DEPARTMENT OF BIOTECHNOLOGY

COURSE STRUCTURE & SYLLABI
(For the students admitted from year 2023-2024 onwards)

Programme : M.Phil. Biotechnology

JAMAL MOHAMED COLLEGE (AUTONOMOUS)
Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University)
TIRUCHIRAPPALLI – 620 020

M.Phil. BIOTECHNOLOGY

Sem	Course Code	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
						CIA	ESE	
I	23MPBT1CC1	Core - I	Research Methodology	4*	4	25	75	100
	23MPBT1CC2	Core - II	Advancements in Biotechnology	4*	4	25	75	100
	23MPBT1CC3	Core - III	Teaching and Learning Skills (Common Paper)	4*	4	25	75	100
	23MPBT1CC4	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**			**400**
II	23MPBT2PD		Dissertation#	-	8	-	200	200
			Grand Total	**16**	**24**			**600**

 # Evaluation of the Dissertation Viva voce shall be made jointly by the Research Supervisor and the External Examiner.

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC1	Core – I	4	4	25	75	100

Course Title	Research Methodology

SYLLABUS		
Unit	Contents	Hours
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
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
III	Principles and applications of SDS- PAGE, 2D- gel electrophoresis, MALD1-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
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-patentable, 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
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.	12
VI	**Current Trends (For CIA only) –** Competing with a pandemic: Trends in research design in a time of Covid-19, Patenting Trends and Innovation in Industrial Biotechnology, Discovering trends and hotspots of biosafety and biosecurity research via machine learning.	

.... Self Study

Text Book(s):
1. J. Anderson, D.Durstonand M.Poole, Thesis and Assignment writing. New Age International Pvt. Ltd, New Delhi, 2010. 2. David Freifelder and W.H.Freeman. Physical Biochemistry: Applications to Biochemistry and Molecular Biology - 2nd Edition and Co Ltd, 2012. 3. Gurdeep R. Chatwal, Sham K. Anand, Instrumental methods of chemical analysis 2nd Edition; Himalaya Publishing House, 2007.

Reference Book(s):
1. Jerrold H. Zar, Biostatistical Analysis (7th edition), Prentice Hall publishers, 2014.
2. Veer Bala Rastogi, Fundamentals of Biostatistics, Ane Books India, New Delhi, 2006.
3. 3. L.Veera Kumar, Bioinstrumentation, MJP Publishers, Chennai, 2006.

Web Resource(s):

1. https://nptel.ac.in/courses/109105115/
2. https://www.elsevier.com/books/an-introduction-to-ethical-safety-and-intellectual property rights-issues-in-biotechnology/nambisan/978-0-12-809231-6
3. https://academic.oup.com/bib/article/23/5/bbac194/6590367

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Identify the various sources of information for literature review and data collection.	**K3**
CO2	Improve the principles of research instruments of biotechnology field.	**K6**
CO3	Elaborate biotechnological practical application of laboratory equipment critically and systematically.	**K6**
CO4	Appraise the components of scholarly writing and evaluate its quality.	**K5**
CO5	Formulate the statistical concepts and applying them in data collection, analysis and interpretation	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	2	2	3	3	2.8
CO2	3	2	2	2	3	2	3	2	2	2	2.3
CO3	3	2	2	2	3	3	1	1	2	2	2.0
CO4	3	3	2	2	3	2	3	1	2	2	2.3
CO5	3	3	2	2	3	2	2	2	2	2	1.9
										Mean Overall Score	**2.36**
										Correlation	**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. J. Sebastin Raj

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC2	Core – II	4	4	25	75	100

Course Title	Advancements in Biotechnology

SYLLABUS

Unit	Contents	Hours
I	**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 organism's*, Eukaryotic cells in culture.	12
II	**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.	12
III	**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, peroxidise*.	12
IV	**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.	12
V	**Stem cells and Nanobiotechnology:** Stem Cells – Types- Gene therapy. Cloning of animals. Stem cell therapy – Reproductive cloning. Nano biotechnology – Self-assembly, Molecular motors. Biologically inspired nanotechnology – Single molecule assays, Atomic force microscopy, Optical Tweezers, The good side of the viruses: Natures Nanotechnology. *design issues of nanobiological devises – imaging using nanotherapeutic contrast agent's*, Magnetic resonance imaging (MRI), Nanoparticle contrast agents, Nano biotechnological contrast agent design. Nanomedicine emerging area in nanobiotechnology.	12

