

B.Sc. BIOTECHNOLOGY

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	HRS/ WEE K	CREDIT	CIA MARKS	SE MARKS	TOTAL MARKS
I	14U1LT1/LA1/LF1/LH1/LU1	I	Language -I		6	3	40	60	100
	14UCN1E1	II	English -I		6	3	40	60	100
	14UBT1A1	III	Allied I	Plant Diversity	5	2	20	30	50
	14UBT1A1P	III	Allied I:	Plant Diversity-Practical	3	2	20	30	50
	14UBT1C1	III	Core I	Cell Biology	4	4	40	60	100
	14UBT1M1	III	Major Based Elective – I	Basic Biotechnology	3	3	40	60	100
	14UCN1VE	IV	Value Education	Value Education	3	3	40	60	100
TOTAL					30	20	240	360	600
II	14U1LT2/LA2/LF2/LH2/ LU2	I	Language -II		6	3	40	60	100
	14UCN2E2	II	English -II	English	6	3	40	60	100
	14UBT 2A2	III	Allied II	Biophysics and Biochemistry	4	2	20	30	50
	14UBT 2A2P	III	Allied II	Biophysics and Biochemistry-practical	3	2	20	30	50
	14UBT 2C2	III	Core II	Animal Diversity	4	4	40	60	100
	14UBT 2M2	III	Major Based Elective –II	Bioinstrumentation	3	3	40	60	100
	14UBT2N1	IV	Non Major Elective – I#		2	2	40	60	100
14UCN 2ES	IV	Environmental Studies	Environmental Studies	2	2	40	60	100	
TOTAL					30	21	280	420	700
III	14U1LT3/LA3/LF3/LH3/ LU3	I	Language -III		6	3	40	60	100
	14UCN3E3	II	English -III		6	3	40	60	100
	14UBT3A3	III	Allied III	Microbiology	4	2	20	30	50
	14UBT 3A3P	III	Allied III	Microbiology-Practical	3	2	20	30	50
	14UBT 3C3	III	Core III	Principles of Genetics	4	4	40	60	100
	14UBT 3M3	III	Major Based Elective – III	Developmental Biology	3	3	40	60	100
	14UBT 3N2	IV	Non – Major Elective –I#		2	2	40	60	100
14UCN3S1	IV	Skill Based Elective - I	Soft Skills	2	2	40	60	100	
TOTAL					30	21	280	420	700
IV	14U1 LT4/LA4/LF4/LH4/ LU4	I	Language -IV		6	3	40	60	100
	14UCN4E4	II	English -IV		6	3	40	60	100
	14UBT 4A4	III	Allied IV	Basic Immunology	5	2	20	30	50
	14UBT 4A4P	III	Allied IV	Basic Immunology -Practical	3	2	20	30	50
	14UBT 4C4	III	Core IV	Enzymology and Enzyme Technology	4	4	40	60	100
	14UBT 4C5	III	Core V	Biopharmaceuticals	4	4	40	60	100
	14UBT 4S2	IV	Skill Based Elective – II	Human Anatomy and Physiology	2	2	40	60	100
	14UCN4EA	V	Extension Activities	NCC, NSS, etc.,	-	2	-	-	-
14UBT 4EC1		Extra Credit -I	Mushroom Cultivation	-	4*	-	100*	100*	
14UBT 4EC2		Extra Credit -II	Ethno botany and Herbal Medicine	-	4*	-	100*	100*	
TOTAL					30	22	240	360	600
V	14UBT5C6	III	Core VI	Molecular Biology	5	4	40	60	100
	14UBT5C7	III	Core VII	Recombinant DNA Technology	4	4	40	60	100
	14UBT5C8P	III	Core VIII	Molecular Biology and Recombinant DNA Technology - Practical	4	4	40	60	100
	14UBT5C9	III	Core IX	Bioprocess Technology	4	4	40	60	100
	14UBT5C10	III	Core X	Environmental Biotechnology	4	4	40	60	100
	14UBT5C11P	III	Core XI	Bioprocess Technology and Environmental Biotechnology - Practical	4	4	40	60	100
	14UBT5M4	III	Major Based Elective – IV	Biostatistics and Computer Applications in Biology	3	3	40	60	100
	14UBT5S3	IV	Skill Based Elective – III	Cancer and Stem Cell Biology	2	2	40	60	100
14UBT5EC3		Extra Credit – III	Marine Ecology and Biodiversity Conservation	-	4*	-	100*	100*	
TOTAL					30	29	320	480	800
VI	14UBT6C12	III	Core XII	Plant Biotechnology	5	4	40	60	100
	14UBT6C13	III	Core XIII	Food Biotechnology	5	4	40	60	100
	14UBT6C14P	III	Core XIV	Plant Biotechnology and Food Biotechnology -Practical	5	4	40	60	100
	14UBT6C15	III	Core XV	Animal Biotechnology	4	4	40	60	100
	14UBT6C16	III	Core XVI	Bioinformatics	4	4	40	60	100
	14UBT6C17P	III	Core XVI	Animal Biotechnology and Bioinformatics -Practical	4	4	40	60	100
	14UBT6S4	IV	Skill Based Elective - IV	Forensic Science	2	2	40	60	100
	14UCN6GS	V	Gender Studies	Gender Studies	1	1	40	60	100
14UBT6EC4		Extra Credit-IV	IPR and Biosafety	-	4*	-	100*	100*	
TOTAL					30	27	320	480	800
GRAND TOTAL					180	140	1680	2520	4200

Non Major Elective Courses offered to the other Departments:

SEM	COURSE TITLE
II	Advance Biotechnology
III	Agriculture Biotechnology

* Not considered for Grand Total and CGPA

**SEMESTER I: ALLIED I
PLANT DIVERSITY**

Course Code: 14UBT1A1
Hours/Week: 5
Credit: 2

Max Marks: 50
Internal Marks: 20
External Marks: 30

Objective:

To study the fundamental knowledge about plant and their reproductive biology.

UNIT I **15 hours**

ALGAE: General characteristics and economic importance of algae, Algae life cycle. (Oscillatoria, Chlorella, Oedogonium, Caulerpa, Cyclotella, Sargassum and [#]Gracilaria[#]).

UNIT II **15 hours**

FUNGI: General characteristics of Fungi; Economic importance of Fungi, Lichen – Usnea. Fungal life cycle (Plasmodiophora, Albugo, Peziza, [#]Puccinia and Cercospora[#]).

UNIT III **15 hours**

BRYOPHYTES AND LICHENS: General characteristics and economic importance of Bryophytes, Bryophytes life cycle (Marchantia, Anthoceros and Funaria and [#]Usnea[#]).

UNIT IV **15 hours**

PTERIDOPHYTES: General characteristics and economic importance of pteridophytes, pteridophytes life cycle (Lycopodium, Isoetes, Equisetum, Adiantum and [#]Marsilea[#]).

UNIT V **15 hours**

GYMNOSPERMS AND ANGIOSPERMS: General characters and economic importance of Gynosperm (Cycas, Araucaria and Gnetum). Taxonomy – Classification – Artificial (Linnaeus system) – Natural (Bentham and Hooker's system). Binomial Nomenclature – [#]Herbarium Preparation[#].

[#] **Self-study portion**

Text Books:

- T.B. 1. Gangulee Das and Datta. College Botany (Vol- I). New central Book Agency P. Ltd. 6th Edition. 2007.
- T.B. 2. Gangulee Das and Datta. College Botany (Vol- II). New central Book Agency P. Ltd. 6th Edition. 2007.

Unit I Chapter I, T.B- 2

Unit II Chapter II, T.B- 2

Unit III Chapter III and VII, T.B-2

Unit IV Chapter IX, T.B-2

Unit V Chapter X, T.B-1

Books for References:

1. Alexopoulos, C. J., Introduction to Mycology, John Wiley & Sons, New York,(1952).
2. Bhojwani, S. S. &Bhatnagar, SP., Embryology of Angiosperms, Vikas Publishing House (P) Ltd., New Delhi,(1994)
3. Gangulee, H. C. &Kar, AK. College Botany, Vol-I,II& III, Books & Allied Pvt. Ltd. Calcutta,(1989).
4. Pandey, B. P. Simplified course in Botany. S. Chand and Company Ltd., NewDelhi,(2005).
5. Pandey, B. P., Taxonomy of Angiosperms, S. Chand & Co. Ltd., New Delhi,(1999).
6. Sambamurty, A.V.V.S &Subrahmanyam, N.S., A Text Book of Economic Botany. Wiley Eastern Ltd., New Delhi, Bangalore, (1989).
7. Sharma, O. P., Text Book of Fungi, Tata McGraw Hill, New Delhi,(1989).
8. Smith, G. M., Cryptogamic Botany Vol-1&II, McGraw Hill, New York, (1955).
9. Vasishta BR &Sinha AK., Botany for degree students Fungi. S Chand and Company Ltd., New Delhi,(2003).
10. Vasishta P. C, Sinha AK &Anilkumar,. Botany for degree students,(2005).

