



<b>DEPARTMENT OF BIOTECHNOLOGY</b>		
<b>B.E/B.Tech/M.E/M.Tech</b> : B.E and B.Tech (Common to all branches except Biotechnology)		LP: OE18207
Regulation	: 2018A	Rev. No: 00
PG Specialisation	: NA	Date: 10.07.2023
Sub. Code / Sub. Name	: <b>OE18207 / BASICS OF NANOBIO TECHNOLOGY</b>	
Unit	: 1	

**Unit Syllabus: BASICS OF BIOLOGY AND MACROMOLECULES****6h**

Basics of biology - cell, organelles and nucleic acids as genetic material and Bio-macromolecules -Carbohydrates, lipids, proteins and Nucleic acids

**Objective:** To acquaint the basic knowledge of biology and macromolecules in the application of nanotechnology

Session No *	Topics to be covered	Ref	Teaching Aids
1.	Basics of Biology	TB3 (1-2)	Animations & BB
2.	Cell and Organelles	TB3 (2-5)	PPT & BB
3.	Nucleic Acids as Genetic Material	TB3 (11)	Animations & BB
4.	Bio-macromolecules: Carbohydrates	TB3 (6-7)	PPT & BB
5.	Lipids	TB3 (7)	PPT & BB
6.	Proteins and Nucleic acids	TB3 (7-10)	Animations & BB

**Content beyond syllabus covered (if any):**

\* Session duration: 50 minutes



Sub. Code / Sub. Name : **OE18207 / BASICS OF NANOBIO TECHNOLOGY**

Unit : 2

**Unit Syllabus: NANOMATERIAL IN BIOTECHNOLOGY**

**12h**

Biomimetic nanotechnology, protein-based nanostructures, Nanomotors, bacterial (*E. coli*) and mammalian (Myosin family), DNA nanotechnology, nanostructures in cells study, microarray platforms, Nano printing of DNA, RNA, and proteins biochips applications in nano scale detection, lab-on-a-chip devices (LOC), tissue engineering

**Objective:** To Describe the role of nanomaterials in biotechnology.

Session No *	Topics to be covered	Ref	Teaching Aids
7.	Biomimetic Nanotechnology	TB1 (7-9) RB1 (11-14)	PPT & BB
8.	Protein-Based Nanostructures	TB1 (11-13) RB1 (16-19)	Animations & BB
9.	Nanomotors	TB3 (16-17)	PPT & BB
10.	Bacterial ( <i>E. Coli</i> ) and Mammalian (Myosin Family)	TB3 (18-19)	Animations & BB
11.	DNA Nanotechnology	TB1 (20-24) RB2 (8-12)	PPT & BB
12.	Nanostructures in Cells Study	TB2 (28-30) RB1 (11-14)	PPT & BB
13.	Microarray Platforms	TB2 (44-46) RB2 (32-38)	Animations & BB
14.	Nano Printing of DNA	TB2 (81-84) RB1 (69-72)	PPT & BB
15.	Nano Printing of RNA And Proteins	TB2 (101-104) RB2 (121-124)	PPT & BB
16.	Biochips Applications in Nano Scale Detection	TB2 (149-153) RB3 (11-14)	PPT & BB
17.	Lab-On-A-Chip Devices (LOC)	TB1 (189-193) RB3 (15-18)	Animations & BB
18.	Tissue Engineering	TB3 (7-9) RB2 (18-23)	PPT & BB

**Content beyond syllabus covered (if any):**

\* Session duration: 50 mins



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Unit : 3

**Unit Syllabus: NANOMATERIAL CHARACTERIZATION**

**9h**

X-ray diffraction, electron microscopy, interaction between electron beam and solids, TEM, SEM, SPM (STM & AFM), AES, XPS, SIMS

**Objective:** To Apply the knowledge of instrumental analysis methods for characterization of biomaterials.

Session No *	Topics to be covered	Ref	Teaching Aids
19.	X-ray diffraction	TB4 (107-110) RB3 (44-46)	Animations & BB
20.	Electron Microscopy	TB4 (111-115) RB3 (47-48)	PPT & BB
21.	Interaction Between Electron Beam and Solids	TB4 (116-117) RB3 (48-49)	PPT & BB
22.	Transmission Electron Microscopy (TEM)	TB4 (107-110) RB3 (50-51)	Animations & BB
23.	Scanning Electron Microscope (SEM)	TB4 (111-114) RB3 (51-53)	PPT & BB
24.	Scanning Probe Microscopy (SPM), Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy AFM)	TB4 (114-115) RB3 (53-55)	PPT & BB
25.	Auger Electron Spectroscopy (AES)	TB4 (115-117) RB3 (56-58)	Animations & BB
26.	X-Ray Photoelectron Spectroscopy (XPS)	TB4 (114-119) RB3 (59-60)	PPT & BB
27.	Secondary Ion Mass Spectrometry (SIMS)	TB4 (120) RB3 (60-61)	PPT & BB

