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**

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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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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**

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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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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

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

Course Name: Molecular Biology and Recombinant DNA Technology

Paper Code: BT333 **No of Classes: 60**
Year/Semester: II/III **No of Credits: 4**

Skill development: The theoretical and practical application of Molecular biology and recombinant DNA technology help students to acquire skills in understanding and analyzing genomics, proteomics, genetic manipulation of microbes and their protein expression.

Course Objective: To compare the structure of nucleic acids, mechanism of gene expression and regulation in Prokaryotes and Eukaryotes, methods of recombinant DNA technology.

Unit wise Course objectives:

Cob 1: To analyze genome organization and understand DNA replication.

Cob2: To understand Gene expression in Prokaryotes and Eukaryotes.

Cob 3: To analyze Gene regulation in Prokaryotes and Eukaryotes.

Cob 4: To evaluate the tools used to formulate cloning strategies and recombinant DNA Technology.

Unit 1- Genome organization and DNA Replication **15 Hours**

1. DNA as the genetic material- Griffiths transformation experiment, Avery, Macleod and McCarty's experiment and Hershey and Chase – labeling experiment, RNA as genetic material- Tobacco Mosaic virus. (3)

2. Organization of prokaryotic genome and eukaryotic nuclear genome. (2)

3. Organization of Mitochondrial and chloroplast genome. (2)

4. DNA Replication –enzymes involved in the replication of DNA, origin of replication fork. (3)

5. Replication of prokaryotic genome and nuclear genome of eukaryotes. (3)

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6. Mutations –types of mutations, spontaneous mutations and induced mutations. (2)

Unit 2: Gene expression in Prokaryotes and Eukaryotes **15 Hours**

1. Structure of prokaryotic gene, structure of eukaryotic gene, structure and functions of prokaryotic RNA –polymerase-subunits. (3)

2. Transcriptional machinery in eukaryotes (RNA polymerase) and their structural and functional features. (2)

3. Genetic code-properties, deciphering of genetic code, wobble hypothesis. (2)

4. Transcription mechanism in prokaryotes-initiation, elongation and proof reading, termination (rho independent and rho dependent). (3)

5. Transcription in eukaryotes- initiation, elongation and termination. (2)

6. Translation mechanism-initiation, elongation and termination. (3)

Unit 3 - Gene regulation in Prokaryotes and Eukaryotes **15 Hours**

1. Prokaryotic transcriptional regulation (inducible system)-operon concept, lac operon and glucose effect. (4)

2. Prokaryotic transcriptional regulation (repressible system) -tryptophan operon. (2)

3. Post transcriptional modification – capping, poly–adenylation. (2)

4. Splicing and alternate splicing. (2)

5. Post translational modifications -glycosylation, acetylation and ubiquitination. (3)

6. Gal regulation in yeast – mating type gene switching. (2)

Unit 4- Recombinant DNA technology **15 Hours**

1. Enzymes used in molecular cloning restriction endonuclease, DNA ligases, polynucleotide kinase, klenow enzyme and DNA polymerase. (3)

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2. Cloning vectors PBR 322, bacteriophage vectors, Cosmid, Phagemid, Shuttle vectors. (3)

3. Vectors for library preparation (lambda phage vectors, cosmids, BAC and YAC). (2)

4. Gene transfer techniques: physical chemical and biological methods. (2)

5. Selection of recombinant clones-colony hybridization and library screening. (2)

6. CRISPR- Introduction, History, Mechanism and Applications (2)

7. Application of recombinant DNA technologies-agriculture, diagnostics, industrial, pharmaceutics and medicine. (1)

Course Outcomes:

By the end of this course students will be able to

BT333. CO1: To understand and demonstrate the various levels of genomic organization and DNA replication.

BT333. CO2: To relate and interpret gene expression in prokaryotes and Eukaryotes.

BT333. CO3: To formulate new strategies applicable to state the function of various genes.

BT333. CO4: To interpret the concepts, techniques and applications of recombinant DNA technology

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Paper III- Practicals

Paper Code: BT333P
Credits: 1

30 hrs(2 hrs/ week)

Skill development: To acquire technical skills in Molecular biology and recombinant DNA technology.

Objective: To provide hands on experience in molecular biology and recombinant DNA technology.

1. Isolation of DNA from bacterial cells.
2. Isolation of Plasmid DNA.
3. Agarose electrophoresis of DNA.
4. Quantification of DNA by Spectrophotometer.
5. Separation of proteins by SDS-PAGE.
6. Polymerase Chain reaction.
7. Restriction digestion of DNA.
8. Bacterial transformation.

Outcome: Students understand the principles involved in isolation of DNA, basic techniques used in Molecular biology and recombinant DNA Technology.

