SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

SCHOOL OF ARTS AND SCIENCE

DEPARTMENT OF BIOSCIENCE

B.Sc. BIOTECHNOLOGY

Minutes of Board of Studies Third Meeting

Venue

Hall No.203, School of Arts and Science Block

Date and Time

24.9.2022 from 2.00 pm to 4.30 pm

2.E.11.1

2.F.11.2

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SCHOOL OF ARTS AND SCIENCE

BOARD OF STUDIES ON B.Sc.BIOTECHNOLOGY

Minutes of Board of Studies Third Meeting

The Board of Studies Third meeting of the Department of Bioscience for B.Sc. Biotechnology Programme was held on 24.9.2022 from 2.00 pm to 4.30 pm through offline mode at the Hall No.203, School of Arts and Science Block, Sri Manakula Vinayagar Engineering College (Autonomous), Puducherry. The following members were present for the BoS meeting

SL. NO	NAME OF THE MEMBER WITH DESIGNATION AND OFFICIAL ADDRESS	MEMBERS AS PER UGC NORMS
1	**Dr. T.R.Rajaram, HOD,** Department of Bioscience- Biotechnology, School of Arts and Science Sri Manakula Vinayagar Engineering College (Autonomous) Madagadipet, Pondicherry	Chairman
2	**Dr. V. Arul, Professor,** Department of Biotechnology Pondicherry University, Pondicherry.	Subject Expert (University Nominee)
3	**Dr. Medha Rajappa, Professor,** Department of Biochemistry JIPMER, Pondicherry	Subject Expert (Academic Council Nominee)
4	**Dr. D. Panneer, Scientist C,** Microbiology and Molecular Biology, Vector Control ResearchCentre, Pondicherry	Subject Expert (Academic Council Nominee)
4	**Dr. A. Balamurugan** Group Leader—Microbiology Lab-Quality Control Solara Active Pharma Sciences Ltd, Cuddalore	Subject Expert (Industry & Research Expert)
5	**Ms.A.Yuvarani**, AssistantProfessor Department of Biosciences-Biotechnology, School of Arts and Science SMVEC, Madagadipet, Pondicherry	(Internal member)
6.	**Mr.A.Jagadesh,** AssistantProfessor Department of Biosciences-Biotechnology School of Arts and Science SMVEC, Madagadipet, Pondicherry	(Internal member)

2. E. 11.3

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
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SCHOOL OF ARTS AND SCIENCE
BOARD OF STUDIES ON B.Sc. Biotechnology
Agenda of the Meeting on 24.9.2022

S.NO	ITEM NO.	AGENDA
1	**Item No.: BoS/2022/SAS/UG/BT 3.1**	Welcome address to the BoS Members.
2	**Item No.: BoS/2022/SAS/UG/BT 3.2**	To discuss about the 3rd and 4th semester execution, lab establishment and department activities.
3	**Item No.: BoS/2022/SAS/UG/BT 3.3**	To discuss about the Curriculum of B.Sc. Biotechnology
4	**Item No.: BoS/2022/SAS/UG/BT 3.4**	To discuss and approve the Syllabi for V and VI semester under Autonomous Regulations 2020 for the B.Sc. Biotechnology.
5	**Item No.: BoS/2022/SAS/UG/BT 3.5**	To discuss about the department establishment

2.E.11.A

Minutes of Meeting

The meeting deliberated on the agenda items that have been approved by the Chairman.

Item No.: BoS/2022/SAS/UG/BT 3.1	Welcome address to the BoS Members. • Chairman of BoS gave the welcome address to the BoS members. • Chairman of BoS introduced the Department staff members.
Item No.: BoS/2022/SAS/UG/BT 3.2	To discuss about the 3rd and 4th semester execution, lab establishment and department activities. BoS members appreciated the about 3rd and 4th semester executions, lab establishment and department activities.
Item No.: BoS/2022/SAS/UG/BT 3.3	To discuss about the Curriculum of B.Sc. Biotechnology • The Panel have given the suggestion to do modification in the 5th and 6th semester curriculum. • To convert the some DSC into DSE to overcome the practical related difficulties. (Refer Annexure – I)
Item No.: BoS/2022/SAS/UG/BT 3.4	To discuss and approve the Syllabi for V and VI semester under Autonomous Regulations 2020 for the B.Sc. Biotechnology. • Panel suggested that to add seminar presentation (PPT) on Biotechnology relavent topic in the 6th semester as a additional skill Enhansment course to replace the Project. • The Syllabi for V and VI semesters of B.Sc. Biotechnology Program was discussed and approved by panel of BoS members. (Refer Annexure – II)
Item No.: BoS/2022/SAS/UG/BT 3.5	To discuss about the department establishment • The Panel suggested to take the students to visit the Animal cell culture facilities and to attend the Hands on training. • The Panel suggested to establish the plant tissue culture lab in the department. • The Panel suggested to get the stusents feedback on framing the curriculum and syllabus. • The Panel suggested to motivate the students to participate and present research paper and posters in conferance. • The Panel suggested to take the students to Academic tour to visit the Research Institute and Industries. • The Panel suggested to establish the central instrumentation facilities in the department lab.

The meeting concluded at 4.30 pm with vote of thanks.

2.E.11.5

The Minutes of the Meeting of the Third Board of Studies of the Department of Bioscience- B.Sc. Biotechnology was held on 24-9-2022 is signed by the members who attended the meeting:

SL. NO	NAME OF THE MEMBER WITH DESIGNATION AND OFFICIAL ADDRESS	MEMBERS AS PER UGC NORMS	SIGNATURE
1	**Dr. T.R.Rajaram, HOD**, Department of Bioscience- Biotechnology, School of Arts and Science Sri Manakula Vinayagar Engineering College (Autonomous) Madagadipet, Pondicherry	Chairman	
2	**Dr. V. Arul, Professor,** Department of Biotechnology Pondicherry University, Pondicherry.	Subject Expert (University Nominee)	V. Arul 24/9/22
3	**Dr. Medha Rajappa, Professor,** Department of Biochemistry JIPMER, Pondicherry	Subject Expert (Academic Council Nominee)	MedhaR 24/9/22
4	**Dr. D. Panneer, Scientist C,** Microbiology and Molecular Biology, Vector Control ResearchCentre, Pondicherry	Subject Expert (Academic Council Nominee)	
4	**Dr. A. Balamurugan** Group Leader—Microbiology Lab- Quality Control Solara Active Pharma Sciences Ltd, Cuddalore	Subject Expert (Industry & Research Expert)	
5	**Ms.A.Yuvarani**, AssistantProfessor Department of Biosciences-Biotechnology, School of Arts and Science SMVEC, Madagadipet, Pondicherry	(Internal member)	
6.	**Mr.A.Jagadesh,** AssistantProfessor Department of Biosciences-Biotechnology School of Arts and Science SMVEC, Madagadipet, Pondicherry	(Internal member)	

HOD

DEAN SAS

Annexure – I

SEMESTER–V										
S. No	Course Code	Course Title	Category	Periods			Credits	Max.Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	A20BTT513	Microbial Biotechnology	DSC	3	1	0	4	25	75	100
2	A20BTT514	Bioinformatics	DSC	3	1	0	4	25	75	100
3	A20BTT515	Plant Biotechnology	DSC	3	1	0	4	25	75	100
4	A20BTE5XX	DSE-III	DSE	3	0	0	3	25	75	100
Practical										
5	A20BTL516	Microbial Biotechnology and Bioinformatics Practical	DSC	0	0	4	2	50	50	100
6	A20BTL517	Plant Biotechnology Practical	DSC	0	0	4	2	50	50	100
Skill Enhancement Course										
7	A20BTS505	In-Plant training / Internship	SEC	0	0	4	2	100	0	100
							21	**300**	**400**	**700**

SEMESTER–VI										
S. No	Course Code	Course Title	Category	Periods			Credits	Max.Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	A20BTT618	Marine Biotechnology	DSC	3	1	0	4	25	75	100
2	A20BTT619	Pharmaceutical Biotechnology	DSC	3	1	0	4	25	75	100
3	A20BTT620	Biosafety, Bio-ethics and IPRs	DSC	3	1	0	4	25	75	100
4	A20BTT621	Medical Biotechnology	DSC	3	1	0	4	25	75	100
5	A20BTE6XX	DSE- IV	DSE	3	0	0	3	25	75	100
Practical										
6	A20BTL622	Marine Biotechnology and Pharmaceutical Biotechnology Practical	DSC	0	0	4	2	50	50	100
Skill Enhancement Course										
7	A20BTS606	R & D and Bio entrepreneurship	SEC	4	0	0	2	100	0	100
8	A20BTS607	Seminar presentation	SEC	4	0	0	2	100	0	100
							25	**375**	**425**	**800**

2.E.11.7

DISCIPLINE SPECIFIC ELECTIVE COURSES

Discipline Specific Electives (DSE - III) - offered in Fifth Semester										
1	A20BTE507	Animal Biotechnology	DSE	3	0	0	3	25	75	100
2	A20BTE508	r-DNA Technology	DSE	3	0	0	3	25	75	100
3	A20BTE509	Bioprocess Technology	DSE	3	0	0	3	25	75	100
Discipline Specific Electives (DSE - IV) - offered in Sixth Semester										
1	A20BTE610	Environmental Biotechnology	DSE	3	0	0	3	25	75	100
2	A20BTE611	Genomics and Proteomics	DSE	3	0	0	3	25	75	100
3	A20BTE612	Enzyme Technology	DSE	3	0	0	3	25	75	100

Annexure – II

		L	T	P	C	Hrs
A20BTT513	MICROBIAL BIOTECHNOLOGY	4	0	0	4	60

Course objective

- To understand the General concepts of microbial biotechnology
- To understand about the Biofertilisers and their importance in crop productivity
- To understand the Concepts & basic modes of fermentation
- To impart practical skills of Fermentation in preparing and preserving foods
- To ensures the students to understand about Microbial applications.

