Bhavan's Vivekananda College of Science, Humanities and Commerce, Sainikpuri Autonomous College (Affiliated to Osmania University)
Re Accredited with "A" Grade by NAAC
Template for B Sc Programme under CBCS
Prescribed by TSCHE for implementation from 2023-24 onwards

BSc BIOTECHNOLOGY

FIRST YEAR- SEMESTER I								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Science	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second language	CC-2A	4		4	4		4
BT133/BT133P	**Optional I- Cell biology and Genetics**	DSC-1A	4	3	7	4	1	5
	Optional II	DSC-2A	4	3	7	4	1	5
	Optional III	DSC-3A	4	3	7	4	1	5
	TOTAL				**31**			**25**

B. Kalpana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

FIRST YEAR- SEMESTER II								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	Computer Skills	AECC-2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second language	CC-2B	4		4	4		4
BT 233/BT233P	Optional I- **Biological Chemistry and Microbiology**	DSC-1B	4	3	7	4	1	5
	Optional II	DSC-2B	4	3	7	4	1	5
	Optional III	DSC-3B	4	3	7	4	1	5
	TOTAL				**31**			**25**
SECOND YEAR- SEMESTER III								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
SE333	**Integrative Pest management**	SEC-I	2		2	2		2
	Communication Skills	AEC C-3	2		2	2		2
	English	CC-1C	3		3	3		3
	Second language	CC-2C	3		3	3		3

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Science College (OU-UGC)
Genetics
Hyderabad-500 007. Telangana

BT 333 / BT333P	Optional I- **Molecular Biology and recombinant DNA Technology**	DSC-1C	4	3	7	4	1	5
	Optional II	DSC-2C	4	3	7	4	1	5
	Optional III	DSC-3C	4	3	7	4	1	5
	TOTAL				**31**			**25**

SECOND YEAR- SEMESTER IV

Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
SE433	**Food preservation and adulteration**	SEC-2	2		2	2		2
	Universal Human values	AEC C-4	2		2	2		2
	English	CC-1D	3		3	3		3
	Second language	CC-2D	3		3	3		3
BT 433/ BT433P	Optional I- **Bioinformatics & Biostatistics**	DSC-1D	4	3	7	4	1	5
	Optional II	DSC-2D	4	3	7	4	1	5
	Optional III	DSC-3D	4	3	7	4	1	5
	TOTAL				**31**			**25**

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMT. [illegible] PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

THIRD YEAR- SEMESTER V								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1E	3		3	3		3
	Second language	CC-2E	3		3	3		3
GE533	**Basics in Biotechnology**	GE	4		4	4		4
BT533A/ BT533AP BT533B/ BT533BP	**Optional I- A/B** **A. Plant Biotechnology** **(OR)** **B. Medical Biotechnology**	DSE - 1E	4	3	7	4	1	5
	Optional- II **A/B**	DSE - 2E	4	3	7	4	1	5
	Optional- III **A/B**	DSE - 3E	4	3	7	4	1	5
	TOTAL				**31**			**25**

THIRD YEAR- SEMESTER VI								
Code	**Course Title**	**Course Type**	**Hours per week**			**Credits**		
			Theory	Practical	Total	Theory	Practical	Total

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
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BT633_PW / BT633_O	**Project in Biotechnology/ IPR, Biosafety & Entrepreneurship (Optional)**		4		4	4		4
	Value Added Course- Plant Tissue culture		2	-	2	0		0
	English	CC-1F	3		3	3		3
	Second language	CC-2F	3		3	3		3
BT 633A/ BT633AP BT633B/ GT633BP	**Optional I- A/B** **A. Animal Biotechnology** **(or)** **B. Environmental Biotechnology**	DSE-1F	4	3	7	4	1	5
	Optional- II **A/B**	DSE -2F	4	3	7	4	1	5
	Optional- III **A/B**	DSE -3F	4	3	7	4	1	5
	TOTAL				**33**			**25**

Total credits= 150

AECC: Ability Enhancement Compulsory Course
SEC: Skill Enhancement Course
DSC: Discipline Specific Course
DSE: Discipline Specific Elective
GE: Generic Elective

B. Archana

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Smita

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

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Autonomous College
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(Accredited with 'A' grade by NAAC)
Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology Paper VA Theory

Course Name: Plant Biotechnology

Paper Code: BT533A **No of Classes: 60**
Year/Semester: III/V **No of Credits: 4**

Employability: In-depth knowledge and understanding in Principles of plant tissue culture helps students procure jobs in various labs involved in plant tissue culture or even start their own startup.

