

M.Phil. BIOTECHNOLOGY

SEM	SUB CODE	COURSE	SUBJECT TITLE	HRS / WEEK	CREDIT	CIA Mark	ESE MARK	TOTAL MARK
I	20MPBT1CC1	Core - I	Research Methodology	4*	4	25	75	100
	20MPBT1CC2	Core- II	Advancements in Biotechnology	4*	4	25	75	100
	20MPBT1CC3	Core - III	Teaching & Learning Skills (Common Paper)	4*	4	25	75	100
	20MPBT1CC4	Core - IV (Elective)	Paper on Topic of Research (The syllabus will be prepared by the guide and examination will be conducted by the COE)	4*	4	25	75	100
		*One hour library for each course						
	TOTAL			16*	16	100	300	400
II	20MPBT2PD		Dissertation ^{##}	-	8	-	-	200
GRAND TOTAL				-	24	-	-	600

^{##} Evaluation of the Dissertation and Viva Voce shall be made jointly by the Research Supervisor and the External Examiner.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC1	Core – I	RESEARCH METHODOLOGY	4	4	100	25	75

Course Outcomes:

1. Identify the various sources of information for literature review and data collection.
2. Summarize the principles of research instruments of biotechnology field.
3. Describe biotechnological practical application of laboratory equipments critically and systematically.
4. Appraise the components of scholarly writing and evaluate its quality.
5. Formulate the statistical concepts and applying them in data collection, analysis and interpretation.

12 hours

Unit-I: Selection of a research problem- experimental approach and research design, library and research documentation- literature review- Thesis writing- components of a thesis, preparation of research documents (abstracts, papers etc).[#]Thrust areas and research priorities in biotechnology at National and International levels[#]. Planning of research: Research proposals, time scheduling of research, available sources and generation of funds and facilities.

12 hours

Unit- II: Principles and applications of confocal microscope. Separation Techniques - Principles and application of thin layer chromatography, gel exclusion chromatography, ion exchange chromatography, affinity chromatography, Gas chromatography, high performance liquid chromatography and reverse phase chromatography. [#]Principles and applications of UV-Vis-FTIR-NMR-Mass spectroscopy, X – Ray Diffraction (XRD)[#].

12 hours

Unit –III: Principles and applications of SDS- PAGE, 2D- gel electrophoresis, MALDI-TOF, gel documentation, Immunoelectrophoresis, Immunodiffusion, Immunoprecipitation – agglutination techniques. [#]Southern, Northern and Western blotting techniques, Molecular techniques - PCR, RFLP, RAPD, AFLP, DNA finger printing and DNA sequencing[#].

12 hours

Unit – IV: Introduction to IPR, Types of IP - Patents, Trademarks, Copyright and Related Rights, Industrial Design, Traditional Knowledge and Geographical Indications. Importance of IPR – patentable and non patentables, patenting life, legal protection of Biotechnological inventions. Objectives of the patent system - Basic, principles and general requirements of patent law. Biotechnological inventions and patent law - Legal development - Patentable subjects and protection in Biotechnology.[#]Introduction to ethics and bioethics[#]. Ethical limits of Animal use.

12 hours

Unit –V: Principles and practice of statistical methods in biotechnological research; collection and tabulation of data; graphical and diagrammatic representation of data; basic statistics; Simple Correlation and regression analyses; significance tests: Chi- square test, student's t-test, ANOVA, Duncan's Multiple Range Test. [#]Bioinformatics: BLAST N and P, Gene discovery using EST[#]. Genbank Database- NCBI, EMBL and DDBJ. Protein sequence Database- Swiss Prot and PDB.

[#].....[#] Self-study portion

Text Books:

- T.B.1 J. Anderson, D.Durston and M.Poole, Thesis and Assignment writing. New Age International Pvt. Ltd, New Delhi, 2010.
- T.B.2 David Freifelder and W.H.Freeman. Physical Biochemistry: Applications to Biochemistry and Molecular Biology - 2nd Edition and Co Ltd, 2012.
- T.B.3 Gurdeep R. Chatwal, Sham K. Anand, Instrumental methods of chemical analysis 2nd Edition; Himalaya Publishing House, 2007.
- T.B.4 Jerrold H. Zar, Biostatistical Analysis (7th edition), Prentice Hall publishers, 2014.