**Content beyond syllabus covered (if any):**

\* Session duration: 50 mins



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Unit : 4

**Unit Syllabus: NANO BIOTECHNOLOGY APPLICATIONS**

**12h**

Micro- and Nano electromechanical devices in drug delivery, other applications in drug delivery, photodynamic therapy in targeted drug administration, Nano biosensors, applications of quantum dots in biotechnology, DNA based nanomaterials as biosensors

**Objective:** To implement the application of nanotechnology for construction materials and therapeutic drug delivery

Session No *	Topics to be covered	Ref	Teaching Aids
28.	Micro-Electromechanical Devices in Drug Delivery	TB3 (14-18)	Animations & BB
29.	Nano-Electromechanical Devices in Drug Delivery	TB3 (18-19) RB3 (65)	Animations & BB
30.	Drug Delivery Applications	TB3 (20-24) RB3 (66-67)	PPT & BB
31.	Photodynamic Therapy in Targeted Drug Administration	TB3 (25-27) RB3 (68)	PPT & BB
32.	Application of Photodynamic Therapy in Targeted Drug Administration	TB3 (28-32)	PPT & BB
33.	Nano Biosensors	TB3 (33-37) RB3 (72-74)	Animations & BB
34.	Applications of Nano Biosensors	TB3 (37-39) RB3 (75)	PPT & BB
35.	Quantum Dots	TB3 (40-47)	PPT & BB
36.	Applications of Quantum Dots in Biotechnology	TB3 (47-49) RB3 (76-77)	PPT & BB
37.	DNA Based Nanomaterials	TB3 (50-51)	Animations & BB
38.	DNA Based Nanomaterials as Biosensors	RB3 (78-81)	Animations & BB
39.	Applications of DNA Based Nanomaterials	TB3 (52-55) RB3 (82-84)	PPT & BB

**Content beyond syllabus covered (if any):**

\* Session duration: 50 mins



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Unit : 5

**Unit Syllabus: SOCIETAL IMPACTS OF NANO-BIOTECHNOLOGY 6h**

Engineered nanomaterial of relevance to human health, routes of entry into the body, toxic effects on health, plants and microbes as nano factories

**Objective:** To assess the societal impacts of nanobiotechnology

Session No *	Topics to be covered	Ref	Teaching Aids
40.	Engineered Nanomaterial of Relevance to Human Health	TB5 (16-19) RB3 (21-27)	PPT & BB
41.	Routes of Entry of Nanomaterials into The Body	TB5 (21-27) RB3 (30-33)	PPT & BB
42.	Toxic Effects of Nanomaterial on Health	TB4 (111-120) RB3 (35-38)	Animations & BB
43.	Toxic Effects of Nanomaterial on Plants	TB4 (121-124) RB3 (29-41)	Animations & BB
44.	Toxic Effects of Nanomaterial on Environment	TB4 (121-125) RB3 (42-44)	PPT & BB
45.	Microbes as Nano Factories	TB4 (114-119)	PPT & BB
<b>Content beyond syllabus covered (if any):</b>			

\* Session duration: 50 mins





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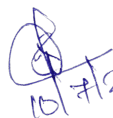
**REFERENCES:****Text Books:**

1. Christof M. Niemeyer, Chad A. Mirkin, "Nanobiotechnology: Concepts, Applications and Perspectives", Wiley VCH, Weinheim, Germany, 2004.
2. Chad A Mirkin and Christ M. Niemeyer, "Nanobiotechnology - II More concepts and applications", Wiley VCH, Weinheim, Germany. 2007.
3. David S. Goodsell, "Bio-nanotechnology: Lessons from Nature", A John Wiley & Sons, INC, Publication, New Jersey, USA, 2004.
4. Subbiah Balaji, "Nanobiotechnology" 1<sup>st</sup> Ed., MJP Publishers, India, 2010.
5. Niemeyer C.M and Mirkin CA, "Nanobiotechnology: Concepts, Applications and Perspectives", Wiley-VCH, USA, 2004.

**Reference Books:**

1. Yubing Xie, "The Nanobiotechnology Handbook", 1<sup>st</sup> Ed, Taylor & Francis Publication, Florida, USA, 2018.
2. Alok Dhawan, Sanjay Singh, Ashutosh Kumar, Rishi Shanker, "Nanobiotechnology: Human Health and the Environment", CRC Press, Florida, USA, 2018.
3. Arunava Goswami, Samrat Roy Choudhury, "Nanobiotechnology: Basic and Applied Aspects", Anthem Press, London, UK.2017

	Prepared by	Approved by
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Date	10.07.2023	10.07.2023
Remarks *:	The same lesson plan will be followed in the subsequent semester	

  
10/7/23