Course objective: To analyze the basic concepts of Plant tissue culture and transgenic plants along with its applications.

Unit wise Course Objective:

Cob1: To discuss the basics of plant tissue culture, media preparation and techniques involved in callus cultures, suspension cultures, organogenesis and somatic embryogenesis.

Cob2: To identify the different techniques involved in plant tissue culture and interpret its applications.

Cob3: To differentiate the methods involved in production of transgenic plants.

Cob4: To appraise the achievements of transgenic plants and its emergence as bioreactors for edible vaccines, antibody production.

Unit 1: Fundamentals of Plant Tissue Culture **15 Hours**

1.1: Introduction to Plant tissue culture, totipotency of plant cells (dedifferentiation, redifferentiation and regeneration). (3)

1.2: Nutritional requirements for plant tissue culture, nutrient media-macronutrients and micronutrients, media additives (carbon source,vitamins, amino acids); types of media. (2)

1.3: Plant growth regulators-auxins, cytokinins and gibberellins. (2)

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1.4: Preparation of media, sterilization, selection & surface sterilization of explant, inoculation of callus cultures and cell suspension cultures. (3)

1.5: Induction of callus cultures and cell suspension cultures. (3)

1.6: Organogenesis and somatic embryogenesis. (2)

Unit 2: Application of plant Tissue culture **15 Hours**

2.1: Meristem culture, micropropagation and their applications . (2)

2.2: Encapsulation and production of synthetics seeds and their applications. (2)

2.3: Cell suspension cultures (batch and continuous cultures) and application. (2)

2.4: Protoplast isolation, culture and fusion- development of somatic hybrids & cybrids and their applications. (3)

2.5: Somaclonal variation and its applications. (2)

2.6: Anther and pollen culture for production of haploids & their applications. (2)

2.7: Cryopreservation - conservation of plant germplasm. (2)

Unit 3: Production of Transgenic Plants **15 Hours**

3.1: Direct gene transfer techniques - physical methods: microinjection, particle bombardment gene gun) and electroporation & Chemical methods. (3)

3.2: Molecular mechanism of Agrobacterium infection and features of Ti plasmid. (2)

3.3: Agrobacterium mediated gene transfer using binary and co - integrate vectors. (3)

3.4: Viral vectors for gene transfer into plants. (2)

3.5: Selection of transgenic plants using reporter and selection marker genes. (3)

3.6: Genome editing - CRISPR CAS 9 Technology. (2)

Unit 4: Applications of Transgenic Plants **15 hours**

4.1: Herbicide resistance in transgenic plants- glyphosate tolerance. (2)

4.2: Insect resistance transgenic plants: Bt cotton, proteinase inhibitors, lectins. (3)

4.3: Virus , bacterial and fungal resistant transgenic plants. (3)

4.4: Abiotic stress tolerance : drought , heat and salinity stress tolerant plants. (2)

4.5: Transgenic plants with enhanced nutritional value vitamin A, oil, amino acids. (2)

B. Vaalpana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
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4.6: Transgenic plants as bioreactors:edible vaccines,antibody production, biodegradable plastics. (3)

Course outcomes:

By the end of this course, students will be able

BT533A CO1: To understand the principles and techniques of plant tissue culture.

BT533A CO2: To appraise the achievements of plant tissue culture techniques and their benefit to society .

BT533A CO3: To determine the different methods involved in gene transfer techniques and CRISPR CAS 9 Technology.

BT533A CO4: To describe the uses of evolving transgenic plants for the resistance to herbicides, insects, virus, bacteria fungi and abiotic stress. They will also be able to determine its role in enhanced nutritional value and as bioreactors.

