand the theory of nanotechnology in agriculture and food technology</i>		Level of Thinking (Bloom)	Engineering Knowledge
CLR-3 : <i>Familiarize Electrical, Electronics and Energy Applications of Nanotechnology</i>		Expected Proficiency (%)	Problem Analysis
CLR-4 : <i>Know Nanotechnology in Textiles and Cosmetics</i>		Expected Attainment (%)	Design & Development
CLR-5 : <i>Explore the concept of Biomedical Applications of Nanotechnology</i>			Analysis, Design, Research
CLR-6 : <i>Understand current developments and future prospects of Nanotechnology</i>			Modern Tool Usage
			Society & Culture
			Environment & Sustainability
			Ethics
			Individual & Team Work
			Communication
			Project Mgt. & Finance
			Life Long Learning
			PSO - 1
			PSO - 2
			PSO - 3
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Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning	Program Learning Outcomes (PLO)
CLO-1 : <i>Apply skills to identify new materials for environmental applications</i>		2 80 75	Engineering Knowledge
CLO-2 : <i>Analyze the role of nanotechnology in agriculture and food technology</i>		2 80 70	Problem Analysis
CLO-3 : <i>Discriminate electrical, electronic and energy applications of nanotechnology</i>		2 75 70	Design & Development
CLO-4 : <i>Apply the techniques of nanotechnology in textile and cosmetics</i>		2 80 75	Analysis, Design, Research
CLO-5 : <i>Appreciate the role of nanotechnology in advancing the biomedical industry</i>		2 80 70	Modern Tool Usage
CLO-6 : <i>Utilize the concept of biosensor to analyze the material nature.</i>		2 80 75	Society & Culture

Duration (hour)	9	9	9	9	9
S-1	SLO-1 Environmental pollutants in air	Nanotechnology in Agriculture	Electronic circuit chips	Nanofibre production in Textiles	Introduction to biomedical applications
	SLO-2 Environmental pollutants in water	Precision farming	Nanosensors and actuators	Electrospinning	Bioreceptors and their properties
S-2	SLO-1 Environmental pollutants in soil	Smart delivery system	Optical switches	Controlling morphologies of nanofibers	Biochips
	SLO-2 Types of toxic and hazards wastes	Nano fertilizers and types	Diodes	Nano-fillers embedded polypropylene fibers	Integrated nanosensor
S-3	SLO-1 Application of nanotechnology - Introduction	Nano urea and mixed fertilizers	Nano-wire transistors	Bionics	DNA based biosensors
	SLO-2 Application of nanotechnology in industrial waste	Nano fertigation	Advantages of nano electrical and electronic devices	Swim-suits with shark-skin effect	Natural nanocomposite systems
S-4	SLO-1 Application of nanotechnology in waste water treatment	Nano pesticides	Memory storage	Soil repellence	Nanomaterials in bone substitutes and dentistry
	SLO-2 Drinking water purifications	Nano-seed Science	Lighting displays and filters	Lotus effect	Implants and Prosthesis
S-5	SLO-1 Air purifications	Nanotechnology in Food industry	Quantum computers	Nano finishing in textile	Tissue Engineering
	SLO-2 Gas purifications	Nano packaging for enhanced shelf life	Medical diagnosis and conductive additives	Modern textiles Nanopolymers in medical textiles	Neuroscience
S-6	SLO-1 Nano Monitoring	Smart packaging	Lead-free solder	Introduction to cosmetics	Neuro-electronic Interfaces
	SLO-2 Nano Biosensors - Overview	Intelligent packaging	Nano coatings and EMI shielding.	Formulation of Gels	Nanorobotics

S-7	SLO-1	Nano Biosensors for Pesticide Detection	Food processing	Energy devices	Shampoos	Photodynamic Therapy
	SLO-2	Nano Biosensors for Plant Pathogen Detection	Food safety	Fuel cells	Hair-conditioners	Protein Engineering
S-8	SLO-1	Nano Bioremediation	bio-security	role of nanomaterials in fuel cell applications	Introduction to Sun-screen dispersions	Nanosensors in Diagnosis
	SLO-2	Pesticide Degradation	Electrochemical sensors	Photovoltaic cells	Sun-screen dispersions for UV protection	Drug delivery
S-9	SLO-1	Soil Structure	sensors for food analysis	Application of nanotechnology in solar cells	Colour cosmetics	Cancer therapy
	SLO-2	Soil structure Remediation	contaminant detection	Application of power in transportation	Types of Colour cosmetics	Other therapeutic applications

Learning Resources	1. Environmental Nanotechnology, by M. H. Fulekar, Bhawana Pathak 2. Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011). 3. Jennifer Kuzma and Peter VerHage, Nanotechnology in agriculture and food production, Woodrow Wilson International Center, (2006).	4. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007). 5. Neelina. H. Malsch (Ed.), "Biomedical Nanotechnology", CRC Press 2005.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (15%)		CLA – 3 (15%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30 %	-	30 %	-	30 %	-	30 %	-	30%	-
Level 2	Understand										
	Apply	40 %	-	40 %	-	40 %	-	40 %	-	40%	-
Level 3	Analyze										
	Evaluate	30 %	-	30 %	-	30 %	-	30 %	-	30%	-
	Create										
Total		100 %		100 %		100 %		100 %		100 %	

# CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
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