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the General concepts of microbial biotechnology
CO2 – Describe about Biofertilisers and their importance in crop productivity
CO3 – Describe the Concepts & basic modes of fermentation
CO4 – Recognize about Fermentation in preparing and preserving foods
CO5 – Demonstrate the Microbial applications

UNIT-I (10 hours)

General concepts of microbial biotechnology - Genetic engineering of microbes for theproduction of antibiotics, enzymes, insulin, growth hormone and monoclonal antibodies. Synthetic bacteria, Microorganisms as factories for the production of novel compounds.

UNIT-II (10 hours)

Biofertilisers and their importance in crop productivity - Bacterial, algal and fungal biofertilisers - their significance and practice. Biopesticides - Bacterial, fungal and viral. Production of biofertilisers and biopesticides for large scale applications.

UNIT – III (10 hours)

Concepts & basic modes of fermentation - Batch, fed batch and continuous fermentation. Types of fermentation - Solid substrate, surface and submerged fermentation. Fermenter design - mechanically agitated, pneumatic and hydrodynamic fermenters.

UNIT – IV (15 hours)

Fermentation in preparing and preserving foods - pickling, producing colours and flavours, Process wastes - whey, molasses, starch substrates and other food wastes for bioconversion to useful products. Bacteriocins from lactic acid bacteria, meat fermentation, soy fermentation, sauerkraut production, Microbial fermentation of tea, coffee and cacao.

UNIT-V (15 hours)

Microbial leaching of ores, Bioweapons and Bioshields, Microial biocatalyst andmicrobial fuel cells. Microbial fuels (biohydrogen, bioethanol and biomethane), Nutraceuticals from algae, Algal Pigments.

Text Books:

1. Microbial Biotechnology: Fundamentals of Applied Microbiology by Alexander N. Glazer (Author), Hiroshi Nikaido (Author), 2nd edition, October 2007.
2. Microbial Biotechnology, Author : N. Arumugam, A. Thangamani, L.M. Narayanan, V. Kumaresan, Saras publication.
3. Jackson AT. 1991. Bioprocess Engineering in Biotechnology. Prentice Hall, Engelwood Cliffs.
4. Shuler ML and Kargi F. 2002. Bioprocess Engineering: Basic concepts, 2nd Edition. Prentice Hall, Engelwood Cliffs.

Reference books:

1. Microbial biotechnology (1995) Alexander N.Glazer Hiroshi Nikaido W.H.Freeman& Company
2. Fungal ecology and biotechnology (1993) Rastogi Publications, Meerut
3. Young M.M., Reed. 2004. Comprehensive Biotechnology: The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine. Vol 1, 2, 3 and 4. Elsevier India Private Ltd, India.
4. Mansi EMTEL, Bryle CFA. 2007. Fermentation Microbiology and Biotechnology. 2nd Edition. Taylor & Francis Ltd, UK.

Web references:

1. https://actascientific.com/ASMI/pdf/ASMI-03-0500.pdf
2. https://biologyreader.com/biofertilizer-production.html
3. https://microbenotes.com/bioreactor/
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6723656/
5. https://www.google.com/search?q=Microbial+leaching+of+ores%

2.E.11.10

		L	T	P	C	Hrs
A20BTT514	BIOINFORMATICS	4	0	0	4	60

Course objective

- To understand the basics of Bioinformatics: an overview
- To ensures the students to understand about the Sequence Analysis.
- To understand the Phylogenetic analysis
- To impart practical skills of Structure prediction: protein.
- To understand the Applications of bioinformatics in Drug discovery.

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Bioinformatics: an overview.
CO2 – Describe about the Sequence Analysis.
CO3 – Describe some of the Phylogenetic analysis
CO4 – Recognize the Structure prediction: protein.
CO5 – Demonstrate the Applications of bioinformatics in Drug discovery

UNIT -I (10 hours)

Bioinformatics: an overview - Introduction to Computational Biology and Bioinformatics; some of the biological problems that require computational methods fortheir solutions; Role of internet and www in bioinformatics. Biological Databases Acquisition –Primary and Secondary databases, Nucleotide sequence databases.Types of DNA sequences – genomic DNA, cDNA, recombinant DNA, Expressed sequence tags (ESTs).

UNIT -II (15 hours)

Sequence Analysis – Methods of sequence alignment: Dot plots; Scoring matrix – identify matrix, genetic code matrix (GCM); Substitution matrix, Percentage accepted Mutation (PAM). Block Substitution Matrix (BLOSUM), dynamic programming algorithms; Needlman-Wunch and Smith Waterman; alignment scores andgap penalties; Database searching (BLAST and FASTA). Multiple Sequence alignment (MSA) – signifiance. Softwares : ClustalW and Meme.

UNIT – III (15 hours)

Phylogenetic analysis – Phylogenetics, cladistics and ontology; Phylogenetic representations – graphs, trees and cladograms; Classification and ontologies; Steps in phylogenetic analysis; Methods of phylogenetic analysis – similarity and distance tables,distance matrix method; Method of calculation of distance matrix (UPGMA, WPGMA); The Neighbor Joining Method; The Fitch/Margoliash method; Steps in constructing alignments and phylogenies; Phylogenetic softwares –PHYLIP

UNIT – IV (10 hours)

Structure prediction: protein- Methods for prediction of secondary and tertiary structures of proteins – knowledge-based structure prediction; fold recognition; Comparative protein modeling. Identification of motifsand domains, protein family database. RNA structure prediction.

UNIT -V (10 hours)

Applications of bioinformatics in Drug discovery: Finding new drug targets to treat diseases – Pharmacophore identification - Structure based drug design. Mining of sequence data: Mining data

2.E.11.11

from Yeasts. Microarray and genome wide expression analysis: transcriptomes, proteome: Genomics in medicine, disease monitoring, profile for therapeutic molecular targeting.

Text Books:

1. Mount, D. Bioinformatics: Sequence and Genome Analysis; Cold Spring HarborLaboratory Press, New York. 2004
2. Baxevanis, A.D. and Ouellellette. B.F. Bioinformatics – a practical guide to the analysis of Genes and Proteins; John Wiley and Sons, New Jersey, USA. 1998.
3. Lesk, A.M. Introduction to Bioinformatics, First edition, Oxford University Press, UK.2002
4. Rastogi, S.C, Mendiratta. N and Rastogi. R. Bioinformatics: Concepts, Skills andApplications, CBS Publishers, New Delhi, India. 2006

Reference books:

1. Pevzner, P.A. Computational Molecular Biology; Prentice Hall of India Ltd,New Delhi. 2004
2. Sensen, C.W. Essentials of Genomics and Bioinformatics. Wiley-VCH Publishers,USA. 2002
3. Andrew R. Leach Molecular Modeling – Principles and Applications Second Edition,Prentice Hall, USA. 2001
4. Creighton, T.E. Proteins: structure and molecular properties Second edition, W.H.Freeman and Company, New York, USA. 1993
5. Bioinformatics, 4th Edition Andreas D. Baxevanis (Editor), Gary D. Bader (Editor), David S. Wishart (Editor), ISBN: 978-1-119-33558-0 May 2020.

Web references:

1. https://www.sciencedirect.com/topics/computer-science/bioinformatics
2. https://www.ncbi.nlm.nih.gov/guide/sequence-analysis/
3. https://www.news-medical.net/health/What-is-Phylogenetic-Analysis.aspx
4. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6407873/
5. https://www.google.com/search?q=Applications+of+bioinformatics+in+Drug+discovery

2.E.11.12

		L	T	P	C	Hrs
A20BTT515	**PLANT BIOTECHNOLOGY**	**4**	**0**	**0**	**4**	**60**

Course objective

- To understand the basics of Conventional breeding for crop improvement
- To ensures the students to understand about the Basics of Plant tissue culture
- To understand the Principles of Somatic Hybridization
- To impart practical skills of Genetic engineering of plants
- To ensures the students to understand about Applications of transgenic plants

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Conventional breeding for crop improvement
CO2 – Describe the concept Basics of Plant tissue culture
CO3 – Describe the Principles of Somatic Hybridization
CO4 – Describe the Genetic engineering of plants
CO5 – Demonstrate the Applications of transgenic plants

UNIT - I (10 hours)

Conventional breeding for crop improvement- Introduction, Domestication, Methods of Plant Breeding- Hybridization, Clonally Propagated Species, Breeding Enhancements- Marker-Assisted Selection, Mutation Breeding. Plant genome organization, organization of chloroplast genome, cytoplasmic male sterility, genetic male sterility.

UNIT -II (15 hours)

Basics of Plant tissue culture, Sterilization, plant tissu culture media Components (inorganic, organic and plant hormones) and types of nutrient media, Callus and Suspension cultures, Micropropagation, Somatic embryogenesis and Germplasm conservation. Embryo culture, Rapid clonal propagation, somaclonal variations and synthetic or artificial seeds, embryo rescue, production of haploid plants (microspores and ovules). Applications and limitations of haploid plants. Secondary metabolites from plants.