B. Kalpana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

Paper VA- Practicals

Paper Code: BT533A P **30 hrs(2 hrs/ week)**
Credits: 1

Skill Development: Students learn media preparation, callus induction, micropropagation , transformation and encapsulation techniques.

Objective: To demonstrate the basic procedures used in plant tissue cultures.

1. Preparation of media for plant tissue culture.
2. Sterilization methods of explants (seed, leaf, internode & root) and inoculation.
3. Establishment of callus culture - from carrot/rice.
4. Preparation of synthetic seeds.
5. Meristem culture.
6. Cell suspension cultures.
7. Protoplast isolation and culture.
8. Agrobacterium mediated transformation.
9. Field visit

Outcomes: Students expertise in media preparation, sterilization methods, different culture techniques, synthetic seeds preparation.

Spotters:

1. Callus cultures
2. Sterilization techniques autoclave and hot air oven
3. Somatic embryo
4. Synthetic seeds
5. Meristem culture
6. Plant regeneration
7. Cell suspension cultures
8. Isolation of Protoplast
9. Particle bombardment (gene gun)
10. Binary or co-integrate vectors

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Chairperson
Scientist In Charge (OU-IAEC)
Department of Genetics
Osmania University
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12. Golden Rice

Recommended books:

1. Plant Tissue culture and its Biotechnological Application by W.Barz, E. Reinhard, M.H.Zenk.

2. Plant Tissue Culture by Akio Fujiwara

3. Frontiers of Plant Tissue Culture by Trevor A. Thorpe

4. In vitro Haploid Production in Higher Plants by S.Mohan Jain, S.K Sopory, R.E. Veilleux

5. Plant Tissue Culture Theory and Practice by S.S Bhojwan and Razdan

6. Plant Cell, Tissue and Organ culture , Applied and Fundamental Aspects by Y.P.S Bajajand A.Reinhard

B. Archana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

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Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology (General Elective)

Course Name: Basics in Biotechnology

Paper Code: GE 533 **No of Classes: 60**
Year/Semester: III/V **No of Credits: 4**

Employability: Acquiring knowledge on the concepts of Basic biotechnology will procure jobs in agricultural, microbial and industrial, animal and medical and bioinformatics sectors.

Course objectives:

To analyze the concepts of Basic biotechnology with reference to Agricultural, Microbial and Industrial, animal and medical sectors including computer applications .

Unit Wise Course objectives:

Cob1: To distinguish the different techniques involved in agricultural biotechnology along with its applications .

Cob2: To interpret the methods involved to characterize and preserve microorganisms, its strain improvement and development along with its application.

Cob3: To discuss the concepts involved in Animal and Medical Biotechnology.

Cob4: To evaluate computer applications in Biotechnology.

Unit 1: Agricultural Biotechnology **15 Hours**

1.1: Plant tissue culture- media, sterilization, culture types. (3)

1.2: Micro-propagation, Synthetic seeds, Somatic hybrids and haploid plants. (3)

1.3: Transgenic plants- direct & indirect methods of gene transfer. (3)

1.4: Applications of transgenic plants- improving productivity & Nutritional quality. (2)

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

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Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
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1.5: Applications of transgenic plants-stress tolerant plants & molecular farming. (2)

1.6: Biofertilizers and biopesticides . (2)

Unit 2: Microbial and Industrial Biotechnology **15 Hours**

2.1: Exploitation of micro-organism and their products. (2)

2.2: Isolation, screening and selection of microorganisms for industrial products. (3)

2.3: Preservation of microorganisms. (2)

2.4: Strain development and improvement, strategies of strain improvement selection and recombination. (2)

2.5: Production of recombinant DNA vaccine, amino acids, vitamins. (3)

2.6: Single cell protein, dairy products, penicillin and streptomycin production. (3)

Unit 3: Animal and Medical Biotechnology **15 Hours**

3.1: Cell culture technique and its applications. (3)

3.2: Animal breeding (Selective breeding and cross breeding) and its limitations. (3)

3.3: In vitro techniques in animal improvement: in vitro fertilization & microinjection. (2)

3.4: Genetically modified animals: transgenic & knock – outs. (3)

3.5: Mouse models of disease: cancer and diabetes. (2)