SEMESTER I: ALLIED I
PLANT DIVERSITY – PRACTICAL

Course Code:14UBT1A1P

Hours/Week :3

Credit:2

Max Marks:50

Internal Marks:20

External Marks:30

Objective:

To observe the fundamental knowledge about morphology and anatomy structure of plants

- 1. ALGAE:** Oscillatoria, Chlorella, Oedogonium, Caulerpa, Cyclotella, Sargassum and Gracilaria.
- 2. FUNGI:** Plasmodiophora, Albugo, Peziza, Puccinia and Cercospora.
- 3. LICHEN:** Usnea.
- 4. BRYOPHYTES:** Marchantia, Anthoceros and Funaria.
- 5. PTERIDOPHYTES:** Lycopodium, Isoetes, Equisetum, Adiantum and Marsilea.
- 6. GYMNOSPERMS:** Cycas, Araucaria and Gnetum.
- 7. ANGIOSPERM:** Identification of one species from the families covered in theory with reference to local flora, Annonaceae, Tiliaceae, Rutaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Sapotaceae, Apocynaceae, Asclepiadaceae, Lamiaceae, Amaranthaceae, Orchidaceae and Poaceae.

Text Books:

1. Vasishta P. C, Sinha AK & Anilkumar,. Botany for degree students,(2005).
2. Gangulee, H. C. & Kar, AK. College Botany, Vol-I,II& III, Books & Allied Pvt. Ltd. Calcutta,(1989).

**SEMESTER I: CORE I
CELL BIOLOGY**

Course Code:14UBT1C1
Hours/week:4
Credit:4

Max Marks:100
Internal Marks:40
External Marks:60

Objective:

Understanding the structural and functional aspects of the cell.

UNIT I : 12 hours

Microscope; Cell as a Basic unit; Classification of cell types; #Cell theory#; Organization of plant and animals cells; Comparison of Microbial, Plant and Animal cells; Biochemical composition of cells and their Biological Significance.

UNIT II: 12 hours

Ultra structure of cells; Sub cellular Organization; structure and function of cell membranes, Cytosol Endoplasmic reticulum, Chloroplast, vacuoles, #Peroxisomes#, lysosome and cell wall.

UNIT III: 12 hours

Chromosomes and cell division: Morphology, Structural Organization, ultra structure of chromosome, #Specialized chromosomes#; salivary gland and lamp brush chromosomes.

UNIT IV: 12 hours

Cell division (Eukaryotic and prokaryotic); Mitosis, meiosis and cell cycle.

UNIT V: 12 hours

Specialized cells: cell movement: amoeboid, ciliary, flagellar movements, nerve cells and muscle cells – #Apoptosis-programmed cell death#.

Self-study portion

Text Book:

1. Robert E. Hausman. The Cell – A Molecular Approach, 4th Edition, ASM Press Washington DC, 2007.

Unit I Chapter II

Unit II Chapter I, II and X

Unit III Chapter V

Unit IV Chapter XVI

Unit V Chapter XII & XVII

Books for References:

1. Ambrose and Dorothy M Easty. Cell Biology - ELBS Publications. (2000).
2. David.Sadava Cell biology Organelle Structure and function-Panima Publication, Indian Edition. . (2006).
3. De Roberties. Cell Biology-Blaze publishers & Distributors Pvt.Ltd.,NewDelhi.(2006).
4. EDP Roberties& EMF Roberties. Cell Biology & Molecular Biology-,Sauder College.8thEdition,Wavely publication.(1995).
5. Jack D Bruke. Cell Biology - The William Twilkins Company. (2002).
6. Lodish and Berk. Molecular Cell biology-5th Edition. (2006).
7. Powar.C.B. Cell Biology- Himalaya publishing house, Edition -3, New Delhi.(1983).

**SEMESTER I: MAJOR BASED ELECTIVE – I
BASIC BIOTECHNOLOGY**

Course Code: 14UBT1M1
Hours/week: 3
Credit: 3

Max Marks: 100
Internal Marks: 40
External Marks: 60

Objective:

To understand the fundamental principles of Biotechnology and its application.

UNIT I: 9 hours

An Introduction to Biotechnology: Definition, History of Biotechnology, Conventional and Modern Biotechnology, public perception of Biotechnology, Careers in Biotechnology, Indian Biotech Sector, #International organization#.

UNIT II: 9 hours

Nucleic acids & their organization: Definition, DNA and RNA as genetic material, DNA & RNA structures, central dogma of life, #prokaryotic and eukaryotic genome organization#.

UNIT III: 9 hours

Genetic engineering and its application: outline of gene cloning, host system, vector, and enzymes in gene cloning, transformation. #GMOS's Application of transgenic technology in plants and animals#.

UNIT IV: 9 hours

Selection of recombinants – selection of recombinant in bacteria, plants. Reporter genes. #Selection for antibiotic resistance genes#.

UNIT V: 9 hours

Marker Techniques & Regulatory issue in Biotechnology: Types of electrophoresis, PCR and its types, Biosafety – IPR – Protecting Biotechnological inventions – patents. #Bioethics – facing problem and finding solutions#.

Self-study portion

Text Books:

1. Clark D.P., Pazdernik N.J., (2009). Biotechnology – Applying the genetic revolution, Elsevier Academic Press.
2. Pandian, T.T. and Kandavel D., (2008). Textbook of Biotechnology. I.K International.
3. Sukatsch, (2006). Basic Biotechnology: A Student's Guide, Panima Publishing Corporation.

UNIT I: Chapter I, T.B.1

UNIT II: Chapter 1, Part III & IV, T.B.2

UNIT III: Chapter 3, T.B.1

UNIT IV: Chapter 4, T.B.1

UNIT V: Chapter 11, T.B.3

Books for References:

1. John M. Walker and Ralph Rapley. Molecular Biology and Biotechnology. Royal Society of Chemistry.(2009).
2. Kumar, H.D. Modern concepts of Biotechnology. Vikas Publishing House Pvt Ltd.(1998).
3. Ravi Pathak,. Introduction to Biotechnology, Atlantic Publishers.(2007).

SEMESTER II: ALLIED II
BIOPHYSICS AND BIOCHEMISTRY

Course Code: 14UBT2A2

Hours/week: 4

Credit: 2

Max. Marks: 50

Internal Marks: 20

External Marks: 30

Objectives:

To ensure students have a strong grounding in structures and reactions of biomolecules. To introduce them to metabolic pathway of the major biomolecules and relevance to clinical conductors.

UNIT I:

12 hours

BIOENERGETICS : Thermodynamics – Principles of bioenergetics- free energy functions – ATP as main carrier of free energy . #Energy molecules, Biological oxidation#-reduction reaction.

UNIT II:

12 hours

BIOMOLECULAR INTERACTIONS: Structure and properties of H₂O. Solute-Solvent interactions-Bonding; Strong and weak interactions-hydrogen bonding-hydrophobic-#hydrophilic interactions and ionic interactions#.

UNIT III:

12 hours

STRUCTURE AND PROPERTIES OF CARBOHYDRATES: Carbohydrates (mono, di, oligo & polysaccharides) Proteoglycans, #glycosaminoglycans, mutarotation#, glycosidic bond, reactions of monosaccharides, reducing sugars.

UNIT IV:

12 hours

STRUCTURE AND PROPERTIES OF LIPIDS: Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, #sphingolipids#, cholesterol, steroids, prostaglandins.

UNIT V:

12 hours

STRUCTURE AND PROPERTIES OF AMINO ACIDS AND NUCLEIC ACIDS: Amino Acids, Peptides, Proteins, structures, hierarchy of primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. #Nucleic acids: purines, pyrimidines, nucleosides, nucleotides#, RNA, DNA reactions, properties, measurement, nucleoprotein complexes.

Self -study portion

Text Books:

1. Voet.D and Voet.J.G, Biochemistry, 3rd Edition, John Wiley& Son, 2004.

Unit-1 Chapter 12 Page no 476-490

Unit-2 Chapter 17 Page no 581-618

Unit-3 Chapter 25 Page no 909-969

Unit-4 Chapter 28 Page no 1069-1098

Unit-5 Chapter26 Page no 985-1044.

Books for References:

1. Conn, E.E., (1987). "Outlines of Biochemistry" 5th Edition, John Wiley & Sons,
2. Nelson, D.L. and M.M. Cox, (2005). "Lehninger's Principles of Biochemsitry", 4th Edition, W.H.Freemen& Co.
3. Rastogi, S.C. (2003). "Biochemistry" 2nd Edition, Tata McGraw-Hill.
4. Satyanarayana, U. and U. Chakerapani, (2006). "Biochemistry" 3rd Rev. Edition, Books & Allied (P) Ltd.,
5. Voet, D. and Voet, J.G., (2004). "Biochemistry", 3rd Edition, John Wiley & Son.

SEMESTER II: ALLIED II
BIOPHYSICS AND BIOCHEMISTRY – PRACTICAL

Course Code: 14UBT2A2P

Hours/week: 3

Credit: 2

Max Marks: 50

Internal Marks: 20

External Marks: 30

Objectives:

1. General guidelines for working in biochemistry lab
2. Units of volume, weight, density and concentration measurements and their range in biological measurements.
3. Demonstration of proper use of volume and weight measurement devices.
4. Determination of p^H using p^H meter.
5. Preparation of buffer – titration of a strong acid and a weak base.
6. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars
7. Quantitative method for amino acid estimation using ninhydrin.
8. Protein estimation by Lowry's methods.
9. Chromatographic methods for macromolecule separation – paper and TLC chromatography.
10. Estimation of nucleic acids.

Text Books:

1. Robert L. Switzer and Liam F. Garrity. Experimental Biochemistry, W.H. Freeman and Company, New York, 1999.

Ex. no 1-3 Chapter 1-2 Page no 1-17

Ex. no 4-8 Chapter 5-6 Page no 39-49

Ex. no 8-10 Chapter 8-10 Page no 129-152.