Spotters:

1. PCR
2. RNA Polymerase
3. Okazaki fragments
4. Plasmid vector Map
5. Prokaryotic gene
6. Eukaryotic gene
7. Splicing
8. Post transcriptional modification
9. Point mutations

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10 .Lac operon

11. Tryptophan operon

12. Post translational modifications (PTMS)

Reference Books:

1. Molecular Biology of the gene- Watson, Hopkins, Roberts, Steitz and Weiner
2. Genes- Benjamin Levin
3. General virology- Luria, Darnell, Baltimore and Campbell
4. Molecular Biology- David Frefielder
5. Practical Microbiology- Aneja
6. Microbial Genetics ByMaloy, Freifelder
7. Molecular Genetics By Gunther and Stent
8. Genetic Analysis By Griffith, Suzuki and others
9. Gene cloning and DNA analysis: an introduction - T.A. Brown
10. Principles of Genetics- Irwin Herscowitz

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

Course Name: Bioinformatics and Biostatistics

Paper Code: BT433 No of Classes: 60
Year/Semester: II/IV No of Credits: 4

Skill development: To acquire knowledge in data retrieval and integration in bioinformatics, problem solving and analytical skills in biostatistics.

Course objective: To analyze biological data digitally and to apply and interpret statistical methods correctly.

Unit wise course objectives:

Cob 1: To retrieve and interpret the biological data from bioinformatics database.

Cob2: To organize, process and analyze biological data

Cob 3: To evaluate statistical tools and its application to problems of human health and disease, with the ultimate goal of advancing statistics.

Cob 4: To apply statistical tests for testing of hypothesis and analysis of variance and interpret statistical results correctly, effectively, and in context.

Unit 1 – Introduction to bioinformatics and biological databases 15 Hours

1. Bioinformatics definition, history, scope and applications. (4)
2. Bioinformatics tools and resources – Internet basics, role of internet, free online tools, downloadable free tools. (3)
3. Bioinformatics web portals –NCBI, EBI, ExPASy. (3)
4. Biological databases –DNA sequence databases (ENA &DDBJ). (3)

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5. Protein sequence databases (Swissprot & PROSITE). (2)

6. Introduction to homology modeling (1)

Unit 2- Sequence alignment **15 Hours**

1. Basics of sequence alignment –match, mismatch, gaps, gap penalties, scoring alignment. (3)

2. Types of sequence alignment –pairwise and multiple alignment, local and global alignment.(3)

3. Dot matrix comparison of sequences. (2)

4. Scoring matrices-PAM and BLOSUM. (2)

5. Pairwise sequence similarity search by BLAST and FASTA. (2)

6. Concepts of Phylogeny – distance based (NJ method and character base (ML method) tree construction methods (3)

Unit 3- Descriptive Biostatistics and probability **15 Hours**

1. Introduction to biostatistics, kinds of data and variables –based on nature (numerical –discrete and continuous: categorical – ordinal and nominal – based on source (primary and secondary data): sample size, sampling methods and sampling errors. (3)

2. Data tabulation and representation methods: graphical methods –stem and leaf plot, line diagram, bar graph, histogram, frequency polygon, frequency curves; diagrammatic method-pie diagram. (3)

3. Measures of central tendency- mean, median, mode; merits and demerits. (2)

4. Measures of dispersion - range, variance, standard deviation, standard error and coefficient of variation; merits and demerits. (2)

5. Concepts of probability-random experiments, events, probability of event, probability rules (addition and multiplication) use of permutations and combinations, random variables (discrete and continuous). (3)

6. Probability distributions: Binomial and Poisson distributions for discrete variables, Normal

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distribution for continuous variables. (2)

Unit 4 – Application of biostatistics **15 Hours**

1. Hypothesis testing –steps in testing for statistical hypothesis, null and alternative hypothesis, level of significance-type 1 and type 2 errors. (3)

2. Test of significance for small samples –student's t-test (one sample and two samples). (2)

3. Test of significance for large samples –Z – test for means and proportions. (3)

4. Chi-square test and its applications- goodness of fit, test of independence. (2)

5. Analysis of variance (ANOVA) – one way analysis. (2)

6. Correlation – definition, simple and linear analysis, Karl Pearson's correlation coefficient. (3)

Course outcomes:

By the end of this course students will be able to

BT 433 CO 1: To apply bioinformatics tools to guide data analysis and interpretation.

BT 433 CO 2: To provide a basic outline of the processes used for sequence alignment.

BT 433 CO 3: To understand the principal concepts about biostatistics and recognize it's importance with the other sciences.

BT 433 CO 4: Implement statistical tests for testing of hypothesis and analysis of variance and to enhance their knowledge in new spheres of Biostatistics.

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Paper IV- Practicals

Paper Code: BT333P 30 hrs(2 hrs/ week)
Credits: 1

Skill development: To acquire the skills to use the basic tools in bioinformatics and interpret the concepts of biostatistics.

Objectives: Students understand the concepts of biostatistics along with hands on expertise in bioinformatics.

1. Omics -Basics
2. Exploring web portals NCBI, EBI & ExPASY.
3. Literature search through Pubmed and Pubmed Central.
4. Sequence retrieval from Genbank, ENA, Swissprot.
5. Pairwise homology search by BLAST and FASTA.
6. Calculation of mean, median, mode, standard deviation, variance, standard coefficient of variation.
7. Construction of bar diagram, Pie diagram, Line diagram, Histogram.
8. Problems on Hypothesis testing using Z- test, t-test and Chi- square test.
9. Problems on probability and probability distributions.