UNIT – III (15 hours)

Introduction and Principles of Somatic Hybridization – Protoplast Isolation, Protoplast fusion, Selection of hybrid cell, Regeneration of hybrid plants, Somatic hybrids and cybrids – cytoplasm transfer, Genetic transformation, Advantages and Limitations, Molecular makers – RFLP, RAPD, DNA fingerprinting.

UNIT – IV (10 hours)

Genetic engineering of plants - Gene constructs, Vectors- Plasmid vectors and plant viral vectors (CaMV, Gemini virus, Tobacco Mosaic virus), cloning vectors for higher plants - Genetic manipulation using *Agrobacterium tumefaciens*. Gene transfer in plants - Electroporation, Particle Gun Method, Microinjection, Polyethylene glycol mediated transformation, Chloroplast transformation, terminator seed technology.

UNIT -V (10 hours)

Applications of transgenic plants- Pest resistance, Herbicide resistance, virus resistance, Fungal and bacterial resistance, Delay of fruit ripening, Salt & drought tolerance, improvement of crop yield and Quality, Improved nutrition.

2.E.11.13

Text Books:

1. Plant Biotechnology,2015 by Singh B.D. (Author)
2. M. S. Clark. 1997. *Plant Molecular Biology:* A *Laboratory Manual.* Springer-Verlag.
3. Slater A., Scott N.W. and Fowler, M.R. 2008. Plant Biotechnology - the genetic manipulation of plants. 2nd Edition. Oxford University press, USA.
4. H.S. Chawla, 2002. Introduction to Plant Biotechnology. Oxford and IBH P Publishing Co. Pvt. Ltd. New Delhi.

Reference books:

1. Monica. A. Hughes. 1999. Plant Molecular Genetics. Pearson Education limited, England.
2. Harrison, M.S. and Bal, I.R. 1997. General techniques of all culture Cambridge University press.
3. Prasash M. and Arora. C.K.. 1998. Plant tissue culture, Ammol publication Pvt. Ltd.
4. Darling D.C. and Morgan S.J. 1994. Animal cells, culture Media. Wiley, New York.
5. Plant Biotechnology by Ricroch, Agnes, Chopra, Surinder, Fleischer, Shelby, Springer Nature (Sie)

Web references:

1. https://www.google.com/search?q=Conventional+breeding+for+crop+improvement
2. https://passel2.unl.edu/view/lesson/a2f44b5b9a27/1#:~:text=Plant%20tissue%20culture%
3. https://www.google.com/search?q=Principles+of+Somatic+Hybridization
4. https://www.google.com/search?q=Genetic+engineering+of+plants
5. https://www.google.com/search?q=Applications+of+transgenic+plants&ei=01k5Y-yUHLyu4-EPi

2.E.11.14

		L	T	P	C	Hrs
A20BTE507	**ANIMAL BIOTECHNOLOGY**	**3**	**0**	**0**	**3**	**45**

Course objective

- To understand the Introduction, history, basic concept of animal cell culture.
- To understand about the Basic techniques of mammalian cell culture.
- To understand the applications and limitations of animal Biotechnology
- To role of Animal models in Experimentation.
- To ensures the students to understand about Animal diseases.

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Describe the Introduction, history, basic concepts of animal cell culture.
CO2 – Describe historical concept of spontaneous generation and the experiments performed .
CO3 – Describe the applications and limitations of animal Biotechnology.
CO4 – Describe the role of Animal models in Experimentation
CO5 – Describe about Animal diseases

UNIT -I (10 hours)

Introduction, history, basic concept of animal cell culture, primary cell culture and established cell lines, maintenance of cultures, requirements of animal cell culture, media - natural (clots, biological fluids and tissue extracts) and synthetic (serum containing media, serum free media, chemically defined media, protein free media).

UNIT-II (10 hours)

Basic techniques of mammalian cell culture, disaggregation of animal tissues - mechanical, enzymatic and EDTA, evolution of cell line, monolayer culture, suspension culture, immobilized culture, organ culture - plasma clot, raft method, agargel, grid method, embryo culture, maintenance of cell culture.

UNIT – III (10 hours)

Artificial insemination, Super ovulation, In vitro fertilization and embryo transfer, applications and limitation, Transgenic animals (avian, rodent & ruminants), Transgenic methods, Embryonic Stem cell transfer, Targeted Gene Transfer, Detection of transgenic animals, Production of useful proteins in transgenic animals, Sericulture basics and production of useful proteins through sericulture.

UNIT – IV (7 hours)

Role of Animal models in Experimentation. Molecular markers - RFLP, RAPD, VNTR,AFLP. Somatic and Reproductive cloning - Definition, history and types. Somatic cellnuclear transfer, story of dolly, Therapeutic cloning and its significance.

UNIT -V (8 hours)

Animal diseases (cattle) -Mad cow, Anthrax, Foot and Mouth, Lumpy skin, Bluetongue; (Poultry)-Newcastle; Bird flu, Avian Influenza, Marek's disease – Vaccines; Bioethics and biosafety in animal handling.

2.E.11.25

Text Books:

1. Bernard R. Glick, Jack J. Pasternak, Cheryl L. Patten, Molecular Biotechnology: Principles and Applications of Recombinant DNA (4th edition), ASMpublisher(2009).
2. Michael wink, An Introduction to Molecular Biotechnology: Fundamentals, methodsand applications, (2nd edition) , John Wiley and sons 2013.
3. Ganga. G & Slochanachetty, An Introduction to Sericulture, (2nd edition), Oxford andIBH publishers Pvt.Ltd.Delhi (2012).
4. Old R.W, Primrose S.B, Twyman R. M, Principles of Gene manipulation (6th edition),Blackwell Sciences, (2001)
5. Textbook of Animal Biotechnology Paperback – 2013, by B. Singh (Author), S.K. Gautam (Author)
6. ANIMAL BIOTECHNOLOGY (PB 2018) Paperback – 2018, by SRIVASTAVA A K (Author)

Reference books:

1. Tom Strachan & Andrew P. Read, Human Molecular Genetics, 2nd edition. GarlandScience, (2004).
2. Maule J.P, The Semen of Animals and Artificial Insemination, CommonwealthAgricultural Bureaux, 1962
3. John R.W. Masters, Animal Cell Culture, 3rd edition, OUP Oxford, (2000).

Web references:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7325846/#:~:text=Cell
2. https://www.abcam.com/protocols/mammalian-cell-tissue-culture-techniques-protocol
3. https://www.google.com/search?q=applications+and+limitations+of+animal+Biotechnology
4. https://www.google.com/search?q=Molecular+markers+of+animal+Biotechnology
5. https://vikaspedia.in/agriculture/livestock/general-management-practices-of-livestock

2.E.11.16

		L	T	P	C	Hrs
A20BTE508	**rDNA TECHNOLOGY**	**3**	**0**	**0**	**3**	**45**

Course objective

- To understand the Introduction of rDNA Technology.
- To ensures the students to understand about the Different types of Vectors.
- To understand the Cloning Strategies.
- To impart Selection & Screening of rDNA products and Gene Sequencing
- To ensures the students to understand about the Applications of rDNA Technology.

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Introduction of rDNA Technology.
CO2 – Describe thel Different types of Vectors.
CO3 – Describe about the Cloning Strategies.
CO4 – Describe the Selection & Screening of rDNA products and Gene Sequencing
CO5 – Demonstrate the Applications of rDNA Technology

UNIT -I (10 hours)

Introduction to rDNA Technology :Introduction to genetic engineering and recombinant DNA technology. Various steps involved in rDNA technology. Isolation of genes. Enzymes of rDNA technology- Restriction endonucleases, exonuclease, DNA modifying enzymes - Polymerase, Transferase, Kinase and Ligase.

UNIT-II (7 hours)

Different types of Vectors:Plasmids, Phage vectors, Cosmids, Phagemids, Virus vectors, Shuttle vectors and expression vectors- YAC, BAC- S. cerevisiae system as a model.

UNIT – III (10 hours)

Cloning Strategies:Cloning vectors for E. coli., Cloning vectors for Eukaryotes. Methods of transformation. Construction of genomic libraries and cDNA Libraries. Probe construction, recombinant selection and screening, DNA amplification using polymerase chain reaction (PCR): key concepts, Analysis of amplified products. Applications of PCR: Ligase chain reaction. RFLP, RAPD, DNA Finger printing.. Principles of Southern, Northern and Western blotting techniques.

UNIT – IV (8 hours)

Selection & Screening of rDNA products and Gene Sequencing :Analysis of recombinant DNA - Selection methods – antibiotics, expression basis, GUS expression. Sequencing - chemical degradation; chain termination and automated sequence. Altered expression and engineering genes. Site- directed mutagenesis.

UNIT -V (10 hours)

Applications of rDNA Technology: Virus and pest resistances Plants, herbicide tolerance and stress tolerance, delay of fruit ripening. Biopharmaceuticals in Transgenic animals. Gene therapy – Haemopoietic cells, genetically engineered bone marrow cells, skin fibroblasts, hepatocytes, myoblast and genetically modified lymphocytes.

Text Books:

1. Recombinant Dna Tech & Genetic Engg by RAJAGOPAL, McGraw Hill
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. 2002. Molecular Biology of the Cell, 4th Edition. Garland Sciences.
3. Uldis N. Streips and Ronalad E. Yasbin. 2002. Modern Microbial Genetics. 2nd Edition. Wiley-Blackwell.
4. Sandy B. Primrose, Richard M. Twyman, Robert W. Old. 2008. Principles of Gene Manipulation. 6th Edition. Blackwell Science.
5. Brown TA. 2008. Genomes. 3rd Edition. New York: Garland Publishing Co. New York: Garland Science.