Books for References:

1. Veer Bala Rastogi, Fundamentals of Biostatistics, Ane Books India, New Delhi, 2006.
2. L.Veera Kumar, Bioinstrumentation, MJP Publishers, Chennai, 2006.

Web Reference: <https://nptel.ac.in/courses/109105115/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Outcomes:										
Semester	Code		Title of the Paper				Hours		Credits	
I	20MPBT1CC1		RESEARCH METHODOLOGY				4		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓					✓	✓	✓	✓	✓
CO5	✓	✓	✓			✓	✓	✓	✓	✓
Number of Matches = 44, Relationship : High										

Prepared by:

1. Dr. J. Sebastin Raj

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Checked by:

1. Dr. Y. ArsiaTarnam
2. Dr. A. Khaleel Ahamed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC2	Core – II	ADVANCEMENTS IN BIOTECHNOLOGY	4	4	100	25	75

Course Outcomes:

1. Acquire education that leads to comprehensive understanding of the principles and practices of biotechnology.
2. Empower students with the ability to think and solve problems in the field of biotechnology.
3. Ensure students are able to effectively communicate with biotech and other interdisciplinary professionals.
4. Produce responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.
5. Ensure students to gain an insight into the concepts and techniques of Plant, Animal and Microbial biotechnology and its wide industrial & medicinal applications.

Unit – I

12 hours

Fundamentals of Biotechnology: Molecular Biotechnology Revolution, Emergence and Commercialization of Molecular Biotechnology, Concerns and Consequences, Prokaryotic and Eukaryotic Organisms, *E.coli*, *Saccharomyces cerevisiae*, #Secretion pathways in prokaryotic and Eukaryotic organisms#, Eukaryotic cells in culture.

Unit II

12 hours

Human Genetics: Modes of human inheritance, Genetic linkage and gene mapping, Comprehensive human linkage maps, Radiation Hybrid mapping, Human genome sequence, #Determining gene function- Functional gene cloning#, Positional candidate gene cloning, cDNA Microarray, Two hybrid system.

Unit –III

12 hours

Protein Engineering: Adding Disulfide Bonds – T4 Lysozyme, Xylanase, Human Pancreatic ribonuclease. Changing Asparagine to other amino acids, Reducing the number of free sulfhydryl residues, modifying metal cofactor requirements, decreasing protease sensitivity, #Modifying protein specificity, Antibodies, Altering multiple properties - Subtilisin, peroxidase#.

Unit - IV

12 hours

Regulating the use of Biotechnology: Regulating the use of Biotechnology, Regulating Recombinant DNA Technology – Regulating Food and Food ingredients – Chymosin, Tryptophan, Bovine Somatotropin; Deliberate Releases of GMOs. #Development of a policy for somatic cell gene therapy, Accumulation of Defective genes in future generations, Human germ line gene therapy#.

Unit – V

12 hours

Stem cells and Nanobiotechnology: Stem Cells – types- Gene therapy. Cloning of animals. Stem cell therapy – reproductive cloning. Nanobiotechnology – self-assembly, Molecular motors. Biologically inspired nanotechnology – single molecule assays, atomic force microscopy, optical Tweezers, The good side of the viruses: Nature's Nanotechnology. # Design issues of nanobiological devices – imaging using nanotherapeutic contrast agents#, magnetic resonance imaging (MRI), Nanoparticle contrast

agents, nanobiotechnological contrast agent design[#]. Nanomedicine emerging area in nanobiotechnology.

#.....# Self-study portion

Text Books:

- T.B. 1. L.A. Allison, Fundamental Molecular Biology. John Wiley and Sons, 2007.
- T.B. 2. Bernard R.Glick, Jack, Pasternak, Molecular Biotechnology, ASM Press, 2010.
- T.B. 3. Ian Freshney, Culture of Animal cells, 3rdEd., John Wiley & Sons, Inc. publications, 2007.
- T.B. 4. James D.Watson, Michael Gilman, Jan A. Witrowski, Mark Zoller. An Overview of recombinant DNA technology, W.H. Freeman Publishers, 2012.