.... Self Study

Text Book(s):
1. L.A. Allison, Fundamental Molecular Biology. John Wiley and Sons, 2007.
2. Bernard R.Glick, Jack, Pasternak, Molecular Biotechnology, ASM Press, 2010.
3. Ian Freshney, Culture of Animal cells, 3rdEd., John Wiley & Sons, Inc. publications, 2007.
4. James D.Watson, Michael Gilman, Jan A. Witrowski, Mark Zoller.An Overview of recombinant DNA technology, W.H. Freeman Publishers, 2012.
Book Reference:
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 Resource(s):
1. https://nptel.ac.in/courses/102103045/
2. https://nptel.ac.in/courses/102103041/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Analyze the education that leads to comprehensive understanding of the principles and practices of biotechnology.	K4
CO2	Support students with the ability to think and solve problems in the field of biotechnology.	K5
CO3	Motive students are able to effectively communicate with biotech and other interdisciplinary professionals.	K4
CO4	Build responsible biotechnologists that can work within the interdisciplinary framework of biotechnology and related fields.	K6
CO5	Propose students to gain an insight into the concepts and techniques of Plant, Animal and Microbial biotechnology and its wide industrial & medicinal applications.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	3	2	3	3	2.9
CO2	3	2	2	2	3	2	3	2	3	3	2.5
CO3	3	2	2	2	3	3	2	2	3	3	2.5
CO4	3	3	2	2	3	2	3	2	3	3	2.6
CO5	3	3	2	3	3	2	2	2	2	3	2.5
										Mean Overall Score	**2.58**
										Correlation	**High**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. T. Nargis Begum

Semester	Course Code	Course Category	Hours/Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	**23MPBT1CC3**	**Core – III**	**4**	**4**	**25**	**75**	**100**

Course Title	Teaching and Learning Skills

SYLLABUS

Unit	Contents	Hours
I	**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.	12
II	**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	12
III	**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 – Defence mechanism – Mental hygiene*.	12
IV	**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*.	12
V	**Educational Technology:** Educational technology – definition – objectives – teaching technology – characteristics of teaching technology – behavioural 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.	12

.... Self Study

Text Book(s):
1. S.K. Kochhar, Methods and Techniques of Teaching Sterling Publisher Pvt. Ltd, 2004.
2. S. Robinson, Fundamentals of Education Psychology 2nd ed., Ane Books Pvt. Ltd, 2008.
3. Sambav siva B Rao, D. Bhaskar B Rao,Techniques of Teaching Psychology, Sonali Publications New Delhi, 2006.

Book Reference:
1. T.M. Srinivasan, Use of Computers and Multimedia in Education Aavisakar Publication, Jaipur, 2002.
2. Zikr-ur Rahman, Modern teaching methods and techniques-Anmol Publication Pvt. Ltd. New Delhi, 2006.
3. K. Sampath, A. Panner selvam and S. Santhanam, Introduction to Educational Technology 4th revised ed., Sterling Publisher Pvt. Ltd, 2000.
Web Resource(s):
1. https://nptel.ac.in/content/storage2/courses/109103023/download/Lecture%207.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Elaborate the teaching and dynamics of teaching – learning.	K6
CO2	Evaluate e-learning and e-teaching with the ICT tools.	K5
CO3	Adapt practical skills (in subject) aiming at gaining confidence to handle practical classes.	K6
CO4	Develop teaching skills and gain confidence in teaching.	K6
CO5	Appraise knowledge on the preparation of teaching aids.	K5

