

  
**UNIVERSITY OF MYSORE**  
Estd. 1916

No.AC2(S)/164/2021-22

Vishwavidyanilaya Karyasoudha  
Crawford Hall, Mysuru- 570 005

Dated: 16-02-2022

**Notification**

**Sub:-** Changes in the Syllabus & Scheme of Examination of Biotechnology (PG) with effective from the next Academic year 2022-23.

- Ref:-**
1. Decision of Board of Studies in Biotechnology (PG) meeting held on 24-11-2021.
  2. Decision of the Faculty of Science & Technology Meeting held on 20-12-2021.
  3. Decision of the Academic Council meeting held on 23-12-2021.


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The Board of studies in Biotechnology (PG) which met on 24-11-2021 has recommended to change the Syllabus & scheme of examination related to Biotechnology (PG) with effective from the next Academic year 2022-23.

The Faculty of Science & Technology and Academic Council at their meetings held on 20-12-2021 and 23-12-2021 respectively have also approved the above said proposal and it is hereby notified.

The Syllabus & Scheme of Examination is annexed herewith and the contents may be downloaded from the University Website i.e., [www.uni-mysore.ac.in](http://www.uni-mysore.ac.in).

**DRAFT APPROVED BY THE REGISTRAR**

  
Deputy Registrar (Academic)  
University of Mysore  
Mysore-570 005

**To:-**

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Chairman, BOS/DOS, in Biotechnology (PG), Manasagangothri, Mysore.
3. The Dean, Faculty of Science & Technology, DoS in Earth Science, MGM.
4. The Director, Distance Education Programme, Moulya Bhavan, Manasagangothri, Mysuru.
5. The Director, PMEB, Manasagangothri, Mysore.
6. Director, College Development Council, Manasagangothri, Mysore.
7. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
8. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
9. Office Copy.

**Cell Biology and Cellular Signaling (SC)**  
**(Proposed for Revision)**

<b>Units</b>	<b>Sub-Topics</b>	<b>Old syllabus</b>	<b>Proposed draft for revision</b>
<b>I</b>	<b>Topic 1</b>	<b>Dynamic organization of the cell</b> Ultra-structure of prokaryotic and eukaryotic cells; Universal features of cells; cell chemistry and biosynthesis: chemical organization of the cell;	<b>Internal organization of the cells and cellular processes</b> <b>Internal organization of the cell; cell membranes:</b> Structure of prokaryotic and eukaryotic cell membranes – models. Cellular organelles; Molecular mechanisms of membrane transport- active, passive, facilitated. Types of vesicles - transport and their functions.
	<b>Topic 2</b>	Internal organization of the cell-cell membranes: structure of cell membranes - models, intracellular organelles: endoplasmic reticulum and Golgi apparatus; Mitochondria, chloroplast, Lysosomes. Nucleus - Internal organization, Nucleosomes, Chromatin-structure and function, cellular cytoskeleton.	<b>Cell cycle:</b> Cell cycle and its regulation; <b>Cell differentiation:</b> stem cells, their differentiation into different cell types and organization into specialized tissues; <b>Cell death:</b> different modes of cell death and their regulation.
<b>II</b>		<b>Cellular processes</b> Cell cycle and its regulation; cell division: mitosis, meiosis and cytokinesis.	<b>Basics of Signal Transduction</b> <b>Extra-cellular matrix components:</b> Cell junctions; Cell adhesion molecules; Hormones and their receptors; Types of cell signaling. Neurotransmission and its regulation.
	<b>Topic II</b>	cell differentiation: stem cells, their differentiation into different cell types and organization into specialized tissues;	<b>Growth factors:</b> EGF, VEGF, PDGF and their Signaling;
	<b>Topic III</b>	cell motility and migration; cell death: different modes of cell death and their regulation	<b>G-protein coupled receptors (GPCR) signaling;</b> Second messengers in signal transduction pathways: cAMP, cGMP, calcium ions (Ca <sup>2+</sup> ), and inositol triphosphate (IP <sub>3</sub> );
	<b>Topic</b>	Molecular mechanisms of membrane	<b>Receptor tyrosine kinases (RTK)</b>