Books for References:

1. James D.Watson, Molecular Biology of the Gene, Pearson Education India, 2010.
2. William S.Klug, Michael R.Cummings, Concepts of Genetics, Pearson Education India, 2007.

Web Reference:

1. <https://nptel.ac.in/courses/102103045/>
2. <https://nptel.ac.in/courses/102103041/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Outcome:										
Semester	Code		Title of the Paper				Hours		Credits	
I	20MPBT1CC2		ADVANCEMENTS IN BIOTECHNOLOGY				4		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓		✓	✓	✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓
Number of Matches = 44, Relationship : High										

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Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC3	Core – III	TEACHING AND LEARNING SKILLS	4	4	100	25	75

Course Outcomes:

1. Describe the teaching and dynamics of teaching – learning.
2. Facilitate e-learning and e-teaching with the ICT tools.
3. Acquire practical skills (in subject) aiming at gaining confidence to handle practical classes.
4. Develop teaching skills and gain confidence in teaching.
5. Acquire knowledge on the preparation of teaching aids.

Unit – I

12 hours

Computer application skills: Internet –meaning – importance-types of networking-LAN, WAN, MAN-internet- website and webpage's, internet connectively – Browsing the internet-Browsing software-URL addresses, search engines, exploring websites and downloading materials from websites, power point-creating a presentation – slide preparation-#popular websites for data collection in Biotechnology, MS Excel- Statistical packages# –SPSS.

Unit – II

12 hours

Communication and Interaction: The theory of communication-communication cycle-Types of communication, communication and language, communication in the class room, Lecture and Lecture demonstration as communication. Interaction methods, Interaction analysis, observation schedule and record.#Bale's interaction process categories, Flander's system of interaction analysis, verbal interaction category system#. Reciprocal category system – Equivalent talk categories.

Unit – III

12 hours

Education skill: Psychology – Definition-Nature- Meaning of educational Psychology – Definition – Nature – Scope. Teaching and learning – meaning – characteristics – effective teaching – concept of learning – comparison between teaching and learning. #Mental health –Frustration – concept of adjustment – Defense mechanism – Mental hygiene#.

Unit – IV

12 hours

Uses of teaching strategies: Group methods of instruction – lecture – demonstration – seminars – workshops – case analysis – panel discussion – team teaching - individual approaches – Teleconferencing – Video conferencing – Description – Advantages – #Micro teaching – Characteristics of Micro teaching – Teaching skills – Programmed Instruction – ICT enabled teaching – Language Laboratory#.

Unit – V

12 hours

Educational Technology: Educational technology – definition – objectives – teaching technology – characteristics of teaching technology – behavioral technology – pedagogy of teaching – General advantage of using teaching aids – Broad classification of teaching aids – #Hardware and software in teaching aids#. Instructional media – media attribution – multimedia and instructional development – Multimedia centre – uses and abuses of multimedia.

#.....# Self-study portion

Text Books:

- T.B. 1. S.K. Kochhar, Methods and Techniques of Teaching Sterling Publisher Pvt. Ltd, 2004.
- T.B. 2. S. Robinson, Fundamentals of Education Psychology 2nd ed., Ane Books Pvt. Ltd, 2008.
- T.B. 3. SambasivaRao, D. BhaskarRao, Techniques of Teaching Psychology, Sonali Publications New Delhi, 2006.
- T.B. 4. K. Sampath, A. Pannerselvam and S. Santhanam, Introduction to Educational Technology 4th revised ed., Sterling Publisher Pvt. Ltd, 2000.

Books for References:

1. T.M. Srinivasan, Use of Computers and Multimedia in Education Aavisakar Publication, Jaipur, 2002.
2. Zikr-urRahman, Modern teaching methods and techniques-Anmol Publication Pvt. Ltd. New Delhi, 2006.