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	2	3	3	3	2.9
CO2	3	2	2	2	3	2	3	3	2	3	2.5
CO3	3	2	2	2	3	3	2	3	2	2	2.4
CO4	3	3	2	2	3	2	3	1	2	2	2.1
CO5	3	3	2	2	3	2	2	2	2	3	2.4
										Mean Overall Score	**2.45**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. K. Gobalan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC4	Core – IV	4	4	25	75	100

Course Title	Plant Molecular Biotechnology

SYLLABUS

Unit	Contents	Hours
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
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
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
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, comparision, composition and properties, useful programs, ClustalW, BioEDIT, BLASTp, Phylogenetic analysis tools- Phylip, ClustalW. *Protein sequence analysis: ExPASy Proteomics tools*.	12
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 *.	12

.... Self Study

Text Book(s):
1. Kalyan kumar De. An Introduction to Plant Tissue Culture Techniques. New Central 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.
Book references:
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.
3. Donald Grierson and S.V. Convey., Plant Molecular Biology. Blackie and Son Limited, New 2010.
Web Resource(s):
1. https://nptel.ac.in/courses/102103016/

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply advance level of plant tissue culture techniques in the field of plant biotechnology.	K3
CO2	Discuss the novel ideas to the real problems in molecular biology of plant microbial interactions.	K6
CO3	Demonstrate the social value of transgenic plants with ethical consumption.	K2
CO4	Appraise plant biotechnological research using bioinformatics tools.	K5
CO5	Solve research enhancement in the field of plant molecular research.	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	3	3	1	1	3	2	2.5
CO2	3	2	2	2	3	2	2	2	2	2	2.2
CO3	3	2	2	2	3	3	1	1	1	1	1.9
CO4	3	3	2	2	3	2	3	1	2	1	2.2
CO5	3	3	2	1	3	2	1	2	2	3	2.2
										Mean Overall Score	**2.2**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. S. Deborah

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC4	Core– IV	4	4	25	75	100

Course Title	Nanoparticle and Nanomedicine

SYLLABUS		

Unit	Contents	Hours
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
II	**Nanomolecular diagnostics - array and chips:** Introduction -Nano diagnostics - Rationale of Nanotechnology for Molecular Diagnostics - Nanoarrays for Molecular Diagnostics. NanoProTM System -Nano fluidic/Nano array 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 Nano biochip Nanoparticles for Molecular Diagnostics -Gold Nanoparticles -Quantum Dots for Molecular Diagnostics Magnetic Nanoparticles -*Use of Nanocrystals in Immuno-histochemistry*	12
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
IV	**Role of nanotechnology in biological therapies**: Biomedical nanoparticles – Liposome's – Dentrimers – 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 -Nano diagnostics for the Battle Field - *Nano diagnostics for Integrating Diagnostics with Therapeutics*.	12
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*.	12

.... Self Study

Text Book(s):	

Text Book(s):

1. Kewal K. Jain,The Handbook of Nanomedicine, Humana Press, 2008.
2. Zhang, Nanomedicine: A Systems Engineering Approach" 1st Ed., Pan Stanford Publishing, 2015.
3. Robert A. Freitas Jr., ―Nanomedicine Volume IIA: BiocompatibilityLandes Bioscience Publishers, 2013.

Books 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,2015.
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, 2014.

Web Resource(s):

1. https://nptel.ac.in/courses/9658475321/
2. https://onlinelearning.hms.harvard.edu/hmx/courses/hmx-pharmacology/
3. https://elearninguoa.org/course/health-nanotechnology-nanomedicine/nanotechnology-and-nanomedicine

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Elaborate the intensive and in-depth learning of Nanotechnology.	**K6**
CO2	Explain the nanomolecular diagnostics for providing new solution into the medical field.	**K5**
CO3	Designate nanomedicine for cancer treatment and new social problems.	**K6**
CO4	Compare the role of nanotechnology in biological therapies.	**K5**
CO5	Appraise the application of nanotechnology in cancer therapy and nanomedicine	**K5**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	2	2	3	3	2.8
CO2	3	2	3	2	3	2	3	2	2	2	2.4
CO3	3	2	3	2	3	3	2	2	2	2	2.4
CO4	3	3	2	2	3	2	3	2	2	2	2.4
CO5	3	3	2	3	3	2	1	2	2	3	2.4
										Mean Overall Score	**2.48**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. M. Habibunisha