3.6: Biotechniques: gel electrophoresis and PCR. (2)

Unit 4: Computer applications in Biotechnology **15 Hours**

4.1: Scope of computer applications in Biotechnology. (2)

4.2: Biotechnology tools and resources -role of the internet, free online tools, downloadable free software. (3)

4.3: Biotechnology web portals- NCBI, EBI, ExPASY. (3)

4.4: Biological databases: Classification of databases – the primary (GenBank), secondary (PIR) databases. (3)

4.5: Sequence databases – DNA sequence databases (ENA & DDBJ). (2)

4.6: Protein sequence databases (Swissprot & PROSITE). (2)

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

Course Outcomes:

At the end of this course, students will be able

CO1: To interpret the different techniques involved in Plant tissue culture, Micropropagation , Gene transfer and the production of biofertilizers and biopesticides.

CO2: To evaluate the concepts and applications of Microbial and Industrial Biotechnology

CO3: To differentiate cell culture and animal breeding techniques,and also to value the role of mouse models of diseases and transgenic animals.

CO4: To identify the tools and resources of computer applications in Biotechnology which will pave a way to acquire a comprehensive knowledge on different kinds of Web portals and databases.

Recommended books:

1. Plant Tissue culture and its Biotechnological Application by W.Barz, E. Reinhard, M.H.Zenk.

2. Plant Cell, Tissue and Organ culture , Applied and Fundamental Aspects by Y.P.S Bajajand A.Reinhard

3. Essentials of Biotechnology for Students by Satya N.Das

4. TextBook of Biotechnology by H.K Das (Wiley publication)

5. Biotechnology by H. J. Rehm and G. Reed VIH Publications, Germany

6. Biogas Technology by T. Nijaguna

7. Biotechnology by K.Trehan

8. Industrial Microbiology by L.E. Casida

9. Essentials of Biotechnology for Students by Satya N.Das

B. Archana

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

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Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology paper VB Theory

Course Name: Medical Biotechnology

Paper Code: BT533B **No of Classes: 60**
Year/Semester: III/V **No of**
Credits: 4

Employability: Theoretical knowledge and practical skills gained on karyotyping helps students to procure jobs in hospitals and institutes as genetic counselors.

Course Objective: To analyze the concepts of Inheritance of Human diseases, its genetic basis and to interpret the techniques for its diagnosis and therapeutic approaches.

Unit wise course objective:

Cob1: To understand the inheritance of human diseases and karyotyping including chromosomal staining.

Cob2: To analyze the genetic basis of Human disorders.

Cob3: To examine the techniques for diagnosis of human diseases.

Cob4: To interpret the Therapeutic approaches for human diseases.

Unit 1: Inheritance of human diseases and karyotyping	**15 Hours**
1.1: Inheritance patterns- pedigree analysis of autosomal traits	(3)
1.2: Inheritance patterns – pedigree analysis of allosomal traits	(3)
1.3: Factors affecting pedigree pattern – penetrance, expressivity	(2)
1.4: Genetic heterogeneity-allele and locus heterogeneity	(2)
1.5: karyotyping of Human chromosomes	(2)
1.6: Chromosomal staining – G.Q, R and C banding techniques.	(3)

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Sainikpuri

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Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
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Unit 2: Genetic basis of Human disorders **15 Hours**

2.1: Chromosomal disorders caused due to structural chromosomal abnormalities (deletions, duplications, translocations and inversions) (3)

2.2: Chromosomal disorders caused due to numerical chromosomal abnormalities (euploidy, aneuploidy, autosomal and allosomal) (3)

2.3: Monogenic disorders (autosomal and X- linked diseases) (2)

2.4: Mitochondrial diseases-LHON, MERRF (2)

2.5: Multifactorial disorders – diabetes and hypertension (2)

2.6: Cancer – types of cancer, genetic basis of cancer (Oncogenes, tumor suppressor genes) (2)

2.7: Introduction to communicable and non- communicable diseases (1)

Unit 3: Techniques for diagnosis of human diseases. **15 Hours**

3.1: Prenatal; diagnosis -invasive techniques -amniocentesis, chorionic villi sampling (3)