Reference books:

1. Old, R.W and S.B. Primrose. 1996. Principles of Gene Manipulation: An Introduction to Genetic Engineering. 2nd Edition. Blackwell Scientific Publications, Oxford.
2. Glover, DM. and BD. Hames. 1995. DNA Cloning: A Practical Approach. 2nd Edition. IRL Press, Oxford.
3. Persing, D.H., K T.F Smith, F.C. Teower and T. J. While. 1993. Diagnostic Molecular Microbiology. 2nd Edition. ASM Press, Washington D.C.
4. Watson J.D., Gilman M., Witkowski, J. and Zoller M. 1992. Recombinant DNA. 2nd Edition. Scientific American Books, New York.
5. Daniel L.Hartl. 2011. Analysis of Genes and Genomes. 8th edition. Maryellen Ruvolo. Laxmi Publications.
6. Keya Chaudhuri. 2012. Recombinant DNA Technology. The Energy and Resources Institute, TERI.

Web references:

1. https://www.britannica.com/science/recombinant-DNA-technology
2. https://www.google.com/search?q=Different+types+of+Vectors+in++rDNA
3. https://www.google.com/search?q=Cloning+Strategies&ei=t2g5Y5qGKoSPseMPy_C36Aw&ve
4. https://www.google.com/search?q=Selection+%26+Screening+of+rDNA+products+&ei
5. https://medcraveonline.com/JABB/application-of-recombinant-dna-technology-genetically

2.E.11.18

		L	T	P	C	Hrs
A20BTE509	BIOPROCESS TECHNOLOGY	3	0	0	3	45

Course objective

- To understand the basics of Principles of Bioprocess technology.
- To ensures the students to understand about the Introduction to fermentation.
- To understand the Microbial growth and death in fermentation
- To impart practical skills of Industrial wastewater treatment and disposal.
- To ensures the students to understand about Industrial wastewater treatment and disposal

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Principles of Bioprocess technology.
CO2 – know the Introduction to fermentation.
CO3 – Describe the Microbial growth and death in fermentation.
CO4 – know about Downstream processing
CO5 – Demonstrate the Industrial wastewater treatment and disposal

UNIT -I (10 hours)

Principles of Bioprocess technology – Introduction and history of traditional and modern bioprocess technology. General concepts of fermentation technology – Outline of an integrated bioprocess and various unit operations. Industrially important microbes: Isolation, Screening & Preservation techniques, Strain improvement methods.

UNIT-II (10 hours)

Introduction to fermentation - Types of fermentation processes (Submerged & solid static) - Media formulation - Synthetic and complete media, Sterilization (batch & continuous) – Air, Filter and Media sterilization – Operation: Inoculum preparation and sampling. Fermenters: Design of a fermenter – Types: Stirred tank, Fluidized bed, Immobilized bed bioreactors, Photo bioreactors, Air lift bioreactors and its other types.

UNIT – III (10 hours)

Microbial growth and death kinetics - Bioprocess control & monitoring of various factors, temperature, agitation, pressure, pH, dissolved oxygen and foam sensing, online measurements. Control systems – Manual control, Automatic control - on/off control & PID control, Computer applications in fermentation technology - Scale up &Scale down of microbial reactions.

UNIT – IV (7 hours)

Downstream processing: Removal of microbial cells and solid matter – Precipitation,Filtration, Centrifugation, Liquid – Liquid extraction, Chromatography and membraneprocesses, BOD and COD measurements.

UNIT -V (8 hours)

Industrial wastewater treatment and disposal: Physical treatment, chemical treatment and biological treatments. Aerobic processes - trickling filter, towers, biologically aerated filters, rotating drums, fluidized bed systems, activated sludge process. Anaerobic treatment - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blankets. Disposal - seas and rivers, lagoons, spray irrigation, well-disposal, landfilling, incineration, disposal of effluents to sewers.

2.E.11.19

Text Books:

1. Stanbury P.F., Whitaker. A & Hall. S. J. Principles of fermentation technology(2nd edition), Aditya Books Private ltd., 2000.
2. Crueger, W. and Crueger, A, Biotechnology: A Textbook of Industrial Microbiology. (2nd Ed.), Panima Publishing Corporation, New Delhi. 2000.
3. Waites M.J., Morgan N.L., Rockey J.S., Industrial Microbiology. 2nd edition,Blackwell Science, 2002.

Reference books:

4. Demain L. & Davies E. Manual of Industrial Microbiology and Biotechnology(2nd edition), ASM Press, Washington, 2004.

5. Emt El Mansi, Bryce, CFA, Demain, AL (Eds). Fermentation Microbiology andBiotechnology (2nd Edition), CRC Press. 2006.

Web references:

1. https://link.springer.com/chapter/10.1007/978-1-4613-8748-0_2
2. https://www.google.com/search?q=Introduction+to+fermentation+&ei=NG45Y5TOGqbn4
3. https://www.google.com/search?q=Microbial+growth+and+death+kinetics+&ei=b245Y7fhFpGt4-E
4. https://www.google.com/search?q=downstream+processing&ei=6m45Y8zoMcGt4-EP
5. https://www.google.com/search?q=Industrial+waste+water+treatment+and+disposal&ei=Lm85Y56

2.E.11.20

		L	T	P	C	Hrs
A20BTL516	MICROBIAL BIOTECHNOLOGY PRACTICAL	0	0	2	1	30

Course objective

- To learn the practical applications of Microbial Biotechnology

Course Outcomes

After the completion of this course, the students will be able to

- Know and Perform the Microbial Biotechnology practicals

Practicals:

1. Design of Batch Fermenter
2. Microbial production of Amylase Enzymes in a Fermenter
3. Microbial production of Alcohol in a Fermenter
4. sauerkraut production
5. Isolation and charectrization of Rhizobium bacteria
6. Seaweed Liquid Fertilizer production
7. Isolation of arbuscular mycorrhizal fungi
8. Solid substrate fermentation
9. Surface fermentation

Text Books:

1.Stanbury P.F., Whitaker. A & Hall. S. J. Principles of fermentation technology(2nd edition), Aditya Books Private ltd., 2000.
2.Crueger, W. and Crueger, A, Biotechnology: A Textbook of Industrial Microbiology. (2nd Ed.), Panima Publishing Corporation, New Delhi. 2000.
3.Waites M.J., Morgan N.L., Rockey J.S., Industrial Microbiology. 2nd edition,Blackwell Science, 2002.

Reference books:

1.Demain L. & Davies E. Manual of Industrial Microbiology and Biotechnology(2nd edition), ASM Press, Washington, 2004.

2.Emt El Mansi, Bryce, CFA, Demain, AL (Eds). Fermentation Microbiology andBiotechnology (2nd Edition), CRC Press. 2006.

Web references:

1. http://biotechjournal.in/images/paper_pdffiles/Bio-61bd9545d78b6.pdf
2. https://www.sciencedirect.com/science/article/pii/S1877705816311997
3. file:///D:/c%20backup/Downloads/3404%20(1).pdf
4. https://link.springer.com/content/pdf/bfm:978-81-322-2095-4/1.pdf
5. https://www.generalmicroscience.com/industrial-microbiology/types-of-fermentation

2.E.11.21

		L	T	P	C	Hrs
A20BTL516	**BIOINFORMATICS PRACTICALS**	**0**	**0**	**2**	**1**	**30**

Course objective

- To learn the Bioinformatics practical to applications in Biology

Course Outcomes

After the completion of this course, the students will be able to

- Perform the Bioinformatics practical on Biology related applications

Practicals:

1. Open access bibliographic resources and literature databases: PubMed, BioMedCentral
2. Nucleic acid sequence databases: GenBank, EMBL, DDBJ;
3. Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL
4. Genome Databases at NCBI, EBI, TIGR, SANGER
5. Sequence file formats: GenBank, FASTA, GCG, MSF.
6. Pairwise sequence alignment: BLAST
7. Multiple sequence alignment: ClustalW, MEGA
8. Protein structure database: PDB, Rasmol.
9. Sequence editing and manipulation: Bioedit and Sequence manipulation suite.