Web Reference:

1. <https://nptel.ac.in/content/storage2/courses/109103023/download/Lecture%207.pdf>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code		Title of the Paper				Hours		Credits	
I	20MPBT1CC3		TEACHING AND LEARNING SKILLS				4		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓	✓	✓	✓		✓
CO4		✓	✓		✓	✓	✓	✓		
CO5	✓	✓	✓			✓	✓	✓		
Number of Matches = 40, Relationship : High										

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2. Dr. T. Nargis Begum

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC4	Core – IV	PLANT MOLECULAR BIOTECHNOLOGY	4	4	100	25	75

Course outcomes:

1. Acquire advance level of plant tissue culture techniques in the field of plant biotechnology.
2. Describe the novel ideas to the real problems in molecular biology of plant microbial interactions.
3. Demonstrate the social value of transgenic plants with ethical consumption.
4. Appraise plant biotechnological research using bioinformatics tools.
5. Generate research enhancement in the field of plant molecular research.

12 hours

Unit –I: Tissue culture Techniques:Brief Historical account: Micropropagation, Single cell culture, Suspension culture. Cellular totipotency, Somatic embryogenesis: Synthetic seeds: somaclonal and gametoclonal variation. Haploid production, Embryo culture. Application of Tissue culture: Protoplast isolation and culture: Somatic hybridization, Cybrid technology: Germplasm conservation: #Production of secondary metabolites: Genetic engineering of metabolites in Bioreactors and downstream procession#.

12 hours

Unit – II: Molecular Biology of Plant Microbial interaction: Biochemistry and Molecular biology of biological nitrogen fixation, Genetic engineering of nif genes and node genes. Agrobacterium and crown gall tumours, mechanism of T-DNA transfer. Ti and Ri plasmid vectors Agro infection - Plant Virus as vectors. Direct transfer of plants by physical and chemical methods. #Selectable marker and reporter genes#.

12 hours

Unit – III: Transgenic plants and their application: Transgenic plants: genetic engineering of plants for herbicide resistance, pest resistance, Virus resistance, Stress tolerance, Cytoplasmic male sterility, Delayed fruit ripening. Genetic engineering of seed storage proteins. #Vaccine production in plants, Edible vaccine, Transgenic plants as bioreactors#.

12 hours

Unit - IV: Sequence alignments and Phylogeny: Introduction, Protein sequences, physicochemical properties based on sequence, sequence comparison. Pair-wise sequence alignment, gaps, gap-penalties, scoring matrices, Smith-Waterman and Needleman-Wunsch algorithms for sequence alignments, multiple sequence alignment, comparison, composition and properties, useful programs, ClustalW, BioEDIT, BLASTp, Phylogenetic analysis tools- Phylip, ClustalW. #Protein sequence analysis: ExPASy Proteomics tools#.

12 hours

Unit – V: Pharmacoinformatics in Drug Discovery: Drug discovery process, Role of Bioinformatics in drug design, Target identification and validation, lead optimization and validation. Molecular Docking; Structure and ligand based drug design. Modeling of target-small molecule interactions. Protein structure prediction– secondary structure – homology modeling, fold recognition and ab initio methods. #Molecular Simulations, Structure Activity Relationship – QSARs Methodology#.

#.....# Self-study portion

Text Books:

1. KalyanKumar De.An Introduction to Plant Tissue Culture Techniques.NewCentral Book Agency, Kolkata,2007.
- 2.Adrian Slater, Nigel W. Scott and Mark R. Fowler., Plant Biotechnology (The genetic manipulation of plants), Oxford University press, UK, 2003.
3. Willow J.H. Liu. John Wiley & Sons (Edited by): Traditional Herbal Medicine Research Methods: Identification, Analysis, Bioassay, and Pharmaceutical and Clinical Studies, 2011.
4. Donald Grierson and S.V. Convey., Plant Molecular Biology. Blackie and Son Limited, New York, 2010.

Books for Reference:

1. R.J. Henry, Practical Application of Plant Molecular Biology. Chapmans and Hall,2014.
2. Sarfaraz K. Niazi, Handbook of Pharmaceutical Manufacturing Formulations, Second Edition: Vol-II, Uncompressed Solid Products. CRC Press, 2009.