3.2: Diagnosis using enzyme markers -Guthrie test (phenylketonuria) (2)

3.3: Diagnosis using monoclonal antibodies-ELISA (HIV) (2)

3.4: DNA /RNA based diagnosis-HBV (3)

3.5: PCR based genotyping techniques for diagnosis-RFLP (MTHFR C677T mutation) (3)

3.6: Chip bases diagnosis and applications- colon cancer (2)

Unit 4: Therapeutic approaches for human diseases **15 Hours**

4.1: Recombinant proteins-human growth hormone, insulin (2)

4.2: Gene therapy -ex vivo and in vivo gene therapy (2)

4.3: Stem cells -potency definitions; embryonic and adult stem cells (2)

4.4: Applications of stem cell-based therapies and regenerative medicine (3)

4.5: Vaccines, different Types and their Applications -(herpes simplex virus, Cholera, Covid) (3)

4.6: Industrial production and Applications of monoclonal antibodies (3)

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. RAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

Paper VB- Practicals

Paper Code: BT533B P **30 hrs(2 hrs/ week)**
Credits: 1

Skill Development: Students learn the method of karyotyping, identification of the mode of inheritance from pedigrees and DOT ELISA.

Objective: To demonstrate the role of karyotyping in identification of chromosomal disorders, to help students to identify the mode of inheritance by pedigree analysis, DOT ELIZA and Chromosome banding.

1. Karyotyping of normal human chromosome set
2. Karyotyping of autosomal abnormality (Down's syndrome)
3. Karyotyping of allosomal abnormality (Klinefelter syndrome)
4. Chromosome banding -G Banding
5. Human pedigree analysis of autosomal disorder
6. Human pedigree analysis of allosomal disorder
7. Estimation of C-reactive protein
8. DOT ELISA
9. Field visit

Outcome: Students evaluate karyotyping procedures, Chromosome banding, different modes of inheritance of traits, and expertise in DOT ELISA

Spotters:

1. Identify the karyotype (Down's syndrome)
2. Identify the karyotype (Klinefelter syndrome)
3. Chromosomal banding techniques)
4. Identify the inheritance pattern of pedigree (autosomal disorder)

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

Course outcomes:

By the end of this course, students will be able

BT533B CO1: To compare the pedigree analysis of autosomal and allosomal traits and the theory behind karyotyping and chromosomal staining of human chromosomes.

BT533B CO2: To distinguish chromosomal disorders, monogenic disorders, multi-functional disorders, mitochondrial disease and cancer.

BT533B CO3: To recognize the principles and applications involved in the techniques involved in the diagnosis of human diseases like Phenylketonuria, HIV, colon cancer.

BT533B CO4: To formulate therapeutic approaches for human diseases which involves recombinant proteins, gene therapy, stem cells, DNA based vaccines, monoclonal antibodies.

CHAIRPERSON
BOS In Genetics/Biotechnology
Bhavan's Vivekanandha College

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (AEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

6. Prenatal diagnosis – invasive technique
7. Prenatal diagnosis- noninvasive techniques
8. Identify the type of gene therapy -ex vivo in vivo
9. Recombinant vaccine
10. ELISA technique
11. Identify the SNP genotype of different samples after performing PCR-RFLP
12. Count the viable cells on Neubauer chamber (hemocytometer)

Recommended Books:

1. Medical Biotechnology by Pratibha Nallari. V Venugopal Rao- Oxford Press
2. Introduction to Human Molecular Genetics by JJ Pasternak- John Wiley Publishers.
3. Human Molecular Genetics by Tom Strachen and AP Read Bios Scientific Publishers
4. Human Genetics Molecular Evolution by McConkey
5. Recombinant DNA Technology by AEH Emery
6. Principles and Practice of Medical Genetics - 1 II III Volumes by AEH Emery
7. Molecular Biotechnology by Glick and Pasternak

B. Kalpana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

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Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology Paper VIA Theory

Course Name: Animal Biotechnology

Paper Code: BT633A **No of Classes: 60**
Year/Semester: III/VI **No of Credits: 4**

Employability: In-depth Knowledge and understanding of applications of biotechnological tools and principles helps students to develop skills in cell and tissue culture helping them to procure jobs in various institutions and companies carrying out production of animal cell cultures.