**SEMESTER II: CORE II
ANIMAL DIVERSITY**

Course Code: 14UBT2C2
Hours/week: 4
Credit: 4

Max Marks: 100
Internal Marks: 40
External Marks: 60

Objective:

To study the fundamental knowledge about vertebrates and invertebrate animals.

UNIT I: **12 hours**

Animal Behavior: Kinesis – Taxis – instinctive learned behaviors.

UNIT II: **12 hours**

Wild life conservation of management. Remote sensing techniques in wild life management. Biodiversity – Types – Mega diversity with reference to India – #conservation strategies#.

UNIT III: **12 hours**

Classification of invertebrates upto phyla with diagnostic features and examples, #Type study: Coakroach#.

UNIT IV: **12 hours**

General characters of chordates – classification of vertebrata upto classes with suitable examples. #Type study: Frog#.

UNIT V: **12 hours**

Insect diversity – classification, Conservation and management. #Diversity and Economical importance#.

#Self -study portion

Text Books:

1. Ekambaranatha Ayyar, Outlines of Zoology. Vol – I: S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai. 1993.
2. Verma Tyagi and Agarwal. Animal Physiology. S. Chand and Co. Delhi. (1997).

Unit I Chapter 1 T.B.1

Unit II Chapter 3, T.B.1

Unit III Chapter 5, T.B.1

Unit IV Chapter 8 T.B.1

Unit V Chapter 5 T.B.2

Books for Reference:

1. Leelavathy. S. Nair, Revised enlarged Edition. A Text book of Invertebrates, Saras Publication. (2001).

**SEMESTER II: MAJOR BASED ELECTIVE –II
BIOINSTRUMENTATION**

Course Code: 14UBT2M2

Hours/ week: 3

Credit:3

Objectives:

Max. Marks:100

Internal Marks:40

External Marks:60

The objective is to educate the students on the basic principles of instrumentation and applications of the analytical tools of biochemistry.

UNIT I

9 hours

Introduction: Scope and History of Microbiology. Classification of microorganisms - bacterial and fungal. Morphology and fine structure of eubacteria, archeabacteria, fungi and virus - Bacteriophage. Properties of Light - Light microscopy - #Phase contrast – Interference#.

UNIT II

9 hours

Spectroscopy: Laws of absorption and absorption spectrum. Principle, instrumentation and applications of UV-visible, IR spectroscopy and #spectro-fluorimetry#.

UNIT III

9 hours

Centrifugation: Basic principles of sedimentation. Low-speed and high-speed centrifuges. Ultracentrifuge- instrumentation and applications. Subcellular fractionation by differential centrifugation. #Density-gradient centrifugation- rate zonal and isopycnic#.

UNIT IV

9 hours

Chromatography: Principle, instrumentation and applications of TLC, GLC, #HPLC#- principle, instrumentation and applications.

UNIT V

9 hours

Electrophoresis and Radioisotope techniques: Electrophoresis: General principles, support media. Electrophoresis of proteins- #SDS-PAGE#, Native gels, Gradient gel, Isoelectric focusing, Agarose gel electrophoresis. Application of radioisotope in Biology.

#Self -study portion

Text Books:

1. Boyer, R..Modern Experimental Biochemistry. 3rd ed. Addison Wesley Longman.(2000).
2. Prescott LM- Harley JP- Klein DA. Microbiology- Wm.C. Brown Publishers.(1996).
Unit I Chapter I, II, III, T.B-1
Unit II Chapter V, T.B-1
Unit III Chapter 7, T.B-1
Unit IV Chapter 3 T.B-1
Unit V Chapter 4 T.B-1

Books for Reference:

1. Wilson and Walker. Principles and techniques of biochemistry and molecular biology. 6th ed. Cambridge University Press.(2005).

SEMESTERII:NON MAJOR ELECTIVE – I

ADVANCE BIOTECHNOLOGY

Course Code:14UBT2N1

Hours/week:2

Credit:2

Max Marks:100

Internal Marks: 40

External Marks: 60

Objective:

To provide with knowledge and to understand the current theories, concepts and laboratory Practices in Biotechnology.

UNIT I

6 hours

Recent Achievements in Biotechnology: An overview - Timeline of Biotechnology –. Scope and importance of Biotechnology in agriculture, medicine, animal, industry and environment.

UNIT II

6 hours

Advancement in Medical and Environmental Biotechnology: pharmacogenomics – toxicogenomics – personalized medicine - #Microbial functions for degradation of pollutants.

UNIT III

6 hours

Advancement in Plant and Animal Biotechnology: Transgenic plants – Genetically modified fruits & vegetables – #plant edible vaccines#. Transgenic animals –Genetically modified fish,pig and insects.

UNIT IV

6 hours

Advancement in Nanotechnology and Stem cell biology: Nanorobots – biochip, nanomedicine – drug/protein/peptide delivery; Stem cell therapy – brain, heart damageand#cancer#.

UNIT V

6 hours

Latest achievements in Biotechnology: Decay – fighting microbe – SmART, Artificial lymph node, asthma sensor, oral Cancer Spit Test, Biological Pacemaker, Smart Contact Lens for Glaucoma, Absorbable Heart Stent, Gastrointestinal Liner, #Nano tea bag in water purification#.

#Self -study portion

Text Book:

1. Amita Sarkar. Embryonic Stem cells, Discovery Publishing House Pvt. Ltd. (2009).
2. Brown CM, Campbell I & Priest FG. *Introduction to Biotechnology*. (2005).
3. Gupta P.K., *Biotechnology and Genomics*, Rastogi publication. (2004).

UNIT I: Chapter 6, 8, 10, T.B.2

UNIT II: Chapter 49,50. T.B.3

UNIT III: Chapter 20, 34,35. T.B.3

UNIT IV: Chapter 8, T.B.1

UNIT V: Chapter 9, T.B.3

Books for References:

1. Acton, A. *Advances in Bionanotechnology Research and Application*, Scholarly Editions. (2013).
2. Chiranjib Chakraborty. *Advances in Biochemistry and Biotechnology*, Daya Books. (2005)
3. Pankaj K. Bhowmik, Saikat K. Basu, Aakash Goyal, *Advances in Biotechnology*, Bentham Science Publishers. (2009).

**SEMESTER III: ALLIED III
MICROBIOLOGY**

Course Code:14UBT3A3

Hours/ week: 4

Credit: 2

Max. Marks: 50

Internal Marks: 20

External Marks: 30

Objective:

To understand the applications of different microbes and to study the applications of microbiology in various industries.

UNIT I

12 hours

History and Scope of Microbiology:Discovery of microbial world: Theories of Biogenesis and Abiogenesis; Contribution of scientists in the field of microbiology; Anton van Leeuwenhoek, Edward Jenner, Robert Koch, Louis Pasteur, Iwanowsky, Alexander Fleming and Paul Ehrlich.
#Scope and application of microbiology in various field#.

UNIT II

12 hours

Microbial Growth:Mathematicalexpression of growth, growth curve, measurement of growth. Synchronous culture and Continuous culture.Factors affecting microbial growth.Culture media and their types. Pure Culture Techniques-Serial dilution methods - spread plate – pour plate – streak plate technique. #Culture collection and preservation of microbial cultures#.

UNIT III

12 hour

Nutritional Requirements: Uptake of nutrients by microorganisms. Photosynthetic microorganisms.Nitrate and sulfur oxidizing bacteria, nitrate and sulfate reducing bacteria.#Nitrogen fixation#.

UNIT IV

12 hours

Host – Parasite Relationship:Normalmicroflora, Causative agent, pathogenesis and control measures of typhoid, cholera, tuberculosis, AIDS, hepatitis, malaria and candidiasis;#Antimicrobial agents and their mode of action#.

UNIT V

12 hours

Mutation and Mutagenesis:UV and chemical mutagens; Types of mutation; Methods of genetic analysis – Transformation, Conjugation, Transduction, Recombination.Plasmids and Transposons.#Viruses and their genetic system#.

#Self-study portion

Text Books:

- T.B.1. Anantha Narayanan R and Panikar CKJ. (6th Edition) General Microbiology, Orient Longman Pvt. Ltd. (2002).
- T.B. 2. Jacquelyn G. Black. Microbiology Principles and Explorations. John Willey & Sons 4th Edition. 1999.
- T.B. 3. Mans G. Schlegel. General Microbiology. Cambridge Edition, Cambridge University Press. 2004.

Unit I Chapter I, T.B-2

Unit II Chapter VI, T.B-3

Unit III Chapter VI, T.B-3

Unit IV Chapter II, T.B-1

Unit V Chapter II, T.B-2

Books for References:

1. Benson, H. J., Microbiological Applications: A Laboratory manual in General Microbiology. 7th Edition. McGraw Hill, (1999).
2. Cappuccino, J G and Sherman N. Microbiology – Laboratory Manual. 5th edition. Editors: Wirth AE and Ols en L, (1996).
3. Dubey, RC and DK. Maheswari. A text Book of Microbiology. S. Chand & Company Ltd, New Delhi, (2005).
4. Freifelder, D., Microbial Genetics, Narosa Publishing House. (1995).
5. Pelczar, M. J, Chan ECS, and Krieg NR., Microbiology, 5th Edition Tata McGraw Hill Publishing Company, (2006).
6. Prescott, LM, Harley JP and Klein DA, Microbiology, 6th Edition. McGraw Hill, (2005).
7. Salle, AJ, Principles of Bacteriology. (7th Edition) Tata McGraw-Hill Publishing Company Ltd. New Delhi. (1986)
8. Talero, KP and Talero A.,. Foundations in Microbiology. 4th Edition McGraw Hill, (2002).