Web reference:<https://nptel.ac.in/courses/102103016/>

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Outcomes:										
Semester	Code		Title of the Paper			Hours		Credits		
I	20MPBT1CC4		PLANT MOLECULAR BIOTECHNOLOGY			4		4		
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓			✓	
CO3			✓	✓	✓	✓	✓	✓	✓	✓
CO4				✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓			✓	✓	✓	✓	✓	✓
Number of Matches = 41, Relationship : High										

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Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC4	Core – IV	NANOPARTICLE AND NANOMEDICINE	4	4	100	25	75

Course outcomes:

1. Underline the intensive and in-depth learning of Nanotechnology.
2. Describe nanomolecular diagnostics for providing new solution into the medical field.
3. Designate nanomedicine for cancer treatment and new social problems.
4. Compare the role of nanotechnology in biological therapies.
5. Appraise the application of nanotechnology in cancer therapy and nanomedicine.

12 hours

UNIT I: Nanoparticles and properties: Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO₂, CeO₂, ZnO) - Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites - Dilute magnetic semiconductor- Biological system - DNA and RNA - Lipids - Size dependent properties - Mechanical, Physical and Chemical properties. Applications of Nanomaterials (15) Molecular electronics and nanoelectronics – Quantum electronic devices - CNT based transistor and Field Emission Display - Biological applications - Biochemical sensor - [#]Membrane based water purification[#].

12 hours

UNIT – II: Nanomolecular diagnostics - array and chips: Introduction -Nano diagnostics - Rationale of Nanotechnology for Molecular Diagnostics - Nanoarrays for Molecular Diagnostics. NanoPro™ System -Nanofluidic/Nanoarray Devices to Detect a Single Molecule of DNA-Self Assembling Protein Nanoarrays -Fullerene Photo detectors for Chemiluminescence Detection on Micro fluidic Chips - Protein Microarray for Detection of Molecules with Nanoparticles Protein Nanobiochip Nanoparticles for Molecular Diagnostics -Gold Nanoparticles -Quantum Dots for Molecular Diagnostics Magnetic Nanoparticles -[#]Use of Nanocrystals in Immuno-histochemistry[#].

12 hours

UNIT – III: Development of nanomedicine: Introduction - Development of nano medicines – Nano Shells – Nano pores – Tectodendrimers – Nanoparticle drug system for oral administration – Drug system for nasal administration – Drug system for ocular administration – Nanotechnology in diagnostic application.

12 hours

UNIT – IV: Role of nanotechnology in biological therapies: Biomedical nanoparticles – Liposome's – Dentrimer – Different types of drug loading – Drug release – Biodegradable polymers – Applications Nanobiotechnologies for Single-Molecule Detection -Protease-Activated Quantum Dot Probes - Nanotechnology for Point-of-Care Diagnostics -Nanodiagnostics for the Battle Field - [#]Nanodiagnostics for Integrating Diagnostics with Therapeutic[#]s.

12 hours

UNIT – V: Application in cancer therapy & nanomedicine: Introduction and Rationale for Nanotechnology in Cancer Therapy - Passive Targeting of Solid Tumors: Pathophysiological Principles and Physicochemical Aspects of Delivery Systems -Active Targeting Strategies in Cancer

with a Focus on\Potential Nanotechnology Applications - Pharmacokinetics of Nanocarrier - Mediated Drug and Gene Delivery - Multifunctional Nanoparticles for Cancer Therapy- Neutron Capture #Therapy of Cancer: Nanoparticles and High Molecular Weight Boron Delivery Agents#.

#.....# Self-study portion

Text Books:

1. Kewal K. Jain, The Handbook of Nanomedicine, Humana Press, 2008.
2. Zhang, Nanomedicine: A Systems Engineering Approach” 1st Ed., Pan Stanford Publishing, 2005.
3. Robert A. Freitas Jr., —Nanomedicine Volume IIA: BiocompatibilityLandes Bioscience Publishers, 2003.