Course objectives: To analyze the principles and applications of animal cell culture and to examine the techniques involved in the in vitro animal improvement ,animal genetics and genetically modified organisms.

Unit Wise Course objectives:

Cob1: To describe the principles and applications of animal cell culture techniques.

Cob2: To distinguish the methods pertaining to animal breeding, superovulation, in vitro fertilization, somatic cell nuclear transfer and their applications.

Cob3: To interpret molecular markers in animal genetics.

Cob4: To appraise the significance of genetically modified organisms and their applications in the field of disease biology and drug development.

Unit 1: Animal cell culture: principles and applications **15 hours**

1.1: Cell culture technique: cell culture media, sterilization techniques. **(2)**

1.2: Characteristic features of cell lines and cell line maintenance. **(2)**

1.3: Methods of isolation and separation of various cell types and establishment of cell lines. **(3)**

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

1.4: Properties and types of stem cells, culturing of embryonic stem cells and adult stem cells and adult stem cells. (3)

1.5: Manipulation of cells: electroporation, transfection, transduction and microinjection. (3)

1.6: Application of cell culture : manufacturing , toxicity testing and tissue engineering. (2)

Unit 2: In vitro techniques in animal improvement **15 hours**

2.1: Principles of animal breeding , selective breeding, cross breeding and their limitations. (3)

2.2: Superovulation , collection of semen and ova. (2)

2.3: In vitro maturation of oocytes, artificial insemination. (2)

2.4: In vitro fertilization, embryo collection and embryo sexing. (3)

2.5: Somatic cell nuclear transfer, cloning of animals (example: Dolly). (3)

2.6: Applications of in vitro techniques in animal improvement. (2)

Unit 3: Molecular markers in animal genetics **15 hours**

3.1 Development in livestock genomes (Estimated Breeding Value-EBV). (3)

3.2: Molecular markers: types and characteristics. (3)

3.3: RFLP and RAPD. (3)

3.4: SNPs and their application in genotyping. (2)

3.5: Identification and isolation of desired genes of interest. (2)

3.6: Marker- assisted selection. (2)

Unit 4: Genetically modified organisms **15 hours**

4.1: Animal models and their significance in scientific research. (3)

4.2: Mouse models for cancer. (2)

4.3: Generation of transgenic mouse. (2)

4.4: Generation of Gene knock-out mouse. (2)

4.5: Genetically modified mice as disease models. (3)

4.6: Applications of genetically modified animals in understanding disease biology

B. Kalpana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

and drug development. (3)

Course outcomes:

By the end of this course students will be able to

BT633A CO1: To interpret the cell culture techniques, cell lines characteristics, stem cell properties and methods of cell manipulation.

BT633A CO2: To evaluate the methods of invitro techniques involved in animal improvement.

BT633A CO3: To identify the significance of molecular markers and their role in RAPD, RFLP and in animal genetics.

BT633A CO3: To value the role of genetically modified animals in scientific research.

B. Archana
CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

Paper VIA- Practicals

Paper Code: BT633A P **30 hrs(2 hrs/ week)**
Credits: 1

Skill development: Students will get hands-on experience to prepare and sterilize animal culture media, establish primary cell culture, suspension cells, adherent cells and to prepare metaphase chromosomes.

Objectives: To demonstrate preparation and sterilization of animal culture media, cell counting, Culturing of suspension and adherent cells and preparation of metaphase chromosomes.

1. Preparation of animal cell culture media
2. Sterilization of cell culture media
3. Cell counting by microscopy
4. Isolation of cells from chicken liver
5. Establishment of primary cell culture: Liver/Spleen
6. Preparation of metaphase chromosomes
7. Culturing suspension cells
8. Culturing adherent cells
9. Field visit.

Outcomes: To expertise in preparing animal culture media,metaphase chromosomes,establishing the primary cell culture procedure which will pave a way for students to seek employability in research laboratories .

