



DEPARTMENT OF BIOTECHNOLOGY		
B.E/B.Tech/M.E/M.Tech : B.E and B.Tech (Common to all branches except Biotechnology)		LP: OE22204
Regulation	: R2022	Rev. No: 00
PG Specialisation	: NA	Date: 08.07.2024
Sub. Code / Sub. Name	: OE22204 / BASICS OF BIO-NANOTECHNOLOGY	
Unit	: 1	

Unit Syllabus: FUNDAMENTALS OF BIOLOGY AND MACROMOLECULES 9h

Basics of biology - cell, organelles and nucleic acids as genetic material, bio-macromolecules - carbohydrates, lipids, proteins and nucleic acids, importance of nano-biology.

Objective: To understand about the importance of basic biology and macromolecules to know the basis of bio-nanotechnology.

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Introduction to Biology and Cells	TB3 (1-2)	Animations & BB
2.	Cell Structure and Function	TB3 (2-5)	PPT & BB
3.	Cell Organelles	TB3 (11)	Animations & BB
4.	Nucleic Acids as Genetic Material	TB3 (6-7)	PPT & BB
5.	Carbohydrates	TB3 (7)	PPT & BB
6.	Lipids	TB3 (7-10)	Animations & BB
7.	Proteins	TB3 (18-19)	PPT & BB
8.	Nucleic Acids	TB1 (18-20) RB2 (6-8)	PPT & BB
9.	Importance of Nano-Biology	TB2 (19-24) RB1 (7-11)	Animations & BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 minutes



Sub. Code / Sub. Name : **OE22204 / BASICS OF BIO-NANOTECHNOLOGY**

Unit : 2

Unit Syllabus: INTRODUCTION TO NANOMATERIALS

9h

Nanomaterial and its various types, three-dimensional, two-dimensional, one-dimensional and zero-dimensional nanomaterials, nanomaterial in biotechnology - nanoparticles, quantum dots, nanotubes and nanowires etc, Development of nano-biotechnology - timelines and progress, overview, synthesis methodologies, top down and bottom up approaches for nanomaterial synthesis.

Objective: To understand about nanomaterials and its synthesis.

Session No *	Topics to be covered	Ref	Teaching Aids
10.	Nanomaterial and its various types	TB1 (7-9) RB1 (11-14)	PPT & BB
11.	Three-dimensional and Two-dimensional nanomaterials	TB1 (11-13) RB1 (16-19)	Animations & BB
12.	One-dimensional and Zero-dimensional nanomaterials	TB3 (16-17)	PPT & BB
13.	Nanomaterial in biotechnology - nanoparticles	TB3 (18-19)	Animations & BB
14.	Nanomaterial in biotechnology - quantum dots	TB1 (20-24) RB2 (8-12)	PPT & BB
15.	Nanomaterial in biotechnology - nanotubes and nanowires	TB2 (28-30) RB1 (11-14)	PPT & BB
16.	Development of nano-biotechnology	TB2 (44-46) RB2 (32-38)	Animations & BB
17.	Timelines and progress, overview, synthesis methodologies	TB2 (81-84) RB1 (69-72)	PPT & BB
18.	Top-down and bottom-up approaches for nanomaterial synthesis	TB2 (101-104) RB2 (121-124)	PPT & BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins



Sub. Code / Sub. Name : **OE22204 / BASICS OF BIO-NANOTECHNOLOGY**

Unit : 3

Unit Syllabus: PROPERTIES OF NANOMATERIALS

9h

Structural properties, chemical properties, surface functionalization, physical properties, Characterization of nanomaterials by various analytical methods, optical characterization and spectroscopy such as FTIR, UV-Vis, DLS, Zetapotential, structural characterization by X-Ray Diffraction, XPS and advanced microscopy (TEM, SEM, AFM) etc.

Objective: To familiarize with the analytical techniques used for characterization of nanomaterials.

Session No *	Topics to be covered	Ref	Teaching Aids
19.	Structural properties of nanomaterials	TB4 (107-110) RB3 (44-46)	Animations & BB
20.	Chemical properties of nanomaterials	TB4 (111-115) RB3 (47-48)	PPT & BB
21.	Surface functionalization of nanomaterials	TB4 (116-117) RB3 (48-49)	PPT & BB
22.	Physical properties of nanomaterials	TB4 (107-110) RB3 (50-51)	Animations & BB
23.	Characterization of nanomaterials by various analytical methods	TB4 (111-114) RB3 (51-53)	PPT & BB
24.	Optical characterization and spectroscopy	TB4 (114-115) RB3 (53-55)	PPT & BB
25.	FTIR and UV-Vis spectroscopy	TB4 (115-117) RB3 (56-58)	Animations & BB
26.	DLS and Zetapotential analysis	TB4 (114-119) RB3 (59-60)	PPT & BB
27.	Structural characterization by X-Ray Diffraction, XPS, and advanced microscopy (TEM, SEM, AFM)	TB4 (120) RB3 (60-61)	PPT & BB
Content beyond syllabus covered (if any): NIL			

* Session duration: 50 mins



Sub. Code / Sub. Name : **OE22204 / BASICS OF BIO-NANOTECHNOLOGY**

Unit : 4

Unit Syllabus: BIONANOTECHNOLOGY APPLICATIONS

9h

Nanobiotechnological applications in health and disease - infectious and chronic, sensors and biosensors, Environment and food - detection and mitigation, Agriculture – nanobased agri and food Products, food preservation and toxicity , nanopesticides and nanofertilizers.