Outcomes: Students expertise Biostatistics and also in analysis of biological data using bioinformatics tools.

Spotters:

1. Line diagram, Bar diagram and pie diagram.
2. Histogram, frequency polygon and frequency curve
3. Normal Probable curve.
4. GenBank
5. DDBJ
6. SWISS-PROT
7. PROSITE
8. PIR

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9. BLAST

10. Pairwise alignment.

11. Multiple sequence alignment

12. PAM, BLOSUM

13. Phylogentic Tree

Reference books:

1. Khan & Khanum (2004), Fundamentals of Biostatistics, II Revised Edition. Ukaaz Publication

2. Bailey, N.T.J, Statistical methods in Biology, Cambridge Univ. Press

3. Fundamentals of Biostatistics, P Hanumantha Rao and K.Janardhan

4. Danial, W. W. Biostatistics, Wiley

5. Introduction to Bioinformatics by Aurther M lesk

6. Developing Bioinformatics Computer Skills By: Cynthia

7. Bioinformatics second edition By David M mount

8. Essential Bioinformatics by Jin Xiong

9. Bioinformatics Computing By Bryan Bergeron

10. Bioinformatics: Concepts, Skills & Applications by R.S. Rastogi

11. Queen. J. P.. Quinn, G. P., & Keough. M. J. (2002). Experimental design and data analysis for biologists Cambridge University Press.

12. Mahajan. B. K. (2002). Methods in biostatistics Jaypee Brothers Publishers.

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Department of Genetics and Biotechnology
Skill Enhancement Course- Credits 2
Effective from 2023-'24 onwards
Title: Integrated Pest Management -SE333

Skill Development: Gain expertise in identifying the pests infesting the crop plants. Manage to incorporate IPM program in controlling the pest infestation.

Course Objectives:

Cob 1: Gain basic knowledge of various pests and Pest control strategies of IPM.

Cob 2: Students understand the side effects of chemical pesticides.

UNIT 1: Theory (15 hours)

1. Basic concepts of pest. (1)
2. Types of pest based on occurrence and nature of damage. (2)
3. Concept of Pest Management. (l)
4. Principles of insect pest management. (2)
5. Tools of Integrated pest management. (2)
6. Chemical pest management (Insecticides- Advantages and disadvantages). (2)
7. Role of soil nutrients in pest control. (1)
8. Biopesticides- success stories and limitations. (2)
9. Bioremediation of Industrial pollutants by insects. (2)

Unit II 15 hours

Project work/survey on

1. Collection and preservation of mature and immature insects.
2. Collection of information on chemical insecticides available in local markets.
3. Collection of information on Biopesticides available in local market.
4. Visit to IPM fields.
5. Neem Extract-Application to plants.

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Break up for classes
Survey and field work (10)
Analysis and compilation of Data (5)

Course Outcomes:

CO1: Students expertise in tackling the pests in an eco-friendly way

CO2: Students are motivated to go for biological pesticides and employ IPM strategies for pest control

Reference Books:

1. Metcalf R L, Introduction to Insect pest management. 3'd Edition New York: A Wiley Interscience publication, c1994

2. Shagufta, Integrated Pest Management APH Publishing corporation, 2012

3. G. S. Dhaliwal and R Arora, Integrated pest management, Concepts and Approaches.

4. D, Prasad, Crop Protection: Management strategies.

5. Awasthi V B, Agricultural Insect Pests and their control'

6. Arora R, Theory and Practice of integrated Pest Management

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Skill Enhancement Course- Credits 2
Effective from 2023-'24 onwards
Title: Food Preservation and adulteration –SE433

Skill Development: Students learn about different processes to preserve food and they also learn to identify the key adulterants in various foods in the market.

Course objectives:

COb 1: Students get an insight into the process of microbial degradation of food.

COb 2: Students get the basic knowledge of the different types of food adulteration added to foods and evaluation of milk by MBRT.

UNIT 1 (15 hours)

1. History of Food preservation -evolution of cooking process. (1)
2. Food fermentation process and preservation process. (3)
3. Food additives- Preservative,Antioxidants, supplements , emulsifiers and thickening agents. (4)
4. Food additives -Taste and Flavour Enhancers (Sweeteners,Bleaching and Maturing agents, Colouring and Flavouring agents. (3)
5. Food adulterants -Types of adulterants (Intentional and Incidental). (3)
6. Health hazards and Risks. (1)

Unit II (15 hours)

1.Report writing on "Food adulterants in coffee,Turmeric, Edible oils, Ghee,Honey ,Milk (4)
2. Microbial Analysis of Foods (3)
3. Determination of quality of Milk by MBRT (6)
4. Preparation of Fruit Squash/Mayonnaise (2)

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Course outcomes:

CO1: Students learn the basic methods of food preservation.

CO2: Students interpret the health risks with different adulterants present in food.

Reference books:

l. Hand book of Analysis and Quality control for fruits and Vegetable products by Ranganna S.

2. Food Microbiology by William G, Frazier

3. Fruit and Vegetable Preservation- Principles and Practice by Srivastava R. P

4. Food Science Experiments and Applications by Mohini Sethi.

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