	<b>c IV</b>	transport active, passive, facilitated. Types of vesicles - transport and their functions.	<b>signaling</b> ; Adapter proteins required for signal transmission.
<b>III</b>	<b>Topic I</b>	<b>Basics of Signal Transduction</b> Extra-cellular matrix components, Cell junctions, Cell adhesion molecules, Hormones and their receptors, Cell surface receptors as reception of extra-cellular signals.	<b>Signal transduction pathways in animals.</b> <b>MAP kinase cascade:</b> SAP/JNK, p38, Wnt signaling, Jak/Stat, Smad, TGF $\beta$ Signaling.
	<b>Topic II</b>	Types of cell signaling, Growth factors-EGFR, VEGF, PDGF and their Signaling, adapter proteins required for signal transmission; signaling through G-protein coupled receptors.	MMPs and Cell Signalling, NF- $\kappa$ B signaling from cytoplasm to nucleus, Intracellular signaling in Development and Disease.
	<b>Topic III</b>	Second messengers in signal transduction pathways: cAMP, cGMP, calcium ions ( $Ca^{2+}$ ), and inositol triphosphate ( $IP_3$ ) and ligand-gated ion channels; signaling through Receptor tyrosine kinases; neurotransmission and its regulation. Biochemistry of vision.	The end point of signal transduction, gene transcription; Nuclear receptors and transcription factors in signaling.
<b>IV</b>	<b>Topic I</b>	<b>Signal transduction pathways in animals:</b> Phosphorylation cascades; MAP kinase, Intracellular signaling in Development and Disease, SAP/JNK, p38, Wnt signaling, Jak/Stat, Smad, TGF $\beta$ Signaling, Cytoskeleton And Cell Signalling, MMPs And Cell Signalling.	<b>Plant-microbe interactions</b> Bacterial and plant two-component signaling systems; bacterial chemotaxis and quorum sensing.
	<b>Topic II</b>	Cross talks among cytoplasmic components, NF- $\kappa$ B signaling from cytoplasm to nucleus. The end point of signal transduction, gene transcription: Nuclear receptors and transcription factors in signaling.	Recognition and entry processes of different pathogens like bacteria, fungi and viruses into host cells; alteration of host cell behavior by pathogens.
	<b>Topic III</b>	<b>Host-parasite interaction:</b> Bacterial and plant two-component signaling systems; bacterial chemotaxis and quorum sensing, Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, pathogen-induced signaling pathways in plants- ROS, Jasmonate, SA-mediated pathways, resistance genes.	<b>Host- pathogen interactions:</b> Compatible-incompatible reactions- hypersensitive reaction, activation of resistance genes; pathogen-induced signaling pathways in plants- Oxidative burst, Reactive oxygen species (ROS), Nitric oxide, Jasmonate and Salicylic acid- mediated pathways.