**SEMESTER III: ALLIED III
MICROBIOLOGY – PRACTICAL**

Course Code: 14UBT 3A3P
Hours/week: 3
Credit: 2

Max. Marks: 50
Internal Marks: 20
External Marks: 30

Objective:

To understand the fundamental knowledge in microorganism growth and development.

1. Sterilization Techniques & sterilization of Media.
2. Media Preparation (solid & liquid).
3. Isolation & Enumeration of Micro-organism from water, air, soil
4. Types of culture method-streak plate, pour plate, Stab & slope method.
5. Measurement of Growth rate of bacteria.
6. Staining Techniques – Gram's staining, Negative staining, flagella staining, spore staining, Lactophenol cotton blue staining.
7. Characterization of micro organisms – motility, carbohydrate utilization, MR-VP, Citrate utilization, Catalase, Oxidase, H₂S production test.
8. Microscopic slide preparation – Bacteria & fungi.
9. Antibiotic sensitivity Test.

Text Book:

1. Cappuccino Sherman. Microbiology – A Laboratory Manual, Pearson Education, 2004.

**SEMESTER III: CORE III
PRINCIPLES OF GENETICS**

Course Code: 14UBT3C3

Max Marks: 100

Hours/ week: 4

Internal Marks: 40

Credit: 4

External Marks: 60

Objective:

To relate the structure and function of the DNA molecule to its functional role in encoding genetic material and to apply the principles of inheritance as formulated by Mendel.

UNIT I

12 hours

Gene – concept of gene – Mendel's experiment - Mendel's laws of inheritance – Phenotype - Genotype. Test cross, Di, tri, poly hybrid crosses. Types of gene action - Multiple alleles – Pleiotropism – #Penetrance and expressivity#.

UNIT I

12 hours

Linkage in Drosophila – Morgan's experiments, theories of linkage, factors affecting linkage, Crossing over, Types, mechanisms, #Cytological evidence for crossing over and significance#.

UNIT I

12 hours

Study of chromosome structure, morphology, number and types - Karyotype and Idiogram. Mitosis and meiosis - their significance and differences between them. Genetic Exchange in Bacteria: Transformation - the process and competency, #Transduction and Conjugation#.

UNIT I

12 hours

Mutation – Genetic variability required for evolution. Mutation types – basic features of the process – Molecular basis of mutation – physical, chemical and biological. Transposable genetic elements. #Ames Test suppression of mutation#.

UNIT I

12 hours

IS Elements- composite transposons-medical significance. Eukaryotes – Ac and Ds elements in maize- P elements in drosophila. Retro transposons. #Genetic and evolutionary significance of transposable elements#.

#Self -study portion

Text Books

1. Daniel L. Hartl, E.W. Jones, Jones.,. Genetics: Analysis of Genes and Genomes, Barlett Publishers.(2005)
2. Klug, Cummings, Spencer, Palladino.,. Concepts of genetics. 9th edition, pearson International edition. (2009)
3. M.W. Strickberger,. Genetics, Prentice Hall of India Pvt Limited. (1999)
4. Stanley R. Maloy, John E. Cronan, David Freifelder, Jones,. Microbial Genetics, Barlett Publishers.(1994)

UNIT I: Chapter 3, T.B.1 Chapter 9, T.B.3

UNIT II: Chapter 5, T.B.1

UNIT III: Chapter 8, T.B.1.

UNIT IV: Chapter 14, T.B.1.Chapter 8, T.B.2

UNIT V: Chapter 14, T.B.1

Books for References:

1. Gardner, E.J., Simmons, M.J., and Snusted D.P.,. Principles of Genetics, John Wiley and Sons, New York. (1991)
2. Hotter, P.,. Textbook of Genetics, IVY Publishing House, New Delhi.(2002).
3. Weaver, R.F. and Hedrick, P.W., Genetics, W.M.C. Brown Publishers, London.(1997).

**SEMESTER III: MAJOR BASED ELECTIVE – III
DEVELOPMENTAL BIOLOGY**

Course Code: 14UBT3M3
Hours/week: 3
Credit: 3

Max. Marks: 100
Internal Marks: 40
External Marks: 60

Objectives:

To study the cellular basis and development process of animals and human beings.

UNIT I **9 hours**

Genetic analysis of development in *Drosophila*- a model system- sex determination in drosophila- maternal gene activity- zygotic gene activity- #vertebrate homologues of invertebrate gene#.

UNIT II **9 hours**

Theories Preformation, Epigenetic, Recapitulation and Germplasm – Gametogenesis: Spermatogenesis, Types of Sperm: Oogenesis – Types of eggs and egg membranes – #Structure of Spermatozoan and ovum in mammals#.

UNIT III **9 hours**

Gametogenesis and Embryo development: Molecular biology of animal development Blastula- gastrulation and morphogenesis. Fertilization: Structure and functions of Human sperm and ovum. Fertilization process (*eg, human, frog and dove*).#Acrosomal reaction, cortical reaction#, Physiological and Biochemical changes.

UNIT IV **9 hours**

Human reproduction- Puberty, Menstrual cycle – Menopause, pregnancy and related problems Types and functions of placenta.– #Parturition – lactation#.

UNIT V: **9 hours**

Environmental disruption of normal animal development: Malformation and disruption, Teratogenic agents: Retinoic acid, Thalidomide, Alcohol and other teratogenic agents.#Genetic environmental interactions.

#Self -study portion

Text Books:

1. Balinsky, B.I.,. An Introduction to Embryology, Holt Saunders, New York.(1981)
2. Berrill, N.J.,. Developmental Biology, McGraw Hill, New Delhi.(1986)
3. Verma, S. and Agarwal, V.K.,. Chordate Embryology, S.Chand& Co., New Delhi.(2000)

Unit I Chapter I, T.B-3

Unit II Chapter II, T.B-3

Unit III Chapter VI, T.B-3

Unit IV Chapter II, T.B-3

Unit V Chapter II, T.B-3

Books for References:

1. Saunders, J.W.,.Devel(1982)opmental Biology – Patterns and Principles, Macmillan, New York.
2. Patten, B.M.,. Foundations of Embryology, McGraw Hill, New York.(1958)

**SEMESTER III: NON – MAJOR ELECTIVE – II
AGRICULTURE BIOTECHNOLOGY**

Course Code: 14UBT3N2

Hours/week: 2

Credit: 2

Max. Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

Understanding the importance of the traditional and modern Agricultural practice to the students.

UNIT I:

6 hours

Conventional methods for crop improvement: – vegetative propagation methods - Grafting – Rapid multiplication techniques. Bio-fertilizers - Bio-fungicides -Bio-Insecticides – Vermi-composting -[#]Farm Pollutants and their Management[#].

UNIT II:

6 hours

Commercial Agriculture: Mushroom Cultivation, Apiculture, Sericulture, Farm Forestry, Seed Production, Crop Breeding, Plant Tissue Culture, [#]Hybrid Seed Production[#].

UNIT III:

6 hours

Genetic Engineering for biotic stress tolerance: insects, fungi, bacteria, viruses- Genetic engineering of abiotic stress tolerance -drought, [#]salt and temperature[#].

UNIT IV:

6 hours

Major pests of Agricultural Crops (elementary account) - Developing pest resistant species - Biocontrol methods - Bioengineered biocontrols – Biotechnology of weed control, [#]Public acceptance of bioengineered GM foods and organisms[#].

UNIT V:

6 hours

Integrated Livestock Farming (Animal Science) and Veterinary: Poultry Production Management, Dairy Production Management, Sheep and Goat Production and Management, Value Addition to Animal Products, Veterinary Care Practices. [#]Agricultural biotechnology and Law – plant variety certification and protection- Farmers rights[#].

[#] **#Self -study portion**

Text Books:

T.B. 1. V. Kumaresan. A Text Book of Biotechnology. Saras Publication, 2010.

T.B.2. Agriculture Biotechnology. Saras Publication. 2006.

Unit I Chapter 39 T.B.1

Unit II Chapter 43, 35 T.B.2

Unit III Chapter 18, T.B.1

Unit IV Chapter 21 T.B.1

Unit V Chapter 22 T.B.2

Books for References:

1. Altman, Arie. Agricultural Biotechnology , Marcel Dekker, Inc.New York..(1998)
2. Chrispeels, M.J. and David E. Sadava,. Plants, Genes, and Crop Biotechnology.. Jones and Bartlett,Boston.(Eds.2003)
3. Erbish, F.H. and M. Maredia,. Intellectual Property Rights in Agricultural Biotechnology. Universities Press, India.(1998)
4. Forbes, J.C and R D Watson,. Plants in Agriculture ,Cambridge Univ. Press, Great Britain.(1992)
5. Jones, L.. Biotechnological innovation in Crop improvement, Butterworth-Hiemann, London.(1991)
6. Joshi, N K.. Biotechnology In Agriculture. Aavishkar Pub., Jaipur, India.(2007)
7. Maarten J. Chrispeels and David E. Sadava,. Plants, Genes and Agriculture, Jones &Barleft Publishers, London.(1994).
8. Ramniwas Sharma (Ed.). BiotechnologyIn Agriculture. Saujanya Books, New Delhi.(2005).

BASIC IMMUNOLOGY

Course Code:14UBT4A4

Hours/week: 5

Credit: 2

Max. Marks: 50

Internal Marks: 20

External Marks: 30

Objective:

This course aims to develop the skills of the students in Immunotechnology, antigen antibody response, immunodiagnosis, immunopathology.