Text Books:

1. Bioinformatics Practical Manual Paperback – Large Print, 28 September 2015 by Mohammed Iftekhar (Author), Mohammed Rukunuddin Ghalib (Author)
2. Bioinformatics: A Practical Manual Paperback – 1 January 2010 by Kasturi K (Author), K. Sri Lakshmi (Author)
3. Bioinformatics Practical Manual : An Easy Guide to In-Silico Analysis ISBN NO:9789391012601, Author(s) / Editor(s):Jaspreet Kaur and Jasvinder Kaur

Reference books:

1. Mount, D. Bioinformatics: Sequence and Genome Analysis; Cold Spring HarborLaboratory Press, New York. 2004
2. Baxevanis, A.D. and Ouellellette. B.F. Bioinformatics – a practical guide to the analysis of Genes and Proteins; John Wiley and Sons, New Jersey, USA. 1998.
3. Lesk, A.M. Introduction to Bioinformatics, First edition, Oxford University Press, UK.2002
4. Rastogi, S.C, Mendiratta. N and Rastogi. R. Bioinformatics: Concepts, Skills andApplications, CBS Publishers, New Delhi, India. 2006

Web references:

1. https://www.psgrkcw.ac.in/wp-content/uploads/2020/06/lab-manual
2. https://www.academia.edu/26542989/LAB_MANUAL_BIOINFORMATICS_LABORATORY
3. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BI0505%20LAB%20MANUAL

2.12.11.22

		L	T	P	C	Hrs
A20BTL517	PLANT BIOTECHNOLOGY PRACTICAL	0	0	2	2	0

Course objective

- To learn the techniques in Plant Biotechnology

Course Outcomes

After the completion of this course, the students will be able to

- Do the plant Biotechnology practicals

Practicals:

1. Safety Practices and Aseptic culture for plant cell culture laboratory
2. Preparation of plant tissue culture medium
3. Micro propagation using (Node, internode, leaf and shoot tip)
4. Callus induction
5. Cell suspension culture
6. Isolation, fusion and Culture of Protoplast
7. Production of Synthetic seeds
8. Transformation of leaf discs with *Agrobacterium tumefaciens*
9. Mapping of plants genome by RAPD marker
10. Genetic variability of Plants by RFLP

Text Books:

1. Satyanarayanan, U. 2005. Biotechnology, Books and allied (p) Ltd.,
2. Bhojwani and Razdan, M.K, 2004. Plant Tissue culture theory & practical.
3. Hurse P.I. and Patterson., M.K. Tissue culture, methods and application,
4. Marchan, D,J. Handbook of cell and Organ culture (2nd ed). Burgess Pub. Co., Minneapolis, USA, (1964).
5. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan

Reference books:

1.Fu, T-J., Singh, G. and Curtis, W.R. (Eds). 1999. Plant Cell and Tissue Culture for the Production of Food ingredients. Kluwer Academic/Plenum Press.
2. Henry, R.J. 1997. Practical Application of plant Molecular biology. Chapman and hall.

Web references:

1. https://jru.edu.in/studentcorner/labmanual/agriculture/Lab%20Manual%20PPB.pdf
2. https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC108J-lab-manual.pdf
3. https://rarsvni.kau.in/sites/default/files/documents/a_plant_biotechnology_laboratory_manual.pdf

2.E.11.23

		L	T	P	C	Hrs
A20BTS505	**IN-PLANT TRAINING / INTERNSHIP**	**0**	**0**	**4**	**2**	**30**

Course objective:

In-Plant training / Internship provides practical knowledge to the students and explain how the industry works. It is expose the students to actual working environment and enhance their knowledge and skill from what they have learned in the college.

Evaluation:

IN-PLANT TRAINING / INTERNSHIP REPORT- A report to be submitted in partial fulfillment of the requirements for the Evaluation and Award of marks.

2.E.11.24

		L	T	P	C	Hrs
A20BTT618	MARINE BIOTECHNOLOGY	4	0	0	4	60

Course objective

- To understand the basics of marine ecosystem and its functioning.
- To understand about the Bioactive compounds from marine organisms
- To understand the Aquaculture
- To know Chromosome manipulation in aquaculture
- To ensures the students to understand about Microbial applications in marine ecoststem

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the marine ecosystem and its functioning.
CO2 – Describe about Bioactive compounds from marine organisms.
CO3 – Describe about Aquaculture.
CO4 – Describe the Chromosome manipulation in aquaculture
CO5 – know the Microbial applications in marine ecoststem

UNIT -I (10 hours)

The marine ecosystem and its functioning: intertidal, estuarine, salt marsh, mangrove, coral reef, coastal & deep sea ecosystems. Hydrothermal vents - biodiversity of organisms. Marine microbes - unculturable bacteria, occurrence, characteristics and exploitation, Barophilic organisms and their potential gene application for Marine Biotechnology Industry

UNIT –II (15 hours)

Bioactive compounds from marine organisms, GFP, RFP characteristics and their applications, Green mussel adhesive protein, Marine hydrocolloids - Agar, Agarose, Chitosan, Chitin, Alginate, Carrageen and its applications, Marine enzymes and their applications in food processing, Marine Pharmaceuticals – Zinconotide, Dolostain, Bryostain.

UNIT – III (15 hours)

Aquaculture - Culturing of shrimp, edible mollusks, oysters, pearl oysters, sea cucumbers. Culture of live feed organisms - brine shrimp, rotifers, marine algae. Techniques for identification of bacterial & viral pathogens in aquaculture Methods of diagnosis of SEMBV, MBV and Vibrio diagnosis, Probiotic bacteria and their importance in aquaculture; Vaccines in aquaculture: Fish, shrimps & prawns

UNIT – IV (10 hours)

Chromosome manipulation in aquaculture – hybridization; Ploidy induction; Gynogenesis, Androgenesis and sex reversal in commercially important fishes; Cryopreservation of fish gametes and embryo; Transgenic fishes - Antifreeze and metalothionine gene.

UNIT – V (10 hours)

Biofouling, biofilms, corrosion and antifouling treatment. Ballast water: consequences & management. Red tides: causative organisms and control. Control of oil spills and bioremediation.

2.E.11.25

Text Books:

1. Milton Fingerman, Nagabhushanam. R, Recent Advances in Marine Biotechnology, Vol. 8: January 1, Science Publisher, (2003).
2. Kim, Se-Kwon, Springer Handbook of Marine Biotechnology, Springer Handbooks,(2014) Pillay
3. T V R; Kutty M N, Aquaculture: Principles and practices, 2nd edition,Blackwell Pub., (2005).
4. Essentials of Marine Biotechnology 1st ed. 2019 Edition, Kindle Edition by Se-Kwon Kim (Author) Format: Kindle Edition

Reference books:

1. Ronald M. Atlas , Richard Bartha, Microbial Ecology: Fundamentals and Applications (4th edition), Benjamin Cummings, (1997).
2. Marco Saroglia, Zhanjiang Liu, Functional Genomics in Aquaculture, Wiley-Blackwell, (2012).
3. Laboratory manual on methodologies for assessing Biodiversity in estuaries,mangroves and coastal waters – Annamalai University

Web references:

1. https://www.sciencedirect.com/topics/earth-and-planetary-sciences
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6163760/
3. https://www.sciencedirect.com/journal/aquaculture
4. https://www.google.com/search?q=Chromosome+manipulation+in+aquaculture
5. https://www.google.com/search?q=Biofouling%2C+biofilms%2C+corrosion+and+antifouling

2.E.11.26

		L	T	P	C	Hrs
A20BTT619	PHARMACEUTICAL BIOTECHNOLOGY	4	0	0	4	60

Course objective

- To understand the Definition and scope of Pharmaceutical Biotechnology.
- To understand the General classes and properties of phytopharmaceuticals.
- To understand the Antimicrobial agents
- To understand the Process of drug discovery and development.
- To ensures the students to understand about Vaccines: concept, production and types

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Definition and scope of Pharmaceutical Biotechnology.
CO2 – Describe the General classes and properties of phytopharmaceuticals.
CO3 – Describe the Antimicrobial agents.
CO4 – know the Process of drug discovery and development
CO5 – know the Vaccines: concept, production

UNIT-I (10 hours)

Definition and scope of Pharmaceutical Biotechnology, sources of drugs, classification of pharmacological agents (based on chemistry, mode of action, dosage forms), route of administration, absorption and bioavailability of drugs, distribution and liver detoxification metabolism and drug excretion.

UNIT-II (15 hours)

General classes and properties of phytopharmaceuticals, Extraction of phytochemicals, Phytochemical screening of medicinal plants. Bioassay guided fractionation methods- TLC, HPTLC, GC, and HPLC, Role of NMR and Mass spectrometry in drug discovery.

UNIT – III (15 hours)

Antimicrobial agents- Antibiotics - source, classification, mode of action, Antimicrobialresistance, and Antimicrobial activity studies (antibacterial, antiviral, antifungal and antiparasitic activity).
Pharmacological Assays - In-vitro assays - anti-oxidant, anti- cancerous and assay system based on enzymes and cells, immunological (RIA and ELISA) - In vivo assays - Anti-inflammatory, Anti-analgesic.

UNIT – IV (10 hours)

Process of drug discovery and development- Target identification and validation, Assaydevelopment, lead optimization, pre-clinical testing, clinical trials involved in drug discovery and development, regulatory approvals and phase IV trials, High throughput screening, CPCSEA guidelines, ICMR guidelines for drug testing.

UNIT-V (10 hours)

Vaccines: concept, production and types - Inactivated, Attenuated, toxoid, Recombinant vaccines, Peptide and DNA vaccines, Edible vaccines, Nanodrugs, Recombinant proteins, approved rDNA drugs in market, Probiotics, Nutraceuticals.

2.E.11.22

Text Books:

1. Satoskar R.S, Nirmala N. Rege, and Bhandarkar S. D, Pharmacology and Pharmacotherapeutics (Revised 23rd Edition), Popular Prakashan, Mumbai.
2. *Tripathy K. D, Essentials of Medical Pharmacology (6th edition), Jaypee publishers*
3. Shoba rani R Hiremath, Text book of industrial pharmacy, orient longman Pvt ltd2008.
4. Crommelin Daan J. A., Sindelar D. Robert (3rd edition) Pharmaceutical Biotechnology: Fundamentals and Applications, CRC Press, 2007.

