INSTITUTE	**FACULTY OF TECHNOLOGY**
PROGRAM	**MASTER OF TECHNOLOGY in CHEMICAL ENGINEERING**
SEMESTER	**2**
COURSE TITLE	**NANOTECHNOLOGY**
COURSE CODE	**01CM0212**
COURSE CREDITS	**3**

Objective:

1 The Course aims to enable the students to learn the basics of nanotechnology.

Course Outcomes: After completion of this course, student will be able to:

1 To introduce the fundamental concepts of nanotechnology and nanoscale systems
2 To explore various synthesis and fabrication techniques for nanomaterials.
3 To learn about advanced characterization techniques for nanomaterials.
4 Enabling current and emerging applications of nanotechnology in various industries.

Pre-requisite of course: Basic knowledge of nano science.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	0	50	30	20	0	0

Contents : Unit	Topics	Contact Hours
1	**Introduction to Nanotechnology** History and evolution of nanotechnology, Overview of nanoscale science and technology, Importance of size and quantum effects	8
2	**Synthesis and characterization of Nanomaterials** Top-down and bottom-up approaches, Chemical methods: sol-gel, hydrothermal, chemical vapor deposition Physical methods: ball milling, sputtering, and laser ablation, Electron microscopy: SEM, TEM Spectroscopy: XRD, FTIR, Raman, UV-Vis Surface analysis: AFM, STM	10
3	**Properties and applications of Nanomaterials** Mechanical, optical, electrical, and magnetic properties Quantum confinement and surface area effects, Nanotechnology in electronics, medicine, energy, and environment, Emerging applications: nanorobotics, nanocomposites	10

DR. DHARMESH HARESHKUMAR SUR
Digitally signed by (Name of HOD)

DR. RAJENDRASINH BAHADURSINH JADEJA
Digitally signed by (Name of Dean/ Principal)

Contents : Unit	Topics	Contact Hours
4	**Ethical, Environmental, and Societal Impacts** Risk assessment and safety of nanomaterials, Regulatory frameworks and public perception, Potential future breakthroughs and challenges	8
Total Hours		**36**

Textbook :

1 Introduction to nanotechnology., Poole, C. P., & Owens, F. J., Cambridge University Press, 2003

References:

1 Nanotechnology: global strategies, industry trends and applications, Nanotechnology: global strategies, industry trends and applications, Schulte, J., John Wiley & Sons., 2005

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	30.00	30.00	10.00	

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory

4 Students will use supplementary resources such as online videos, NPTEL videos, ecourses, Virtual Laboratory.

Supplementary Resources:

1 https://archive.nptel.ac.in/courses/113/106/113106093/

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