UNIT I:

15 hours

Historical perspectives and overview of immune system, innate and acquired immunity. Haematopoiesis. Cells of Immune system- Macrophages, T cells, B Cells, NK Cells, Mast cells, #Organs of the immune system#.

UNIT II:

15 hours

Antigen – Properties, Classes. Haptens, Epitope, paratope, Adjuvants .Humoral response – B cell activation and proliferation. #Cell mediated immunity# – T cell receptors and its activation.

UNIT III:

15 hours

Cytokines: Types and function, Complement- Properties and activation pathways, Major Histocompatibility Complex. Antigen processing & presentation. #Hypersensitivity and its types#.

UNIT IV:

15 hours

Autoimmunity – Definition, Types and mechanism. Vaccines – active & passive, purified macromolecules, DNA vaccine, recombinant vector vaccine. #Immune response to viral#, bacterial & protozoan infection.

UNIT V:

15 hours

Immunoglobulins – Structure and function. Antigen – Antibody reactions – Agglutination, precipitation, RIA, ELISA, FACS. #Organization and expression of immunoglobulin genes#. Chimeric antibodies.

15 Hours

#Self -study portion

Text Books:

1. Ivan Roitt.,. Essential Immunology, 10th Edn. Blackwell Scientific Publication.(2002)
2. Kuby, J.,. Immunology. W.H. Freeman and Company, New York.(2002)
3. Madhavee Latha P.,. A Text Book of Immunology. First Edition. S. Chand & Company Ltd, New Delhi.(2003).

UNIT 1: Part 1 T.B.2

UNIT 2: Part II T.B.2

UNIT 3: Part III T.B.2

UNIT 4: Part IV T.B.2

UNIT 5: Part II T.B.2

Books for References:

1. Janeway, CA and Paul Travers. Immuno-biolog. Panima publishing corporation, New Delhi.(1994)
2. Rajasekarapandian M and Senthilkumar B,. Immunology and Immunotechnology. Panima publishing corporation, New Delhi. (2007)
3. Weir DM and Stewart, J.,. Immunology, 10th Edn. Churchill Livingston, New York.(2000)

BASIC IMMUNOLOGY– PRACTICAL

Course Code: 14UBT4A4P

Hours/week: 3

Credit: 2

Max. Marks: 50

Internal Marks: 20

External Marks: 30

Objective:

To familiarize students with basic concepts in immunology and to develop new ideas for experimental work based on the previously learned concepts.

1. Preparation of human blood smear and identification of cells.
2. Determination of blood groups.
3. Rocket immunoelectrophoresis
4. Double diffusion.
5. Immunoelectrophoresis
6. Radial Immuno diffusion.
7. DOT ELISA for the presence of specific antigen.
8. Isolation of DNA from blood.
9. Isolation of DNA from animal tissue.
10. Agarose gel electrophoresis of DNA
11. Quantitative analysis of DNA

Text Book:

1. Kuby, J., Immunology. W.H.Freeman and Company, New York. 2002.

ENZYMOLGY AND ENZYME TECHNOLOGY

Course Code: 14UBT4C4

Hours/week:4

Credit: 4

Max Marks: 100

Internal Marks: 40

External Marks: 60

Objective: To understand the application of the enzymes in various discipline.

UNIT I

12 hours

Enzyme Classification and nomenclature: General properties of enzymes like effect of pH- Temperature- Ions etc. Extraction- assay and purification of enzymes. Steady state kinetics. Michaelis – Menten- Lineweaver Burke- Eadie-Hofstee and Hanes – Woolf equation and y value. Different types of inhibitors. Pre-steady state kinetics. #Km and Kcat values#.

UNIT II

12 hours

Enzyme Kinetics and Mechanism: Enzyme specificity. Co-Enzymes, Mechanism of enzyme action eg. - DNA Polymerase- RNase. Enzyme Inhibition, Allosteric interactions and product inhibition. Clinical and Industrial applications of Enzymes. Immobilizations of Enzymes and their applications. Enzyme engineering. #Biosensors and their industrial applications#.

UNIT III

Enzymes and Isoenzymes of Diagnostic importance- LDH, CK, Transaminases, Phosphatases, Amylase and Choline Esterase. Enzyme patterns in diseases- Liver Disease and Myocardial infarction. Enzyme Histochemistry. #Enzyme Engineering with reference to T4 lysozyme#- Abzymes- Enzyme electrode.

UNIT IV

12 hours

Applications of enzymatic analysis in medicine and industry- Assay of Plasma Enzymes, Enzymes and inborn errors of metabolism, Enzymes as reagents in clinical Biochemistry. #Applications in industry, Applications in Food, Drink and other industries#.

UNIT I

12 hours

Biotechnological Applications of Enzymes- Large scale production and purification of enzymes- production of enzymes on an industrial scale, Large scale purification of enzymes, Synthesis of artificial enzymes. Immobilized Enzymes- Preparation, Properties and Applications. #Enzyme and rDNA Technology#, Enzymes and Bioinformatics.

#Self -study portion

Text Books:

T.B. 1.Palmer.T, Understanding Enzymes, Prentice Hall, 2004.

T.B.2. LEWIS, Fundamentals of Enzymology, 2004.

Unit-1 Chapter 8 Page no 321-367 T.B.1

Unit-2 Chapter 4 Page no 118-153 T.B.1

Unit-3 Chapter 6 Page no 217-266 T.B.1

Unit-4 Part-3 Chapter 19 Page no 340-351 T.B.2

Unit-5 Part-3 Chapter 20 Page no 352-380 T.B.2

Books for References:

1. Dixon and Webb,. Enzymes 3rd ed. Longmans.(1979)
2. Palmer, T..Understandingenzymes.Prentice Hall.(2004)
3. Stryer. Biochemistry 5th ed. Freeman.(2002).
4. Zubay,. Principles of Biochemistry –4th ed. William C.Brown Publ. (1998).

BIOPHARMACEUTICALS

Course Code:14UBT4C5
Hours/week:4
Credit:4

Max. Marks: 100
Internal Marks: 40
External Marks: 60

Objective:

To understand the pharmacokinetics and pharmacodynamics of drugs and pharmaceutical industry

UNIT I

12 hours

Introduction - Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; #economics and regulatory aspects#.

UNIT II

12 hours

Drug Action, Metabolism and Pharmacokinetics -Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; #pharmacokinetics#.

UNIT III

12 hours

Manufacture Of Drugs, Process and applications -#Types of reaction process and special requirements for bulk drug manufacture#.

UNIT IV

12 hours

Principles Of Drug Manufacture -Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oral liquids – #preservation of drugs#; packing techniques, quality management.

UNIT V

12 hours

Biopharmaceuticals -Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, #hormones and biological#.

#Self -study portion

TextBooks

1. A TEXTBOOK OF PHARMACOLOGY FOR NURSES BY PADMAJA UDAYKUMAR ,Thearora medical book publishers pvt ltd.(2005).
Unit 1:TB 1-section 1.1 to 1.5
Unit 2:TB 1-section 1.1to 1.5
Unit 3: TB 1-section 1 to 2
Unit 4:TB 1-section 2.5 to 3
Unit 5:TB 1-section 5

Books for References

1. Finkel, Richard, "Lippincott's Illustrated Reviews Pharmacology" 4th Edition.(2009)
Wolters Kluwer / Lippincott Williams & Wilkins.
1. Gareth Thomas..MedicinalChemistry.Anintroduction.John Wiley. (2000)
2. KatzungB.G..Basic and Clinical Pharmacology, Prentice Hall of Intl.(1995)

**SEMESTERIV:SKILL BASED ELECTIVE – II
HUMAN ANATOMY AND PHYSIOLOGY**

Course Code: 14UBT4S2

Hours/week: 2

Credit: 2

Max. Marks:100

Internal Marks: 40

External Marks: 60

Objectives:

To study the basic principles of Human Anatomy and physiology and to understand the physiology of various organs and organ systems.

UNIT I

6 hours

Human organs Anatomical view: Sensory organs: eye, Ear, Nose. Circulatory organ: Heart, Lungs, Kidney, liver. Digestive system: #Small and large intestine#.

UNIT II

6 hours

Respiration-Respiratory pigments-and functions. Transport of gases [CO₂+O₂] - Respiratory quotient. #Circulation:- Types, Composition, Properties and Functions of blood#.

UNIT III

6 hours

Excretion - kinds of excretory products - mechanism of urine formation in mammals - hormonal regulation of Excretion. #Kidney Failure and Transplantation#.

UNIT IV

6 hours

Nervous tissue - Neuron - Structure, types of neurons. Nerve Impulse - Synapse - Synaptic transmission of impulses – Neuro-transmitters. #Receptors# - Photoreceptor - eye - structure of retina - visual pigments - Physiology of vision.

UNIT V

6 hours

Endocrine glands - structure, secretions and functions of Endocrine glands of Human beings -pituitary, Hypothalamus, thyroids, Adrenal, Thymus, #Islets of Langherhans#, Gonad – Testis, Ovary.

#Self -study portion

Text Books:

1. Parameswaran, Anantkrishnan and AnantaSubramaniam,. Outlines of Animal Physiology, S. Viswanathan [Printers & Publishers] Pvt. Ltd.,(1975)
2. Prosser, C.L. Brown. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282 003.(1985)
3. Sambasivaiah, Kamalakararao and Augustine chellappa,. A Text book of Animal Physiology and Ecology, S. Chand & co., Ltd., New Delhi - 110 055.(1990)
4. S.C. Rastogi. Essentials of Animal Physiology. New Age International Publishers. 2001.