## Nanobiotechnology (SC) (Proposed for revision)

**Preamble:** The contents were rearranged among the Units to reduce repeatability.

Units	Sub-Topics	Old syllabus	Proposed draft for revision
I	Topic 1	<p><b>Introduction and Fundamentals of Nanobiotechnology.</b>            Concepts, historical perspective; Nanoscale materials: Definition and properties; Different formats of nanomaterial and applications; Cellular nanostructure; nanopores; Biomolecular motors; Bio-inspired Nanostructures, Quantum dots.</p>	<p><b>Introduction and Fundamentals of nanobiotechnology</b>            Concepts, historical perspective; Nanoscale materials: Definition and properties; Different formats of nanomaterial and applications; nanopores; Biomolecular motors.</p>
	Topic 2	<p><b>Synthesis and characterization of different nanomaterials:</b> Synthesis of nanomaterials from plant, microbial and animal cell sources. Characterization of nanomaterials using Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Scanning Tunneling Microscopy, Optical Absorption and Emission Spectroscopy, Thermogravimetric Analysis, Differential Scanning Calorimetry, Thermomechanical Analysis, X-Ray, neutron diffraction.            Applications of nanobiotechnology in Plant and animal cell cultures, stem cell culture and artificial organ synthesis.</p>	<p><b>Synthesis and characterization of different nanomaterials:</b> Synthesis of nanomaterials from plant, microbial and animal cell sources. Characterization of nanomaterials using different Microscopy techniques, Optical Absorption and Emission Spectroscopy, X-Ray diffraction.</p>
II		<p><b>Nano-particles</b>  <b>Concepts of Nanoparticles:</b> Basic structure of Nanoparticles- Kinetics in nano-structured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two-dimensional nanostructures; clusters of metals and semiconductors, bionanoparticles.</p>	<p><b>Concepts of Nanoparticles:</b> Basic structure of Nanoparticles- Kinetics in nano-structured Materials.</p>
	Topic II	<p><b>Bionanocomposites:</b> Nano-particles and Microorganisms; Microbial Synthesis of Nano- materials; Biological methods for synthesis of nano-emulsions using</p>	<p>Zero dimensional size and shape of nanoparticles, Quantum dots; one-dimensional and two-dimensional nanostructures and their</p>

		bacteria, fungi and Actinomycetes; Plant-based nanoparticle synthesis.	applications.
	<b>Topic III</b>	Nano-composite biomaterials – Fibres, devices and structures, Nano Bio-systems.	<b>Nanocomposites:</b> Nanocomposite biomaterials – Fibres, devices and structures.
<b>III</b>	<b>Topic I</b>	<b>Applications of Nanobiotechnology</b> <b>Applications of Nanomedicine:</b> Nanotechnology in diagnostic applications, materials used in Diagnostics and Therapeutics. Nanomaterials for catalysis, development and characterization of nanobiocatalysts, application of nano-scaffolds in synthesis, applications of nanobiocatalysis in the production of drugs and drug intermediates.	<b>Applications of Nanobiotechnology</b> <b>Applications of Nanomedicine:</b> Nanobiotechnology in Diagnostics and Therapeutics; Nano-scaffolds; Nanobiocatalysts in the production of drugs.
	<b>Topic II</b>	<b>Nano-films:</b> Thin films; Colloidal nanostructures; Self-assembly, Nanovesicles; Nanospheres; nanocapsules and their characterization.	<b>Nanostructures:</b> Nanofilms; Nanovesicles; Nanospheres; Nanocapsules. <b>Nanoparticles for diagnostics and imaging:</b> Concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development.
	<b>Topic III</b>	<b>Nanoparticles for drug delivery:</b> Strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers. <b>Nanoparticles for diagnostics and imaging:</b> Concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development.	<b>Nanoparticles for drug delivery:</b> Strategies for cellular internalization, long circulation and enhanced permeation through various anatomical barriers.
	<b>Topic IV</b>	<b>Applications in Agriculture:</b> Biogenic nanomaterials and their role in soil, water quality and plant protection; Smart nanoscale systems for targeted delivery of fertilizers, pesticides (nanocides);	<b>Applications in Agriculture and Environment:</b> Biogenic nanomaterials for Smart nanoscale systems for targeted delivery of fertilizers, pesticides (nanocides);

		Nanoremediation.	Nanoremediation.
<b>IV</b>	<b>Topic I</b>	<b>Sustainable bionanotechnology:</b> Application of industrial ecology to nanotechnology, Fate of nanomaterials in environment, environmental life cycle of nano-materials, environmental and health impacts of nano materials, Nano-materials in future - implications.	<b>Sustainable Nanobiotechnology:</b> Fate of nanomaterials in environment, health impacts of nanomaterials, Future implications of Nanomaterials.
	<b>Topic II</b>	<b>Toxicity and safety of nanomaterials:</b> Introduction to Safety of nanomaterials; Concept of Nanotoxicology – Models and assays for nanotoxicity assessment; Laboratory rodent studies. Ecotoxicologic studies: Methodology for Nanotoxicology - toxicity testing; Mechanism of nano-size particle toxicity; Reactive oxygen species mechanisms of NSP toxicity; Interactions between nanoparticles and living organisms.	<b>Nanotoxicology:</b> Mechanism of nanomaterial toxicity; Models and assays for nanotoxicity assessment. Interactions between nanomaterials and living organisms.