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC4	Core – IV	4	4	25	75	100

Course Title	Cancer Biology

SYLLABUS

Unit	Contents	Hours
I	**Origins and Overview**: History of Cancer, Introduction: What is Cancer? The Six Hallmarks of Cancer, Causes, *Initiation and Progression*.	12
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
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
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
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*.	12

.... Self Study

Text Book(s):
1. Robert A. Weinberg, Required Textbook: The Biology of Cancer – Garland Sciencem, 2010.
2. William S.Klug, Michael R.Cummings, Concepts of Genetics, Pearson Education India, 2007.
Books Reference:
1. Bernard R.Glick, Jack, Pasternak, Molecular Biotechnology, ASM Press, 2010.
2. Ian Freshney, Culture of Animal cells, 3rdEd., John Wiley & Sons, Inc. publications, 2007.
3. James D.Watson, Michael Gilman, Jan A. Witrowski, Mark Zoller.An Overview of recombinant DNA technology, W.H. Freeman Publishers, 2012.
Web Resource(s):
1. https://nptel.ac.in/courses/45689752322332/cancer

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Elaborate the research in the field of cancer biology.	**K6**
CO2	Discuss the Death and Life Apoptosis and Immortality.	**K6**
CO3	Designate Carcinogens and cancer relevant social problems.	**K6**
CO4	Compare the role of cancer science in biological therapies.	**K5**
CO5	Appraise the application of cancer therapy in modern medicine for human welfare.	**K5**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	3	3	3	2	2.8
CO2	3	2	2	2	3	2	3	2	2	2	2.3
CO3	3	2	2	2	3	3	1	2	2	3	2.3
CO4	3	3	2	2	3	2	3	2	2	2	2.4
CO5	3	3	2	3	3	2	1	2	2	3	2.4
										Mean Overall Score	**2.46**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. Geet Andrea

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23MPBT1CC4	Core – IV	4	4	25	75	100

Course Title	STEM CELL RESEARCH

SYLLABUS		
Unit	**Contents**	**Hours**
I	**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*.	12
II	**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*.	12
III	**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*.	12
IV	**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*.	12
V	**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*.	12

……… Self Study

Text Book(s):
1. Ramon Pinon Jr., Biology of Human Reproduction, University Science Books, Sausalito, California, USA, 2002.
2. JMW Slack., "Essential Developmental Biology", Blackwell Publishing Company, Carlton, Victoria, Australia 2016.

Reference Books:

1. Andras Nagy, Marina Gertsentein, Kristina Vintersten and Richard Behringer, Manipulating the Mouse Embryo- A Laboratory Manual, ColdSpring Harbor Laboratory Press, NewYork, USA, 2013.
2. Robert Lanza., Handbook of Stem Cells, Volumes -I & -II, Elsevier Academic Press, San Diego, California, USA, 2014.

Web Resource(s):

1. https://nptel.ac.in/courses/1114478956622/stem cell biology

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Discuss the Introduction and basic biology of stem cells.	**K6**
CO2	Determine the Biology and varieties of stem cells.	**K5**
CO3	Designate the cancer treatment and new social problems	**K6**
CO4	Compare the Biotechnology of stem cells and applications.	**K5**
CO5	Appraise the Opportunities and policy matters on stem cell research-therapy.	**K5**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	2	2	3	3	2.8
CO2	3	2	2	2	3	2	3	2	2	2	2.3
CO3	3	2	2	2	3	3	1	1	2	1	2.0
CO4	3	3	2	2	3	2	3	1	2	2	2.3
CO5	3	3	2	1	3	2	1	2	2	3	2.2
										Mean Overall Score	**2.3**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Ms. M.S. Shabeena Banu