Unit I Chapter 16, 7 T.B-4

Unit II Chapter 9, 11, T.B-2

Unit III Chapter 14, T.B-4

Unit IV Chapter 15, T.B-4

Unit V Chapter 19,T.B-4

Books for References:

1. William S. Hoar,. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., New Delhi - 110 001. (1976)
2. Wood, D.W.,. Principles of Animal Physiology 3rd Ed.,(1983)

**SEMESTERIV: EXTRA CREDIT –I
MUSHROOM CULTIVATION**

Objective:

The subject will provide independent handling and culture capability of all edible mushrooms.

UNIT I

Morphology and classification; Edible and non-edible mushroom (Historical account, most commonly cultivated mushrooms in the world, distribution and production in various countries).

UNIT II

Cultivation of button mushroom -morphology raising a pure culture & spawn preparation. Preparation of compost & cultivation of *Agaricus bisporus*, *Pleurotus flabellatus*, harvest. Breeding and genetic improvement of mushroom strains.

UNIT III

Cultivation of oyster and paddy straw mushroom - preparation of pure culture & spawn cultivation methods, harvest.

UNIT IV

Pests and diseases of Edible mushrooms (Environmental, fungal, bacterial, viral, insect pests and Nematode diseases and competitor moulds).

UNIT V

Medicinal and nutritional value of medicine. Post harvesting and commercialization of microbiology.

Text Books:

1. Changs. T. W.A. Hayanes,. "Biology and cultivation of Mushrooms" AcadPress.N.Y. (1978).
2. Ignacimuthu, S.. Applied Plant Biotechnology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.(1997).
3. Kannaiyan,. Handbook of Edible Mushrooms" TNAU Publication.(2001).
Unit I Chapter I, T.B-3
Unit II Chapter II, T.B-2
Unit III Chapter VI, T.B-3
Unit IV Chapter II, T.B-4
Unit V Chapter II, T.B-5

Books for References:

1. M.C. Nair,C. Gokulapalan and Lulu das,. Topics on mushroom cultivation, Scientific Publishers, Jodhpur, India. (1997).
2. Zadrazil. F & K. Grabbe.,. "Edible Mushroom, Biotechnology" Vol. 3, Weinheim: VerlagChemie, Berlin. (1983).

Course Code : 14UBT 4EC2

Hours/week :

Credit : 4*

Max Marks : 100*

Internal Marks : --

External Marks : 100*

Objective:

The subject will provide to understand the Ethnobotany and Herbal Medicine Preparation.

UNIT I

Basic Knowledge of tribes in India and Tamil Nadu. Tribal knowledge towards disease diagnosis, Treatment with medicinal plant, Plant conservation and cultivation. Herbal Medicinal practice in your native place.

UNIT II

Importance of ethno botany in Indian systems of medicine (Siddha, Ayurveda and Unani). Anthropological relationship with sacred grooves.

UNIT III

Herbal Preparation, Collection of Wild herbs, Hydrotherapy, Herbal Oil, Liquid extract of medicinal plants.

UNIT IV

Extraction of Phytopharmaceuticals: Alkaloids, Volatile Oils, Resins and Tannins.

UNIT V

Introduction, Origin and basic notion of ethnobotanical study – Ethnobotany as an emerging science and its scope; Ethnobotany in India and Tamil Nadu.

Text Books:

1. Jain S K. Methods and approaches in ethnobotany, society of ethnobotanists, Lucknow.(1989)
2. Pal, D C and Jain S K.. Tribal Medicine. NayaPrakash Publishers, Calcutta.(1998).
Unit I Chapter I, T.B-1
Unit II Chapter II, T.B-1
Unit III Chapter VI, T.B-1
Unit IV Chapter II, T.B-2
Unit V Chapter II, T.B-2

Books for Reference:

1. Wallis, T.E.. Text book of Pharmacognosy, J and A Churchill Ltd. (1946).

**SEMESTER V: CORE VI
MOLECULAR BIOLOGY**

Course Code: 14UBT5C6

Hours/Week: 5

Credit: 4

Max Marks:100

Internal Marks: 40

External Marks:60

Objective:

To understand the structures and various cellular functions associated with the macromolecules found in cells.

UNIT I

15 hours

Introduction to DNA & RNA - as genetic material – properties, structure and function. Nucleosides & Nucleotides (structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA. #Prokaryotic and eukaryotic genome organization#.

UNIT II

15 hours

Replication: The Basic Rule for Replication of all Nucleic acids. Enzymology of DNA replication, Discontinuous Replication, Events in the Replication Fork. Prokaryotic and eukaryotic replication, #Regulation of DNA replication#.

UNIT III

15 hours

Expression of genetic information : from Transcription to Translation – The Relationship between genes and protein, Prokaryotic and Eucaryotic - transcription and translation, Encoding genetic information, #Decoding the codons : the role of transfer RNAs#.

UNIT IV

15 hours

Gene Regulation: General aspects of Regulation, The lactose system and the operon model, The Galactose operon, The Arabinose operon, Relative positions of Promoters and Operators, #Regulation of Translation, #Regulation of the synthesis of Ribosomes#.

UNIT V

15 hours

DNA Repair & Protein Targeting: DNA damage and repair; Targeting signals, protein translocation – co-translational translocation and post-translational translocation. Sorting protein to mitochondria – chloroplast – #peroxisomes# - Golgi.

#Self -study portion

Text Book:

1. Gerald Karp,. Cell and Molecular Biology: Concepts and Experiments, John Wiley & Sons. (2009)
2. Harvey Lodish,. Molecular Cell Biology, W. H. Freeman. (2008)
3. S. C. Rastogi,. Cell and Molecular Biology, New Age International. (2006)

UNIT I:Chapter 10, T.B.2 Chapter 14, T.B-1

UNIT II: Chapter 13, T.B-1

UNITIII: Chapter 11, T.B-1.

UNIT IV: Chapter 12, T.B-1

UNIT V: Chapter 13, T.B.1; Chapter 16, T.B-2

Books for References:

1. Philip C. Turner,.Molecular Biology, Garland Science. (2005)
2. Buchanan,.Biochemistryand Molecular Biology of Plants.(2000)
3. Carey and Smale,.Translational regulation in eukaryotes.(2000)

RECOMBINANT DNA TECHNOLOGY

Course Code:14UBT5C7

Hours/week:4

Credit: 4

Max Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

To understand the concepts of Recombinant DNA Technology.

UNIT I

12 hours

Overview of recombinant DNA technology - Steps, Discovery of Restriction and modifying enzymes. Enzymes in rDNA Technology. #Restriction mapping#. Strategies in gene cloning- Restriction, Ligation.

UNIT II

12 hours

Plasmids - Size - Copy Number - Amplification- Types of Plasmids- Bacterial cloning vectors- pBR322 - origin – advantage – pUC. Lambda phage vectors, cosmids and #phagemid as vectors#.

UNIT III

12 hours

Animal and Plant Viral vectors and their uses, Shuttle vectors, Expression vectors. Characteristics of plasmid and phage vectors. Screening and selection of recombinants- #Hybridization techniques#.

UNIT IV

12 hours

Gene transfer techniques: Molecular mechanism of antisense technology. PCR-types and applications, RAPD, RFLP, Micro arrays. DNA sequencing methods. Molecular diagnosis, #Blotting techniques#.

UNIT V

12 hours

Construction of genomic and cDNA libraries, screening of libraries, Site directed mutagenesis, Ethical issue involving in rDNA Technology. rDNA Technology in solving human problems. #Safety regulations in rDNA technique#.

#Self -study portion

Text Books:

1. James D. Watson, Micheal Gilman, Mark Zoller,. Recombinant DNA Second Edition - W.H. Freeman and Company, New York.(2001).
2. Primrose, S.B. and Twyman,R.M. Principles of Gene Manipulation and Genomics - 7th Edition. Blackwell Publishing Company.(2006).
3. Winnacker. From Genes to Clones Introduction to Gene Technology -, E.L., Panima Educational Book Agency, New Delhi.(1987).

UNIT I: Chapter 4 & 6.T.B.1

UNIT II: Chapter 5, T.B.2

UNIT III: Chapter 6, T.B.2

UNIT IV: Chapter 7, T.B.2

UNIT V: Chapter 15, T.B.2

Books for References:

1. Ansubel FM, Brent R, Kingston RE, Moore DD,,"Current Protocols In Molecular Biology ", Greene Publishing Associates, NY.(1988).
2. Desmond S. T. Nicholl,. An Introduction to Genetic Engineering, Blackwell Science Publications, (2002).
3. Saleesha A. Stanely. "Bioethics", Wisdom educational service.(2008).

SEMESTER V: CORE VIII

MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY – PRACTICAL

Course Code: 14UBT5C8P

Hours/week: 4

Credit: 4

Max. Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

To provide comprehensive hands-on training on techniques of molecular biology and genetic engineering.

1. Preparation of competent cells and transformation.
2. Experiments with lac operon- induction and assay of beta-galactosidase.
3. Mounting buccal epithelium and observing living cells using vital staining.
4. Staining of macro molecules.
5. Isolation of Antibiotic Resistant Mutants.
6. Isolation of Plasmid DNA
7. Gel electrophoresis of plasmid DNA
8. Restriction digestion of DNA
9. Ligation of DNA fragments.

Text Books:

1. Anselmi FM, Brent R, Kingston RE, Moore DD. Current protocols in Molecular Biology. Green Publishing Associates, New York. 1988.
2. Gerald Karp. Cell & Molecular Biology: Concepts and Experiments, John Wiley & Sons. 2009.