Objective: To have a knowledge in the applications of bionanomaterial in various fields.

Session No *	Topics to be covered	Ref	Teaching Aids
28.	Nanobiotechnological applications in health and disease - infectious diseases	TB3 (14-18)	Animations & BB
29.	Nanobiotechnological applications in health and disease - chronic diseases	TB3 (18-19) RB3 (65)	Animations & BB
30.	Sensors and biosensors in nanobiotechnology	TB3 (20-24) RB3 (66-67)	PPT & BB
31.	Environmental applications – detection	TB3 (25-27) RB3 (68)	PPT & BB
32.	Environmental applications – mitigation	TB3 (28-32)	PPT & BB
33.	Nanobiotechnological applications in food – detection	TB3 (33-37) RB3 (72-74)	Animations & BB
34.	Nanobiotechnological applications in food – mitigation	TB3 (37-39) RB3 (75)	PPT & BB
35.	Agriculture - nanobased agri and food products, food preservation, and toxicity	TB3 (40-47)	PPT & BB
36.	Agriculture - nanopesticides and nanofertilizers	TB3 (47-49) RB3 (76-77)	PPT & BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins



Sub. Code / Sub. Name : **OE22204 / BASICS OF BIO-NANOTECHNOLOGY**

Unit : 5

Unit Syllabus: SOCIAL IMPACT AND FUTURE OF BIONANOTECHNOLOGY

9h

Engineered nanomaterial of relevance to human health, Routes of entry into the body, Toxic effects on health, plants and microbes are nanofactories, Trends in nanotechnology, Critical voices and future of bionanotechnology.

Objective: To inculcate the importance of bionanotechnology

Session No *	Topics to be covered	Ref	Teaching Aids
37.	Engineered nanomaterials of relevance to human health	TB4 (16-19) RB3 (21-27)	PPT & BB
38.	Routes of entry of nanomaterials into the body	TB4 (21-27) RB3 (30-33)	PPT & BB
39.	Toxic effects of nanomaterials on health	TB4 (111-120) RB3 (35-38)	Animations & BB
40.	Toxic effects of nanomaterials on plants	TB4 (121-124) RB3 (29-41)	Animations & BB
41.	Toxic effects of nanomaterials on microbes	TB4 (121-125) RB3 (42-44)	PPT & BB
42.	Plants and microbes as nanofactories	TB4 (114-119)	Animations, BB & YouTube Video
43.	Trends in nanotechnology	TB4 (128-131) RB3 (42-47)	Animations & BB
44.	Critical voices in nanotechnology	TB4 (121-125) RB3 (47-49)	PPT & BB
45.	Future of bionanotechnology	TB4 (119-121)	PPT & BB

Content beyond syllabus covered (if any): NIL

* Session duration: 50 mins



Sub. Code / Sub. Name : **OE22204 / BASICS OF BIO-NANOTECHNOLOGY**

REFERENCES:

Text Books:

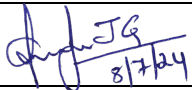

1. Clad A.M & Christof M.N (Eds.), "Nanobiotechnology: Concepts, Applications and Perspectives", Wiley VCH, 2004.
2. Shoseyov O, & Levy, I (Eds.), "Nanobiotechnology: BioInspired Devices and Materials of the Future", 1st edition, Humana Press, 2007.
3. Madhuri S, Maheshwar S, Sunil P & Goldie O, "Bio-Nanotechnology Concepts and applications", 1st edition, Ane Books, 2012.
4. Clarke A. R & Eberhardt C. N (Eds.), "Microscopy Techniques for Material Science", 1st edition, CRC Press, 2002.

Reference Books:

1. Yubing X, "The Nanobiotechnology Handbook", 1st Ed, Taylor & Francis, 2018
2. Dhawan A, Singh, S, Kumar, A, & Shanker, R (Eds.). "Nanobiotechnology: Human Health and the Environment", CRC Press, Florida, USA, 2018.
3. Arunava G, Samrat Roy C, "Nanobiotechnology: Basic and Applied Aspects", Anthem Press, 2017.

YouTube Video:

1. <https://www.youtube.com/playlist?list=PLODKZZeKAWb-PMMqRrD4hNUG4v7bkVbt1>

	Prepared by	Approved by
Signature		
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Date	08.07.2024	08.07.2024
Remarks *:	The same lesson plan will be followed in the subsequent semester	