Books for References:

1. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C.N.R.Rao, A.Muller, A.K.Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh&Co, Weinheim, 2004.

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Outcome:										
Semester	Code		Title of the Paper				Hours		Credits	
I	20MPBT1CC4		NANOPARTICLE AND NANOMEDICINE				4		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓		✓	✓	✓	
CO3			✓	✓	✓	✓	✓	✓	✓	✓
CO4				✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓			✓	✓	✓	✓	✓	✓
Number of Matches = 41, Relationship : High										

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Checked by:

1. Dr. T. Nargis Begum

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Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC4	Core – IV	CANCER BIOLOGY	4	4	100	25	75

Course outcomes:

1. Underline the the research in the field of cancer biology.
2. Describe **Death and Life Apoptosis and Immortality**.
3. Designate **Carcinogens** and cancer relevant social problems.
4. Compare the role of cancer science in biological therapies.
5. Appraise the application of cancer therapy in modern medicine for human welfare.

12 hours

Unit I: Origins and Overview: History of Cancer, Introduction: What is Cancer? The Six Hallmarks of Cancer, Causes, Initiation and Progression.

12 hours

Unit II: Gene Expression and Regulation: DNA Structure and Stability, Maintenance and Repair, Gene Expression and Regulation, Transcription and Translation, Signal Transduction Pathways, Transcription Factors, Growth Factors, Proto-oncogenes, Oncogene Activation.

12 hours

Unit III: Growth Inhibitors: The Cell Cycle, Checkpoints of the Cell Cycle, G1 and S Phases, G2 Phase and Mitosis, Cyclin -Dependent Kinases, Tumor-Suppressor Genes, Functions and Pathways, Examples: p53, Rb (retinoblastoma), BRCA1 and BRCA2 ,Cell Biology and Cancer.

12 hours

Unit IV: Death and Life Apoptosis and Immortality: Apoptosis ,The Apoptosis Pathway, Death Receptors, Mutations to the Pathway, Immortality, Normal Limits on Proliferation, Telomeres and Telomerase, Tumorigenesis, Hyperplasia, Anaplasia and Dysplasia.

12 hours

Unit V: Carcinogens: Types of Carcinogens, Environmental Carcinogens, Carcinogenesis (Oncogenesis), Gene-Environment Interactions, Carcinogen Metabolism, Identifying Carcinogens and Cancer Risk, Carcinogen Screening, Known Carcinogens, Specialized Testing for Carcinogens. Cancer Therapy-Past, Present, and Future: Cancer Risk Assessment, Screening and Early Detection , Colorectal Cancer Screening, Prostate Cancer Screening.

#.....#Self-study portion

Text Books:

- T.B.1. Required Textbook: Robert A. Weinberg, 2010, The Biology of Cancer – Garland Science.
- T.B.2. Primary Resources: This course is comprised of a range of different free, online materials.

Unit I Chapter I - XII, T.B.1
 Unit II Chapter III, T.B. 2
 Unit III Chapter IV, T.B.2
 Unit IV Chapter X, T.B.2
 Unit V Chapter V, T.B.3

Books for References:

1. American Cancer Society's "The History of Cancer"
2. National Cancer Institute's "Understanding Cancer Series"
3. Cold Spring Harbor Laboratory's Inside Cancer
4. Emory University's Cancer Quest

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

CANCER BIOLOGY										
Semester	Code		Title of the Paper				Hours		Credits	
I	20MPBT1CC4		CANCER BIOLOGY				4		4	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓		✓	✓	✓	
CO3			✓	✓	✓	✓	✓	✓	✓	✓
CO4				✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓			✓	✓	✓	✓	✓	✓
Number of Matches = 38, Relationship : High										

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Checked by:

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Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20MPBT1CC4	Core – IV	STEM CELL RESEARCH	4	4	100	25	75

Course outcomes:

1. Underline the Introduction and basic biology of stem cells.
2. Describe the Biology and varieties of stem cells.
3. Designate the cancer treatment and new social problems.
4. Compare the Biotechnology of stem cells and applications.
5. Appraise the Opportunities and policy matters on stem cell research-therapy.