SEMESTER V: CORE IX

BIOPROCESS TECHNOLOGY

Course Code: 14UBT5C9

Hours/week: 4

Credit: 4

Max. Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

To study the avenues of exploiting microbes in bioconversion technology and to study the downstream processing for product recovery in fermentation.

UNIT I

12 hours

INTRODUCTION TO BIOPROCESSBIOTECHNOLOGY: Isolation and screening of industrially important microbes. Strain improvement - mutation and recombination. Preservation of industrially important microorganisms.#Media/substrates for industrial fermentation#.Media formulation.

UNIT II

12 hours

TYPES OF BIOREACTORS: Mechanical - Stirred tank bioreactors, Airlift fermentors, solid state fermentors, #animal cell culture reactors# and plant cell culture reactors.

UNIT III

12 hours

BIOREACTOR AND FERMENTATION: Bioreactor design and operations - basic function, design, components and body construction. Computers in bioprocess control system. #Concepts of basic modes of fermentation# – Batch, Fed batch and Continuous fermentation.

UNIT IV

12 hours

DOWNSTREAM PROCESSING: Objectives and criteria - foam separation - precipitation methods. Filtration devices and filter aids. Centrifugation - #industrial scale centrifugation and cell disruption#.

UNIT V

12 hours

BIOPROCESS AND INDUSTRIAL PRODUCTION: Production of enzymes- amylases and proteases. Antibiotic production - penicillin and tetracycline.Amino acid - Lysine and glutamic acid.Vitamin production - vitamin B12.#Organic acid production# - citric acid.SCP production.

#Self -study portion

Text Books:

1. Arnold L. demain& Julian E. Davis. Industrial Microbiology & Biotechnology ASM Press.(2004)
2. Casida L.E. Industrial Microbiology, John Wiley & Sons. (1968)
3. Coulson, J.M and J.F. Richardson Chemical Engineering Pergamon Press.(1984)
4. Flickinger M.C., Drew S.W. Encyclopedia of Bioprocess Technology – 5 Volumes, John Wiley & Sons. (1999)
5. Glazer, A N. and Nikaldo, H.,. Microbial Biotechnology -W H Freeman and company network. (1995)
6. Stanbury, P.F. - A. Whitaker & S.J. Hall. Principles of fermentation technology, Butterwoth Heinemann Oxford.(1997).

Unit 1 Chapter 3, T.B-6

Unit 2 Chapter 7, T.B-6

Unit 3 Chapter 2, 8, T.B-6

Unit 4 Chapter10, T.B-6

Unit 5 Chapter 1, T.B-6

Books for References:

7. Gungalus, I.C. and Stainer. RY. (Eds.) The Bacterial Vol. III Academic press. New York. 2004.
8. Prescott, L M., Harley, J P and Klein, D A.. Microbiology 4th edition McGraw Hill. (1999)
9. Stainer, R Y, Ingrtham, J L., Wheels, M.L and Painter P.R.. General Microbiology. Maomillan.(1987)

SEMESTER V: CORE X
ENVIRONMENTAL BIOTECHNOLOGY

Course Code: 14UBT5C10
Hours/week: 4
Credit: 4

Max. Marks: 100
Internal Marks: 40
External Marks: 60

Objective:

To study the basic concept and issues of environmental pollution biotechnological treatment to clean up polluted environments and to create valuable resources for the human society.

UNIT I

12 hours

BASIC CONCEPTS AND ISSUES. Types of pollution methods for measurement of pollution, methodology of environmental management- the problemsolving approach and its limitations. Global environmental problems- Ozone depletion, #Green house effect# and Acid rain.

UNIT II

12 hours

POLLUTION: Pollution and its control through biotechnology, bioremediation of soil and water contaminated with oil spills, heavy metals and detergents, Microbiological and biochemical aspects of waste water treatment process. #Various industrial effluent treatment methods#.

UNIT III

12 hours

BIODEGRADATION: Biodegradation of xenobiotics in environment: Ecological considerations, decay behaviour and degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants. #Biosensors#.

UNIT IV

12 hours

PHYTOREMEDIATION: Degradation of pesticides and other toxic chemicals by Plants. #Degradation aromatic chlorinated petroleum products#.

UNIT V

12 hours

BIOLEACHING: Leaching of ores by microorganisms (gold, copper and uranium). Environmental significance of genetically modified (GM) microbes, plants and animals. #Waste disposal and management, legislation of environmental problems#. Microbial association in environment.

#Self -study portion

Text Books:

- T.B. 1. A.K. Chatterji. Environmental Biotechnology, Prentice Hall of India Pvt. Ltd. 2007.
T.B.2. K. Pradipta.Environmental Microbiology, I.K International Publishing House Pvt. Ltd. 2008.
T.B.3. Environmental Science and Biotechnology, Saras Publication. 2008.
T.B.4. V. Kumaresan.A Text Book of Biotechnology, Saras Publication. 2009.

Unit I Chapter I, T.B. 3

Unit II Chapter XII, T.B.2

Unit III Chapter XIII, XIV, T.B4

Unit IV Chapter XIII, XIV, T.B. 4

Unit V Chapter VIII, T.B.4

Books for References:

1. Agarwall K.V.,. Environmental Biotechnology, Nidhi Publishers.(2005)
2. Chatterji, A.K.. Introduction to Environmental Biotechnology, Prentice-Hall of India.(2002)
3. Chhatwal.Encyclopaedia of Environmental Biology. (2005)
4. Eugenia J.Olguin and Tayloir and Francis.. Environmental Biotechnology and cleaner Bioprocesses.(2000)
5. Murugesan, A.G.andC.Rajakumari,.Environmental Science and Biotechnology: theory and Techniques.(2005)
6. Sharma P.D.,. Environmental Biology, Rastogi Publications.(1994)
7. William P. Conningham and Mary Ann Conningham. Principle Environmental Science , Tata McGraw-Hill publishing Company.(2003)

SEMESTER V: CORE XI
BIOPROCESS TECHNOLOGY AND ENVIRONMENTAL BIOTECHNOLOGY – PRACTICAL

Course Code: 14UBT5C11P

Hours/week: 4

Credit: 4

Max. Marks: 100

Internal Marks: 40

External Marks: 60

Objectives:

1. Isolation of any one industrially important enzyme and antibiotics.
2. Production and estimation of biomass (SCP) – dry weight and wet weight method.
3. Production of wine.
4. Mushroom cultivation.
5. Immobilization of yeast cells
6. Immobilized beads for alcohol production and estimation.
7. Estimation of Dissolved Oxygen in water
8. Determination of Total hardness in water
9. Analysis of Carbonates and bicarbonates in water
10. Estimation of Available Nitrogen in soil.
11. Quantitative Estimation of Nitrates in soil.

Text Books

1. K.C. Agrawal. Environmental Biotechnology, Nidhi Publishers (India), Bikaner. 2004.

SEMESTER V: MAJOR BASED ELECTIVE – IV
BIOSTATISTICS AND COMPUTER APPLICATIONS IN BIOLOGY

Course Code: 14UBT5M4

Hours/week: 3

Credit: 3

Max Marks: 100

Internal Marks: 40

External Marks: 60

Objectives:

To learn the basics of statistics in Biological context and to apply the statistical principles in designing Biological experiments and solving Biological problems

UNIT I

9 hours

Introduction to Computers: – Characteristics of Computers. Classification of Computers – Programming Languages: Machine Language – Assembly Language – Input Devices- #Keyboard – Mouse – Out Put, Devices#.

UNIT II

9 hours

Internet and world wide web, Client- server organization, FTP, HTTP, Telnet, protocols, Concepts of mail servers and clients, Browsers and mail managers, #Netscape and Internet explorer#, Internet domain.

UNIT III

9 hours

Types of operating systems: Introduction to MS DOS Office automation tools: MS words, MS excel and MS power point – #Application in biological science#

UNIT IV

9 hours

web media – networks and application – FAX, voice, information services, #person to person communication# (internet, E-mail, teleconferencing etc.,)- exchanging files.

UNIT V

9 hours

Measures of central tendency – mean, median and mode - Measures of dispersion – range, variance, standard deviation – Theories of probability – Students t-test, chi square test for goodness of fit - #statistical error (definition and types only)#.

Self-study portion

Text Books:

1. Sawyer Williams and Hutchinson. Using information technology, McGraw Hill.(1999).
2. Alexis Leon and Mathews Leon. Fundamentals of Information technology– vikas Publication.(1999).

Unit I Chapter III, T.B. 1

Unit II Chapter VII, T.B.1

Unit III Chapter XII, XIV, T.B 1

Unit IV Chapter XIII, XIV, T.B. 1

Unit V Chapter VIII, T.B.2

Books for References:

1. Glover & Mitchell an Introduction to Biostatistics, 2009.

**SEMESTER V: SKILL BASED ELECTIVE – III
CANCER AND STEM CELL BIOLOGY**

Course Code: 14UBT5S3

Hours/week: 2

Credit: 2

Max Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

To gain a deeper understanding on the basic processes related to the growth and differentiation of cancer, multipotent and pluripotent stem cells from various sources.

UNIT I

6 hours

Cancer: Definition, Benign Tumors vs. Malignant Tumors, Types of Cancer, Common Symptoms, Invasion and Metastasis, Molecular Basis of Cancer - #Oncogenes and Tumor Suppressor Genes#.