Spotters:

1. Microscope
2. CO2 incubator
3. Biosafety cabinet/Laminar air flow
4. Trypan blue stained cells
5. Cell culture flasks and dishes
6. Metaphase slide

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Department of Genetics
Osmania University
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8. Centrifuge
9. Example of an RFLP
10. Microinjection into egg cells

Recommended Books:

1. Text book of Animal Biotechnology by B Singh. The Energy and Resources Institute (teri)
2. Genetics for Animal Sciences by WH Freeman Van Vleck LD, Pollak EJ & Bltenacu EAB.1987
3. Cancer Cell Culture Methods and Protocols 731 (Methods in Molecular Biology) Human; 2nd 2011 edition (28 April 2011).
4. Genetic Engineering by VK Agarwal and P.S. Varma. S. Chand & Company Ltd, 2009

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BOS in Genetics/Biotechnology
Bhavan's Vivekananda College

Prof. SMITA C. PAWAR
Chairperson
Scientist In-Charge (OU-IAEC)
Department of Genetics
Osmania University
Hyderabad-500 007. Telangana

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Autonomous College
Affiliated to Osmania University, Hyderabad.
(Accredited with 'A' grade by NAAC)
Department of Genetics and Biotechnology
Program name: B.Sc BtGC & BtMbC (w.e.f. 2023- '24)
Biotechnology Paper VIB Theory

Course Name: Environmental Biotechnology

Paper Code: BT633B
Year/Semester: III/VI

No of Classes: 60
No of Credits: 4

Employability: A profound knowledge gained from bioremediation helps students procure jobs in organizations dealing with bioremediation like sewage treatment.

Course objectives: To acquire knowledge on pollution and sources and understand the importance of Biomass, Biofuels, Biofertilizers, Biopesticides and Bioremediation.

Unit Wise course objectives:

Cob1: To discuss the different types of pollution and its sources.

Cob2: To appraise the different sources of Biomass and Biofuels.

Cob3: To distinguish the different concepts and types of Biofertilizers and biopesticides.

Cob4: To analyze the different methods of bioremediation of environmental pollution.

Unit 1: Environmental pollution **15 Hours**

1.1: Introduction to environment and pollution. (2)

1.2: Types of pollution -air, water and soil pollution. (3)

1.3: Types of pollution-inorganic, organic and biotic. (3)

1.4: Sources of pollution -domestic waste, agricultural waste, industrial effluents and municipal waste. (3)

1.5 Greenhouse gases, global warming and climate change. (2)

1.6: Measurement methods of environmental pollution -BOD & COD. (2)

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Unit 2: Biomass and Biofuels **15 Hours**

2.1: Renewable and non- renewable energy resources. (2)

2.2: Fossil fuels energy source and their impact on the environment. (3)

2.3: Biomass as source of energy (Bioenergy). (3)

2.4: Types of biomass -plant, animal and microbial biomass. (3)

2.5: Production of biofuels: bioethanol and biodiesel. (2)

2.6: Production of biohydrogen and biomethane. (2)

Unit 3: Biofertilizers and Biopesticides **15 hours**

3.1: Chemical fertilizers and their impact on the environment (eutrophication). (3)

3.2: Concepts of biofertilizers. (2)

3.3: Types of biofertilizers – bacterial, fungal and algal fertilizers. (3)

3.4: Pesticides and their impact on the environment. (2)

3.5: Concepts of biopesticides, types of biopesticides. (3)

3.6: Uses of biofertilizers and biopesticides. (2)

Unit 4: Bioremediation of Environmental Pollutants **15 hours**

4.1: Waste water treatment – sewage and industrial effluents (aerobic and anaerobic methods). (3)

4.2: Bioremediation -concepts and types (in-situ and ex-situ bioremediation). (3)

4.3: Bioremediation of toxic metal ions-biosorption and bioaccumulation. (3)

4.4: Composting of organic wastes. (2)

4.5: Microbial remediation of pesticides and xenobiotic compounds. (2)

4.6: Phytoremediation- concepts and applications. (2)

Course outcomes:

By the end of this course students will be able to

BT633B CO1: To interpret the different types of Pollution and its sources ,its effect on the globe along with the measurement methods.