UNIT –I

12 hours

Introduction and basic biology of stem cells : Stem cell evolution, Historical perspective - with model systems, Stemness basic, Type of stem cells, Embryonal carcinoma cells: Teratomas and Teratocarcinoma, Stem cell markers, Stem cell niches, Growth Factors and Paracrine mechanism and action of stem cells, Cell stage to blastocyst formation, Implantation, gastrulation, properties and characterization of embryonic stem cells, Types of adult stem cells: Bone marrow, adipose tissue, cord blood and placenta.

UNIT- II

12 hours

Biology and varieties of stem cells: Concepts on stem cells and historical perspectives, Cellular and molecular features of stem cells, Regulation of stem cells; self-renewal & molecular markers, Derivation, differentiation and propagation of stem cells, Cellular and molecular basis of stem cell differentiation, Embryonic stem cells & germ stem cells, Fetal-adults stem cells & cancer stem cells, New generation stem cells, Induced pluripotent stem cells & patient-specific stem cells, Genetically engineered stem cells.

UNIT-III

12 hours

Lineage-specific differentiation of stem cells: Stem cells, progenitors and their differentiation, Trans-differentiation, Molecular net-works to induce stem cell differentiation, Stem cell differentiation-specific culture systems, Molecular phenotyping & cell propagation-enrichment strategies, Structural & functional integration of differentiated cell types *in vivo*, Differentiation and trans- differentiation of stem cells, regulation of stem cell niche in different adult tissues.

UNIT-IV

12 hours

Biotechnology of stem cells & applications: Academic research need for stem cells, Stem cells: model system for cell-developmental biology, Biopharmaceutical need for stem cells, Medical (therapeutic) need for stem cells, Stem cells and progenitors for drug testing, Genetically engineered stem cells for drug discovery & gene therapy, Disease and disorders requiring stem cells, Clinical trials, safety and therapeutic-grade stem cells, Stem cell therapy in neurodegenerative disorders, cardiovascular disorders, metabolic/diabetic/systemic disorders, hematopoietic & autoimmune

diseases, Stem cell therapy in organ disorders, reproductive failures, Stem cell preservation in cancer patients.

UNIT-V

12 hours

Opportunities and policy matters on stem cell research-therapy: Research scope and human resource development, National and global need for stem cell research-therapy& medical tourism, Institutions involved in stem cell research therapy, Guidelines & SOPs on stem cell research therapy, Informational resources on stem cells, Overview of research governance, Research ethics, Gaining ethical approval, Guidelines of India, Guidelines in other countries, Religious consideration, Regulatory consideration.

#.....# Self-study portion

Text Books:

1. "Biology of Human Reproduction" by Ramon Pinon Jr , University ScienceBooks, Sausalito, California, USA (2002).
2. "Essential Developmental Biology" by JMW Slack, Blackwell PublishingCompany, Carlton, Victoria, Australia (2006).

Unit I Chapter I - XII, T.B.1

Unit II Chapter III, T.B. 2

Unit III Chapter IV, T.B.1

Unit IV Chapter X, T.B.2

Unit V Chapter V, T.B.2

Books for References:

1. Manipulating the Mouse Embryo- A Laboratory Manual by Andras Nagy, Marina Gertsentein, Kristina Vintersten and Richard Behringer, ColdSpring Harbor Laboratory Press, New York, USA (2003)
2. "Handbook of Stem Cells" Volumes -I & -II by Robert Lanza, ElsevierAcademic Press, San Diego, California, USA (2004).

Relationship Matrix for Course Outcomes, Programme Outcomes and Programme Specific Outcomes:

Semester	Code					Title of the Paper					Hours	Credits
I	20MPBT1CC4					STEM CELL RESEARCH					4	4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2	✓	✓	✓	✓	✓		✓	✓	✓			
CO3			✓	✓	✓	✓	✓	✓	✓	✓		
CO4				✓	✓	✓	✓	✓	✓	✓		
CO5	✓	✓			✓	✓	✓	✓	✓	✓		

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