Reference books:

1. Trease, G.E.and Evans, W.C., 2011, Pharmacognosy (12th edition), Bailliere Tindall Eastbourne, U.K
2. Mukherje P.K.,Quality Control Herbal Drugs–An approach to evaluation of botanicals. Business Horizons Pharmaceutical Publishers, 2005
3. Sambamurthy K., Pharmaceutical Biotechnology (1st edition) New Age International

Web references:

1. https://www.google.com/search?q=Definition+and+scope+of+Pharmaceutical
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4840792/
3. https://www.britannica.com/science/antimicrobial-agent
4. https://www.nebiolab.com/drug-discovery-and-development-process/
5. https://vk.ovg.ox.ac.uk/vk/types-of-vaccine

2.E.11.28

		L	T	P	C	Hrs
A20BTT620	BIOSAFETY, BIO-ETHICS AND IPRS	4	0	0	4	60

Course objective

- To understand the basics of Biosafety
- To ensures the students to understand about the Food safety issues
- To understand the Bioethics
- To understand about IPR
- To ensures the students to understand about Patent.

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the Biosafety.
CO2 – Describe about Food safety issues.
CO3 – Describe about Bioethics.
CO4 – knowabout IPR
CO5 – know about Patent

UNIT-I (10 hours)

Biosafety: Ethical issues concerning biotechnology, Primary containment for biohazards, Recommended biosafety levels for specific microorganisms, Biosafety guidelines for industrial operations with GMOs, Field trial of GM crops.

UNIT-II (15 hours)

Food safety issues: Environmental risk assessment and food and feed safety assessment, Balance of genetically altered and natural population in an ecosystem, Safety of modified crops, Livestock as food and their nutritional values, Social and economic effects.

UNIT – III (15 hours)

Bioethics: Ethical conflicts in biological sciences - bioethics in health care, Artificial reproductive technologies, Ethics in transplantation and stem cell research. Animal rights/welfare, Agricultural biotechnology - Genetically engineered food, environmental risk. Protection of environment and biodiversity – biopiracy.

UNIT – IV (10 hours)

IPR: Different forms of IPR; General concept of patenting; Indian Patent Act 1970; Current Indian patent law, rules and regulation. Basics of patents: types of patents; recent amendments; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT) and implications; procedure for filing a PCT application.

UNIT-V (10 hours)

Role of a Country Patent Office; filing of a patent application. Examples for any plant, microbe, animal patents, Patenting of drugs, Food products, new inventions.

2.E.11.29

Text Books:

1. Satheesh. M. K. Biosafety and Bioethics, (1st edition), I.K. International publishinghouse pvt. ltd., 2008
2. IPR, Biosafety and Bioethics Deepa Goel, Shomini Parashar, Pearson Education India, 2013
3 . Intellectual Property Rights, Bioethics, Biosafety and Entrepreneurship in Biotechnology by Sibi G. 2020

Reference books:

1. Ignacimuthu.S, Bioethics, (1st edition), Alpha Science International, 2009
2. Rajmohan Joshi, Biosafety And Bioethics 01 Edition, 2006. Isha Books.
3. M.K. Sateesh, Bioethics and Biosafety 2008 . I K International Publishing House.
4. Goel And Parashar, IPR, Biosafety and Bioethics, 1e Paperback – 2013, Pearson.

Web references:

1. https://www.iberdrola.com/innovation/what-is-biosafety
2. https://environhealthprevmed.biomedcentral.com/articles/10.1186/s12199-019-0825-5
3. https://bioethics.msu.edu/what-is-bioethics
4. https://www.wipo.int/about-ip/en/
5. https://ipindia.gov.in/patents.htm

2.E.11.30

		L	T	P	C	Hrs
A20BTT621	MEDICAL BIOTECHNOLOGY	4	0	0	4	60

Course objective

- To understand the basics of Medical Biotechnology.
- To ensures the students to understand about the Genetic & Metabolic Disorders
- To understand the Revolution in treatment
- To understand the Cancer - Molecular, cellular and genetic basis.
- To ensures the students to understand about Gene therapy

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the importance of Medical Biotechnology
CO2 – Describe the Genetic & Metabolic Disorders.
CO3 – Describe about the Revolution in treatment.
CO4 – Recognize the Cancer - Molecular, cellular and genetic basis
CO5 – know about the Gene therapy

UNIT-I (10 hours)

Introduction – Origin, significance & worldwide market of Medical Biotechnology. Revolution in clinical diagnosis, Antibody and Nucleic Acid Hybridization techniques, Imaging techniques (Nanodiagnosis).

UNIT -II (15 hours)

Genetic & Metabolic Disorders – Introduction, Classification, Impact of genetic diseases on human health - Chromosome errors - Down syndrome, Klinefelter's and Turner's syndrome. Metabolic disorders – Phenylketonuria, Homocystinuris, Mucopolysaccharidosis, Gangliosidosis, Gaucher's disease, Diabetes, Hemophilia and sickle cell anemia. Treatment of Genetic diseases - prenatal diagnosis, Genetic Counseling - Ethical, Legal and Social Issues.

UNIT – III (15 hours)

Revolution in treatment – Recombinant DNA technology for human insulin, Hepatitis B vaccine. Therapeutic proteins and peptides – Erythropoietin, Tissue plasminogen activator, clotting factor VIII, Antibody Engineering and Therapeutic Antibodies,Phage therapy.

UNIT – IV (10 hours)

Cancer - Molecular, cellular and genetic basis of cancer, tumor virus and oncogenes, tumor suppressor genes and mechanism of action of p53 proteins. Stem Cells - Sourcesand types of stem cells, Stem cell transplant and its types, Potential targets for stem cell treatment, Therapeutic applications of stem cells, Regenerative medicine and Stem cellethics.

UNIT-V (10 hours)

Gene therapy- basic approaches and types of gene therapy, vectors used in gene therapy,application of gene therapy in medicine. Nanobiotechnology - Introduction, types and structures of nanoparticles, biosynthesis of nanoparticles, application of nanoparticles in treatment.

2.E.11.3)

Text Books:

1. Glick B.R. and Pasurank .Molecular biotechnology – Principle and Applications ofRecombinant DNA- J.I.(4th edition), ASM Press. 2010.
2. Anthony D. Ho, Hoffman. R, and Esmail D. Zanjani, Stem Cell Transplantation (4thedition), Wiley – liss publishers, 2006.
3. Hornyak. G.L , Moore. J.J. Tibbals H.F., Dutta. J. Fundamentals of Nanotechnology (1st edition), CRC press, 2008.
4. Medical Biotechnology Book by Dr. V. V. Rao and Pratibha Nallar
5. Medical Biotechnology Book by Bernard R. Glick, Cheryl L. Patten, and T. L. Delovitch
6. Medical Biotechnology Book by S. N. Jogdand

Reference books:

1. Jogdand. S. N. Medical Biotechnology –, (4th edition), Himalayan publishing house,2004.
2. Freshney.I, Stacey. G. N, Auerbach.J.M, Culture of Human Stem Cells (1st edition) ,Wiley – Liss publishers, 2007.

Web references:

1. https://india.oup.com/productPage/5591038/7421214/9780195699609
2. https://www.webmd.com/a-to-z-guides/inherited-metabolic-disorder-types-and-treatments
3. https://www.readcube.com/articles/10.1155/2016/2405954
4. https://wiki.cancer.org.au/oncologyformedicalstudents/Cancer_biology:_Molecular_and_genetic_basis
5. https://www.google.com/search?q=gene+therapy&ei=jMI5Y6D5MsWY4-EP3aizmAw&ved=0ah

2.E.11.32

		L	T	P	C	Hrs
A20BTE610	ENVIROMENTAL BIOTECHNOLOGY	3	0	0	3	45

Course objective

- To understand about the Introduction of Environmental biotechnology.
- To ensures the students to understand about Methanogenic bacteria and biogas.
- To understand the Principles of waste management
- To know the Basics and types of bioremediation .
- To ensures the students to understand about know about Biomonitoring

Course Outcomes

After the completion of this course, the students will be able to

CO1 – know the Introduction to Environmental biotechnology.
CO2 – Describe the Methanogenic bacteria and biogas.
CO3 – Describe the Principles of waste management.
CO4 – know the Basics and types of bioremediation.
CO5 – know about Biomonitoring

UNIT-I (10 hours)

Introduction to Environmental biotechnology, Non Renewable resources - coal, petroleum, and natural gas. Renewable resources - solar, wind, tidal, biomass, nuclear, geothermal and hydroelectric resources. Current status and environmental impact of renewable and non-renewable resources

UNIT-II (7 hours)

Methanogenic bacteria and biogas, microbial hydrogen production, conversion ofsugars to alcohols, plant-based petroleum industry, cellulose as the source of energy, Environmental impact of modern fuels.

UNIT – III (8 hours)

Principles of waste management, types, sources and effects of solid waste, Physical and biological treatment methods, Concept of composting and vermicomposting, Waste to energy conversion, Disposal of wastes.

UNIT – IV (10 hours)

Basics and types of bioremediation, Bioremediation of oil, heavy metals, pesticides contaminated soil and water, Phytoremediation and its types, Biochemical and genetic basis of biodegradation, Xenobiotic compounds and recalcitrance, Biodegradation of pesticides and petroleum products, Biotransformation of heavy metals, Biopolymers and Biodegradable plastics.

UNIT -V (10 hours)

Biomonitoring - Bioassays, Biosensors, Biochips, Biological indicators and Biomarkers, Biorestoration of waste land, Bioleaching – microbes involved, Role of Biotechnology in pollution abatement.

2. E. 11.33

Text Books:

1. Scragg A. H, Environmental Biotechnology, (2nd revised edition), Oxford UniversityPress 2005
2. Jogdand S. N, Environmental Biotechnology (3rd edition), Himalaya publishing housepvt.ltd 2012.
3. Thakur. I. S, Environmental Biotechnology: Basic Concepts and Applications, (2nd revisededition), I K International Publishing House Pvt. Ltd, 2011.