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BOS in Genetics/Biotechnology
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BT633B CO2: To evaluate the different types of biomass and biofuels used and its importance to the maintenance of the environment.

BT633B CO3: To explore the sources of energy that are eco-friendly like bio-fuels and biofertilizers and to motivate the students to pursue research in the same field for the betterment of the society.

BT633B CO4: To analyze the importance of bioremediation to the environment and to identify its methods.

B. Archana

CHAIRPERSON
BOS in Genetics/Biotechnology
Bhavan's Vivekananda College
Sainikpuri

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Chairperson
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Paper VI B- Practicals

Paper Code: BT633B P **30 hrs(2 hrs/ week)**
Credits: 1

Skill development: Students will obtain skills to analyze polluted samples, produce biogas and biofertilizers.

Objective: To demonstrate the techniques involved to evaluate polluted water samples and to help students understand the microbial flora present in it.

1. Estimation of BOD in polluted water samples.
2. Estimation of COD in polluted water samples.
3. Estimation of total dissolved solid in wastewater samples.
4. Determination of quality of water sample (Coliform test).
5. Isolation of microorganisms from polluted soil/ industrial effluents.
6. Production of hydrogen or biogas.
7. Identification and characterization of bioremediation microorganisms.
8. Production of microbial biofertilizers.
9. Field Visit

Outcome: The students estimate BOD, COD of polluted water samples, isolate and characterize the microorganisms from different sources and analyze the techniques in the production of biofertilizers and biogas.

Spotters:

1. Air/water /soil pollution
2. Municipal waste
3. Industrial effluents
4. Algal blooms
5. Greenhouse effect
6. Plant biomass
7. Waste water treatment plant

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CHAIRPERSON
BOS in Genetics/Biotechnology
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Chairperson
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9. Biogas plant

10.Xenobiotic degrading bacteria

11. Phytoremediation

12. Microbial biofertilizers.

Recommended books:

1. TextBook of Biotechnology by H.K Das (Wiley publication)
2. Biotechnology by H. J. Rehm and G. Reed VIH Publications, Germany
3. Biogas Technology by T. Nijaguna
4. Biotechnology by K.Trehan
5. Industrial Microbiology by L.E. Casida
6. Food Microbiology by P.K.Gupta
7. Essentials of Biotechnology for Students by Satya N.Das
8. Bioethics – Readings and Cases by B.A Brody and h.t Engelhardt.Jr.(Pearson education)
9. Biotechnology. IPRS and biodiversity by M.B.Rao and Manjula Guru (Pearson education)

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Department of Genetics and Biotechnology

Subject: Biotechnology

B.Sc Life Sciences

Semester–VI

CBCS

W.e.f 2023-24 onwards

PROJECT WORK

Credits: 4

Paper Code: BT632_PW
No of Hours: 60 (4hr/wk)

1. **Basic concepts of Project planning**

    a) **Selection of Project topic and defining objectives**
    b) **Planning of methods/approaches**

2. **Guidelines for Project writing**

- **Title of the project:**
- **Title page- Name of the Project, Name of the Student & the Supervisor**
- **Declaration by Student**
- **Declaration by Supervisor**
- **Introduction**
- **Objectives**
- **Review of Literature**
- **Methodology**
- **Results and Discussion**
- **Conclusion**
- **References**

B. Archana

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Course Objectives:

Cob 1: To develop practical and project writing skills.

Cob 2: To select a topic and execute the planned work using scientific analysis and logic.

1. **Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.**

- Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.

- Project work may be allotted to students as individual or as group project (not exceeding 4-5 students per group).

- The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.

- Final evaluation of the project work will be through a panel consisting of internal and external examiners.

- Guidelines provided for execution and evaluation of project work will be strictly adhered.

- The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

Course Outcome:
At the end of the course, students will be able to
CO1: Plan and execute a project effectively in the stipulated time.
CO2: They develop analytical skills, statistical data handling skills, paper writing and oral presentation skills.

PROJECT WORK EVALUATION SCHEME

Presentation of Thesis Dissertation to External Examiner - 70 Marks
(50 Presentation + 20 Dissertation)

Continuous Evaluation by the Internal Examiner - 30 Marks

Total - 100 Marks

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