**University of Mysore**  
**Department of Studies in Biotechnology**  
**Manasagangotri, Mysore – 570 006**

**Revised Scheme of Study (2022-23 Onwards)**

**Master's Degree Program in Biotechnology**

<b>Credits to be earned</b>	<b>76</b>
Core papers	52 credits
Soft core	20 credits
Open elective paper*	04 credits

\*Open elective shall be entirely from different discipline of study

**Credit matrix for Master's Degree Program in Biotechnology**

<b>Credits to be earned</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>Total Credits</b>
Hard Core	16	16	12	08	52
Soft Core	04	04	04	08	20
Open elective	-	04	-	-	04
<b>Total</b>	<b>20</b>	<b>24</b>	<b>16</b>	<b>16</b>	<b>76</b>

**I Semester**

<b>Paper Code</b>	<b>Title of the course</b>	<b>HC/SC/OE/etc</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
	Bioanalytical Techniques	HC	3	1	0	4
	Microbiology	HC	3	1	0	4
	Biochemistry	HC	3	1	0	4
	Practical-1 (Bioanalytical Techniques, Microbiology, Biochemistry)	HC	0	0	4	4
<b>SOFTCORE (Choose any ONE/TWO from the list below)</b>						
	Molecular Genetics	SC	3	1	0	4
	Food & Environmental Biotechnology	SC	3	1	0	4
	Biostatistics & Bioinformatics	SC	3	1	0	4

**II Semester**

<b>Paper Code</b>	<b>Title of the course</b>	<b>HC/SC/OE/etc</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
	Molecular Biology	HC	3	1	0	4
	Genetic Engineering	HC	3	1	0	4
	Immunotechnology	HC	3	1	0	4
	Practical-2 (Molecular Biology, Genetic Engineering, Immunotechnology)	HC	0	0	4	4

<b>SOFTCORE (Choose any ONE from the list below)</b>						
	Bioprocess Technology	SC	3	1	0	4
	Cell Biology and Cellular Signalling	SC	3	1	0	4
	<b>OPEN ELECTIVE</b> (Choose from other department)	OE				4
16957	Biotechnology and its applications (For other discipline students)	OE	4	0	0	4

### III Semester

<b>Paper Code</b>	<b>Title of the course</b>	<b>HC/SC/OE/etc</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
	Plant Biotechnology	HC	3	1	0	4
	Animal Biotechnology	HC	3	1	0	4
	Practical-3 (Plant and Animal Biotechnology, Bioprocess Technology)	HC	0	0	4	4
<b>SOFTCORE (Choose any ONE/TWO from the list below)</b>						
	Molecular Diagnostics	SC	3	1	0	4
	Natural Products & Drug Discovery	SC	3	1	0	4
	Genomics & Proteomics	SC	3	1	0	4

### IV Semester

<b>Paper Code</b>	<b>Title of the course</b>	<b>HC/SC/OE/etc</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
<b>SOFTCORE (Choose any ONE from the list below)</b>						
	Nanobiotechnology	SC	3	1	0	4
	Molecular Plant Pathology	SC	3	1	0	4
	Project work/Dissertation*	HC	0	2	6	8

\* Dissertation shall be allotted to the students in the III Semester itself.

### Additional Softcores

<b>Paper Code</b>	<b>Title of the course</b>	<b>HC/SC/OE/etc</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
	Bioentrepreneurship	SC	3	1	0	4
	Seed Health and Diagnostics	SC	3	1	0	4
	Stem Cell & Regenerative Medicine	SC	3	1	0	4
	Cancer Biology	SC	3	1	0	4