Reference books:

1. Varnam A. H - Environmental Microbiology (1st Edition), ASM Press 2001
2. Wang, L.K., Ivanov, V., Tay, J.H., Hung, Y.T, Environmental Biotechnology(Volume 10), Humana Press 2010

Web references:

1. https://www.biologydiscussion.com/biotechnology/environmental-biotech
2. https://www.intechopen.com/chapters/52663
3. https://www.earthreminder.com/waste-management-principles-methods-benefits/
4. https://microbenotes.com/bioremediation/
5. https://www.epa.gov/sites/default/files/2015-06/documents/biomonitoring_intro.pdf

MSR

2.E.11.34

		L	T	P	C	Hrs
A20BTE611	GENOMICS AND PROTEOMICS	3	0	0	3	45

Course objective

- To understand the basics Definition of of Genomics and proteomics
- To ensures the students to understand about the Comparative genomics.
- To understand the Functional genomics
- To know about protein detection and Analysis
- To ensures the students to understand about Protein characterization

Course Outcomes

After the completion of this course, the students will be able to

CO1 – Define the basic of Genomics and proteomics
CO2 – Describe the Comparative genomics.
CO3 – Describe about Functional genomics
CO4 – know about the detection and Analysis of protein
CO5 – understand about Protein characterization

UNIT-I (10 hours)

Definition: Genome organizations, Principles of gene expression, C-value paradox, Genome mapping – Physical mapping and Genetic mapping, Chromosome walking,Linkage analysis

UNIT-II (15 hours)

Comparative genomics - genome annotation and analysis, Genome-based search for mutations.

UNIT – III (15 hours)

Functional genomics: protein-nucleic acid interactions, RNA interference, Microarrays, Sequencing – Maxam Gilbert and Sanger's methods, Next Generation Sequencing technologies, whole genome sequencing.

UNIT – IV (10 hours)

Proteomics – Introduction, Protein detection & Methods of Analysis of Proteins, Protein purification and Separation techniques, Two dimensional PAGE for proteome analysis; Image analysis of 2D gels

UNIT-V (10 hours)

Protein characterization – MALDI-TOF and Peptide mass finger printing, Protein sequencing, Protein-protein interactions (Two hybrid interaction screening), Protein arrays, Applications of proteome analysis to drug development

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Text Books:

1. Terence A. Brown, Genomes 2, (2nd edition) – Garland Science publishing, 2002.
2. Old R.W & Primrose S. B, Principles of gene manipulation – An introduction togenetic Engineering, Black well publishers, (5th Edition), 2000.
3. Helen Kreuzer and Adrianne Massey, Recombinant DNA and Biotechnology (2ndedition), ASM Press, 2001
4. Concepts and Techniques in Genomics and Proteomics 1st Edition, 2011, N Saraswathy, P Ramalingam.
5. Genomic and Proteomic Techniques: In Post Genomics Era by R.S. Dassanayake
6. Discovering Genomics, Proteomics and Bioinformatics (Paperback) | Released: 2007 By: A. Malcolm Campbell (Author) | Publisher: Pearson Education

Reference books:

1. Primrose S.B. & Twyman R.M. Principles of Genome Analysis and Genomics (3rdedition) Blackwell publishing. 2003.
2. Mike Bailey and Keith Hirst, Advanced Molecular Biology, Haeper Collins PublisherLimited,(2nd edition) 2000.
3. Genomics and Proteomics: Principles, Technologies, and Applications Hardcover – 24 June 2015, by Devarajan Thangadurai (Editor), Jeyabalan Sangeetha (Editor)

Web references:

1. https://journals.asm.org/doi/10.1128/MMBR.00006-15
2. https://www.nature.com/scitable/knowledge/library/comparative-genomics
3. https://www.ebi.ac.uk/training/online/courses/functional-genomics-i-introduction
4. https://www.technologynetworks.com/proteomics/articles/proteomics
5. https://www.biosyn.com/tew/protein-characterization-and-purification-methods

MBN

2.E.11.36

		L	T	P	C	Hrs
A20BTE612	ENZYME TECHNOLOGY	3	0	0	3	45

Course objective

- To understand the Introduction of Enzymes
- To ensures the students to understand about the Enzyme Catalysis.
- To understand the Enzyme Kinetics and Inhibition
- To understand about Enzyme Regulation
- To understand about Industrial and Clinical uses of Enzymes

Course Outcomes

After the completion of this course, the students will be able to

CO1 – know about the Introduction of Enzymes
CO2 – understand about the Enzyme Catalysis
CO3 – understand the Enzyme Kinetics and Inhibition
CO4 – understand about Enzyme Regulation
CO5 – understand about Industrial and Clinical uses of Enzymes

UNIT-I (10 hours)

Introduction to Enzymes: General introduction and historic background- General Terminology, Nomenclature and Classification of Enzymes. Criteria of purity of enzymes- Specific activity. Enzyme units-Katal and IU. Enzyme activity- chemical nature of enzymes. Protein nature of enzymes and Non protein enzymes- Ribozymes and DNAzymes. Metalloenzymes and metal activated enzymes. Coenzymes and Cofactors- Prosthetic group.

UNIT-II (8 hours)

Enzyme Catalysis: Lock and key, Induced fit and Transition state Hypotheses. Mechanism of enzyme catalysis- Acid-base catalysis, covalent catalysis, Metal ion catalysis, Proximity and orientation effects etc. Mechanism of Serine proteases- Chymotryspin, Lysozyme, Carboxypeptidase A and Ribonuclease., Proenzymes (Zymogens).

UNIT – III (10 hours)

Enzyme Kinetics and Inhibition: Kinetics of a single-substrate enzyme catalysed reaction, Michealis-Menten Equation, Km, Vmax, L.B Plot, Turnover number, Kcat. Kinetics of Enzyme Inhibition. Kinetics Allosteric enzymes. Factors affecting the enzyme activity- Concentration, pH and temperature. Reversible Inhibition- Competitive, Non Competitive, Uncompetitive, Mixed, Substrate, Allosteric and Product Inhibition. Irreversible Inhibition.

UNIT – IV (7 hours)

Enzyme Regulation: Feedback Regulation, Allosteric Regulation, Reversible Covalent Modification and Proteolytic Activation. Enzymes in the cell, localization, compartmentation of metabolic pathways, enzymes in membranes, concentrations. Mechanisms of enzyme degradation, lysosomal and nonlysosomal pathways, examples.

UNIT-V (10 hours)

Industrial and Clinical uses of Enzymes (Applied Enzymology): Industrial Enzymes- Thermophilic enzymes, amylases, lipases, enzymes in industry, enzymes used in variousfermentation processes, cellulose degrading enzymes, Metal degrading enzymes.Clinical enzymes- Enzymes as thrombolytic agents, Anti-inflamatory agents, strptokinasae, asparaginase, Isoenzymes like CK and LDH, Transaminases (AST, ALT),Cholinesterases, Phosphatases. Immobilization of enzymes.

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Text Books:

1. Nelson.D.L, Cox. M. M. Lehninger's Principle of Biochemistry. 4th ed. Freeman,2004
2. Berg.J.M, Tymoczko.J.L, Stryer, L. Biochemistry. 6th ed. Freeman, 2006.
3. Understanding Enzymes: An Introductory Text (Muticolour) Paperback – 1 January 2018 by Dr. Aditya Arya (Author, Illustrator), Dr. Amit Kumar (Author), Jayanti Jha (Author)

Reference books:

1. Dixon & Webb. Enzymes. 3rd ed. Longmans, 1979.
2. Murray. R.K, Granner.D.K, Mayes. P.A, Rodwell. V.W.Harper's Biochemistry. 27th ed. McGraw Hill, 2006.
3. Fundamentals Of Enzymology, 3rd Edition, Released: 2009, Publisher: Oxford University Press Publisher Imprint: Oxford University Press

Web references:

1. https://www.shivajicollege.ac.in/sPanel/uploads/econtent/ed8ad70c5da6e71fs
2. https://byjus.com/jee/enzyme-catalyst/
3. https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_
4. https://study.com/learn/lesson/enzyme-regulation-mechanisms.html
5. https://www.slideshare.net/mallikaswathi/industrial-and-clinical-medical-applications

2.E.11.38

		L	T	P	C	Hrs
A20BTL622	MARINE BIOTECHNOLOGY PRACTIACL	0	0	2	1	30

Course objective

- To learn the Marine Biotechnology Practicals

Course Outcomes

After the completion of this course, the students will be able to

- Perform the Marine Biotechnology Practicals

Practicals:

1. Study of any 5 marine bacteria and algae (Macro and micro)
2. Isolation, characterization and antagonistic effects of probiotic bacteria against fishpathogens.
3. DPPH assay for antioxidant extracted from marine algae
4. Extraction of carotenoids from marine algae/Bacteria/Fungi
5. Extraction and estimation of Gelatin / Collagen.
6. Extraction of alkaloids from marine organisms and their separation by TLC.
7. Monodon baculovirus (MBV) detection by PCR
8. Estimation of BOD in marine water
9. Estimation of COD in marine waters

Text Books:

1. Kim, S.K. Springer Handbook of Marine Biotechnology; Springer: Berlin, Germany; Heidelberg, Germany, 2015.
2. Nollet, Leo M. L- Marine microorganisms- extraction and analysis of bioactive compounds-CRC Press_Taylor& Francis (2017)
3. Introduction to Marine Biology, Laboratory Manual Paperback – Import, 29 January 2010 by George Karleskint, James Small, Richard Turner, Peter Baass

Reference books:

1. R. S. K. Barnes, R. N. Hughes(auth.)-An Introduction to Marine Ecology, Third Edition-Wiley-Blackwell (1999)
2. Blanca Hernández-Ledesma, Miguel Herrero-Bioactive Compounds from Marine Foods-Plant and Animal Sources-Wiley-Blackwell (2013)
3. Fabio Rindi, Anna Soler-Vila, Michael D. Guiry (auth.), Maria Hayes (eds.)-Marine Bioactive Compounds_ Sources, Characterization and Applications-Springer US (2012)
4. W. Evans-Trease and Evans Pharmacognosy 15 th ed.-Saunders (2010)

Web references:

1. https://www.christianbook.com/marine-biology-manual-introductions
2. https://www.google.com/search?q=marine+biotechnology+lab+manual&source=hp&eis
3. https://downloads.hindawi.com/journals/specialissues/429647.pdf

2.E.11.39

	L	T	P	C	Hrs
A20BTL622 PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL	**0**	**0**	**2**	**1**	**30**

Course objective

- To learn the Pharmaceutical Biotechnology Practicals

Course Outcomes

After the completion of this course, the students will be able to

- Do the Pharmaceutical Biotechnology Practicalss

Practicals:

1. Preparation of different methods of medicinal plant extracts.
2. Antibacterial activity of medicinal plant extracts.
3. Antifungal activity of medicinal plant extracts.
4. Phytochemical screening of Primary metabolites.
5. Phytochemical screening of Secondary metabolites.
6. Total antioxidant activity.
7. Separation of medicinal plant extracts by chromatography.
8. Estimation of ascorbic acid in multivitamin formulations.
9. Sterility testing of injectables.

Text Books:

1. Satoskar R.S, Nirmala N. Rege, and Bhandarkar S. D, Pharmacology and Pharmacotherapeutics (Revised 23rd Edition), Popular Prakashan, Mumbai.
2. Tripathy K. D, Essentials of Medical Pharmacology (6th edition), Jaypee publishers
3. Shoba rani R Hiremath, Text book of industrial pharmacy, orient longman Pvt ltd 2008.
4. Crommelin Daan J. A., Sindelar D. Robert (3rd edition) Pharmaceutical Biotechnology: Fundamentals and Applications, CRC Press, 2007.

Reference books:

1. Pharmaceutical Microbiology - Hugo, W.B, Russell, A.D 6th edition Oxford Black Scientific Publishers
2. Trease, G.E.and Evans, W.C., 2011, Pharmacognosy (12th edition), Bailliere Tindall Eastbourne, U.K
3. Mukherje P.K.,Quality Control Herbal Drugs–An approach to evaluation of botanicals. Business Horizons Pharmaceutical Publishers, 2005
4. Sambamurthy K., Pharmaceutical Biotechnology (1st edition) New Age International

Web references:

1. https://www.academia.edu/40480618/DEPARTMENT_OF_PHARMACEUTICAL
2. https://www.researchgate.net/publication/257028879_Lab_Manual_in_Pharmaceutical_Microbiology_Biotechnology-I
3. https://web.xidian.edu.cn/yqxia/files/20140227_103205.pdf

2.E.11.40

		L	T	P	C	Hrs
A20BTS606	**R&D and BIO-ENTREPRENEURSHIP**	**0**	**0**	**4**	**2**	**30**

Course objective

- To understand the R & D key concepts and Definitions
- To understand the Innovation and entrepreneurship in bio-business
- To understand about the Bio markets - business strategyand marketing
- To understand the Finance andaccounting
- To understand technology management

Course Outcomes

After the completion of this course, the students will be able to

CO1 – know about R & D key concepts and Definitions
CO2 – Define the Innovation and entrepreneurship in bio-business
CO3 – Understand about the Bio markets - business strategyand marketing..
CO4 – Understand the Finance andaccounting
CO5 – Understand technology management

UNIT -I (6 hours)

R & D key concepts and Definitions-Technological inovation, Characteristics of Technological Innovation and Innovative Activities within the firms, Models of the technological innovation process, role of R&D within the process of innovation, implications of R&D strategy and organisation.

UNIT-II (6 hours)

Innovation and entrepreneurship in bio-business: Introduction and scope in Bio-entrepreneurship, Types of bio-industries and competitive dynamics between the sub-industries of the bio-sector (e.g. pharmaceuticals vs. Industrial biotech), Strategy and operations of bio-sector firms: Factors shaping opportunities for innovation and entrepreneurship in bio-sectors, and the business implications of those opportunities, Alternatives faced by emerging bio-firms and the relevant tools for strategic decision, Entrepreneurship development programs of public and private agencies (MSME, DBT, BIRAC, Make In India), strategic dimensions of patenting & commercialization strategies.

UNIT – III (6 hours)

Bio markets - business strategy and marketing: Negotiating the road from lab to the market (strategies and processes of negotiation with financiers, government and regulatory authorities), Pricing strategy, Challenges in marketing in bio business (market conditions & segments; developing distribution channels, the nature, analysis and management of customer needs), Basic contract principles, different types of agreement and contract terms typically found in joint venture and development agreements, Dispute resolution skills.

UNIT – IV (6 hours)

Finance andaccounting: Business plan preparation including statutory and legal requirements, Business feasibility study, financial management issues of procurement of capital and management of costs, Collaborations & partnership, Information technology.

UNIT-V (6 hours)

Technology management: Technology – assessment, development & upgradation, Managing technology transfer, Quality control & transfer of foreign technologies, Knowledge centers and Technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GCP, GLA, GMP).

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Text Books:

1.R&D Strategy and Organisation - World Scientific by V Chiesa
2. Adams, D. J., & Sparrow, J. C. (2008). *Enterprise for Life Scientists: DevelopingInnovation and Entrepreneurship in the Biosciences*. Bloxham: Scion.
3. Shimasaki, C. D. (2014). *Biotechnology Entrepreneurship: Starting, Managing, andLeading Biotech Companies*. Amsterdam: Elsevier. Academic Press is an imprintof Elsevier.

Reference books:

1. Onetti, A., & Zucchella, A. *Business Modeling for Life Science and Biotech Companies: Creating Value and Competitive Advantage with the Milestone Bridge*.Routledge.
2. Jordan, J. F. (2014). *Innovation, Commercialization, and Start-Ups in Life Sciences*. London: CRC Press.
3. Desai, V. (2009). *The Dynamics of Entrepreneurial Development and Management*.New Delhi: Himalaya Pub. House.

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1. https://www.oecd-ilibrary.org/docserver/9789264239012-4-en
2. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.4354&rep=rep1&type=pdf
3. https://www.researchgate.net/publication/262153345_Marketing_of_Biological_Products
4. bplans.com/accounting-and-bookkeeping-business-plan/
5. emerald.com/insight/content/doi/10.1108/jtmc.2007.30202aaa.001/full/html

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		L	T	P	C	Hrs
A20BTS607	SEMINAR PRESENTATION	0	0	4	2	30

Course objective:

The objective of the course is to enhance the communication skill of student and to introduce students to the latest upcoming updates of the field.

Evaluation:

Identifying suitable topic in Biotechnology and Literature survey. Preparation of report for the seminar presentation and Presentation of the seminar in PPT format. Discussion on the topic and evaluation.

2.E.11.43

Sl.No.	Regulation	Sem	Couse Title with CourseCode	Unit No.	Particulars
1	R 2020	V	Microbial Biotechnology-A20BTT513	Complete Course from VI sem to V sem	• The Animal Biotechnology (DSC) course was substituted by the Microbial Biotechnology course, because the Animal Biotechnology practicals need highly sterile condition. So, Animal Biotechnology course was consider as DSE (without practical) in the 5th sem.
2	R 2020	V	Plant Biotechnology-A20BTT515	Complete Course from VI sem to V sem	• The Medical Biotechnology (DSC) course was substituted by the Plant Biotechnology course, because the Medical Biotechnology practicals need highly sterile condition and High end requirments. So, Medical Biotechnology course was consider as DSC (without practical) in the 6th sem.
3	R 2020	V	Microbial Biotechnology and Bioinformatics practical-A20BTL516	Lab	• The Animal Biotechnology and Bioinformatics practical was Repalced by Microbial Biotechnology and Bioinformatics practical
5	R 2020	V	Plant Biotechnology practical - A20BTL517	Lab	• The Medical Biotechnology practical was Repalced by Plant Biotechnology practical
6	R 2020	VI	Marine Biotechnology-A20BTT618	Complete Course from DSE to DSC in the same sem	• The Marine Biotechnology course was changed form DSE to DSC in the same VI sem
7	R 2020	VI	Pharmaceutical Biotechnology-A20BTT619	Complete Course from DSE to DSC in the same sem	• The Pharmaceutical Biotechnology course was changed form DSE to DSC in the same VI sem
8	R 2020	VI	Medical Biotechnology-A20BTT621	Complete Course from V sem to VI sem	• Medical Biotechnology course was replaced the Genomics and proteomics course and it was consider as DSE in the VI sem.

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9	R 2020	VI	Marine Biotechnology and Pharmaceutical practical- A20BTL622	Lab	• The plant Biotechnology and Microbial Biotechnology practical was Repalced by Marine Biotechnology and Pharmaceutical Biotechnology practical
10	R 2020	VI	Seminar presentation- A20BTS607	SEC	• Panel suggested that to add seminar presentation (PPT) on Biotechnology relavent topic in the 6th semester as a additional skill Enhansment course to replace the Project

2.E.11.45

2.E.11.46