UNIT II

6 hours

Cancer Classification: TNM Classification - Purpose, Types of Staging, TNM System, Stage Grouping, Other Factors that Can Affect the Stage, Other Staging System, Molecular Classification of Cancer. #Cancer screening#.

UNIT III

6 hours

Stem cells: Introduction to stem cells, Classification and Sources. Tissue specific stem cells – Embryonic, #Hematopoietic and Neural stem cells#.

UNIT IV

6 hours

Embryonic Stem Cells: Blastocyst and Inner cell mass cells; Mammalian Nuclear Transfer Technology; Stem cell differentiation; #Stem cells cryopreservation#.

UNIT V

6 hours

Human Embryonic Stem Cells and society: Human stem cells research: Ethical considerations; Stem cell religion consideration; Stem cell based therapies (cancer, heart damage and infertility). Stem cell research policy – #International bodies# (International Cellular Medicine Society and International Society for Stem Cell Research); National Bodies.

#Self-study portion

Text Book:

1. Biology of Cancer, AmitaSarkar. Discovery Publishing House Pvt. Ltd. 2009.
2. Embryonic Stem cells, AmitaSarkar. Discovery Publishing House Pvt. Ltd. 2009.
3. Specific stem cells, AmitaSarkar. Discovery Publishing House Pvt. Ltd. 2009.

UNIT I: Chapter 1,2,3, T.B.1

UNIT II:Chapter 14, T.B.1

UNIT III:Chapter 11, T.B.3

UNIT IV:Chapter 8, T.B.2

UNIT V: Chapter 7,T.B.2

Books for References:

1. Ann A.Kiessling, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartett, 2003.
2. Peter J.Quesenberry, Stem Cell Biology and Gene Therapy, 1st Edition, Willy-Less, 1998.
3. A.D.Ho., R.Hoffiman, Stem cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.

SEMESTER V: EXTRA CREDIT – III
MARINE ECOLOGY AND BIODIVERSITY CONSERVATION

Course Code : 14UBT5EC3
Hours/week:
Credit : 4*

Max .Marks:100*
Internal Marks:-
External Marks:100*

Objective:

To encourage self-learning thoughts in the field of Marine ecology and Biodiversity Conservation.

UNIT I

Marine ecosystems (pelagic and benthic ecosystem), coral reef, deep sea, concept of food chain, food web, niche, trophic structure and ecological efficiency, community structure diversity and ecosystem function, factor regulating community structure.

UNIT II

Phytoplankton ecology – diatoms, dinoflagellates, coccolithophores, foraminifers, harmful algal blooms – foraminifers – causative species, bloom formation, propagation, decomposition and its impact on ecosystem function.

UNIT III

Zooplankton ecology – copepods, euphasids, chaetognaths and other major groups and their role in food chain and food web.

UNIT IV

Biodiversity, definition, taxic, phylo-genetic and molecular measurements, indigenous and traditional knowledge.

UNIT V

Coastal biodiversity, wild and domesticated, Indian fisheries & status, ecosystem based management traditional and mechanized crafts and gears, fishing fleets, fishing through food webs.

Text Books:

- T.B.1. N.S. Subrahmanyam and A.V. Sambamurty. Ecology, Narosa Publishing House, 2004.
- T.B.2. Mahesh Prasad Singh. Biodiversity, APH Publishing Corporation, 2009.
- T.B. 3. V. Kumerasan. Biotechnology, Saras Publication, 2010.
- T.B. 4. Chandrawati Jee Shagufta. Fish Biotechnology, APH Publishing Corporation, 2010.

Unit I Chapter 16, 17, T.B.1

Unit II Chapter 14, 16, T.B.1

Unit III chapter 14, T.B.3

Unit IV chapter 31, T.B.3

Unit V Chapter 7, 9, 10, T.B.4

Books for References:

1. Marine Biodiversity - Pattern and Processes, edited by Rupert F.G. Ormond, John.D.Gage and Martin.V.Angel, Cambridge University press (1997): pp449.
2. Biodiversity and Environment by ArvindKumar, Published by S.B.Nangia, A.P.H. Publication Corporation, New Delhi, 110 002: pp659. (2004)
3. Biodiversity Conservation, edited by Vandana Shiva, Publication of Indian National Trust for Art and Cultural Heritage, New Delhi, 110 002; pp 315. (1994)
4. Marine ecology,– Levinton, J.S. 1982
5. Biological oceanographic processes,– Parsons, T.R. 1984
6. Marine biological processes(2nded), Valiela, I., springer .1995
7. Plankton and productivity in the oceans (Vol. 1 & 2), – Raymont, J.E.G. 1983
8. Introduction to marine ecology, Barnes, R.S.K. and Hughes, R.N. 1982
9. Population ecology: An unfied study of plants & animals, Begon, M. & Mortimer, M. 1986
10. Ecology: the experimental analysis od distribution and abundance, – Krebs, C.J. 1985

**SEMESTER VI: CORE XII
PLANT BIOTECHNOLOGY**

Course Code: 14UBT6C12

Hours/week: 5

Credit: 4

Max. Marks: 100

Internal Marks: 40

External Marks: 60

Objective:

To study the basic principles and techniques involved in plant tissue and the concepts of transformation and achievements of biotechnology in Plant.

UNIT I

15 hours

History of plant tissue culture – laboratory organization – aseptic techniques – nutritional requirements and culture media – #Types of cultures# – Solid – Liquid.

UNIT II

15 hours

Micropropagation – mass production of plantlets – hardening and mist chambers – techniques for maintaining plantlets in the field – Callus induction - somatic embryogenesis – induction of multiple shoots – production and exploitation of haploids and triploid – #embryo rescue – protoplast culture, #Somaclonal variations#.

UNIT III

15 hours

Genetic Engineering in Plants-Molecular biology of Agrobacterium mediated DNA transfer- Ti plasmid Vectors- Technique of hairy root production. #Physical method of transfer#- Biolistics –Electroporation.

UNIT IV

15 hours

Selectable Markers, reporter genes- Promoters used in Plant vectors genetic engineering for- heat, drought and saline tolerance - Virus resistance - Pest resistance - #Herbicide resistance#- Delayed fruit ripening.

UNIT V

15 hours

Production of therapeutic proteins - antibodies- vaccines - hormones- Golden Rice.#Secondary metabolite production#.

Self-study portion

Text Books:

T.B. 1.Kalyankumar De.An Introduction to Plant Tissue Culture Techniques.New Central Book Agency, Kolkata.2007.

T.B. 2.U.Satyanarayana, Biotechnology, Uppala Author-Publisher Interlinks, 2005.

Unit I – Chapter 1, T.B. 1

Unit II – Chapter 2 - 14, T.B. 1

Unit III – Chapter 7, section 49, T.B. 2

Unit IV – Chapter 7, Section 50, T.B. 2

Unit V – Chapter 7, Section 51, T.B. 2

Books for References:

1. Bernard R.Glick and Jack J.Pasternak. Molecular Biotechnology, Principles and applications of recombinant DNA technology. ASM Press Washington DC.(2001)
2. Bhojwani, S.S. and M.K. Razdan Plant Tissue culture: theory and practice a revised edition Elsevier science.(2004)
3. Chrispeels, M.J. and D.F. Sadava. Plants- Genes and Agriculture Jones and Bartlett.(1994)
4. Dixon, R.A And R.A. Gonzales.Plant cell culture, IRL press.(2004)
5. Erbisch, F.H and K.M.Maredia. Intellectual property in agricultural Biotechnology, Edited by, University Press.(2000)
6. Glick and Paster mark Molecular Biotechnology by Panima.(2002)
7. Hammond, J., P.McGarvey and V.Yusibov (eds). Plant Biotechnology – New products and Applications. By Springer Publication.(1999).
8. Lycett, G.W. and D. grierson. Genetic Engineering of crop plants- (Eds).(1990).

**SEMESTER VI: CORE XIII
FOOD BIOTECHNOLOGY**

Course Code: 14UBT6C13
Hours/week: 5
Credit: 4

Max. Marks: 100
Internal Marks: 40
External Marks: 60

Objectives:

To study the principles of food processing, preservation and manufacture.

UNIT I **15 hours**
Microorganisms associated with food- bacteria, fungi & yeast (*eg. Fish, Meat, Vegetables and Fruits*). #Enzymes in food preparation#.

UNIT II **15 hours**
Food colors (natural & artificial food colourants) – carotenoids, anthocyanins and melanin.
#Food flavoring agents#.

UNIT III **15 hours**
Food engineering operations: Characteristics of food rawmaterials, #preparative operations in food industry#, cleaning of food raw materials, sorting of foods, grading of foods.

UNIT IV **15 hours**
Food quality: Sensory evaluation of food quality, quality factors for consumer safety, food safety standards. Food Safety and Standards Authority of India (FSSAI), #Hazard Analysis and Critical Control Point (HACCP) and #Food and Drug Administration (FDA)#.

UNIT V **15 hours**
Food preservation & Food spoilage- types. Canned foods. Food borne diseases. #Food Adulteration#.

#Self -study portion

Text Books:

1. Bibek Laramie and Bhunia, (2003). Fundamentals of Food Microbiology - CRC Press.
2. Michael P. Doyle and Larry. R. (2006). Food Microbiology – Fundamentals & Frontiers.
Unit I – Chapter 1, T.B. 1
Unit II – Chapter 3 - 14, T.B. 1
Unit III – Chapter 5, section 49, T.B. 1
Unit IV – Chapter 6, Section 50, T.B. 2
Unit V – Chapter 8, Section 51, T.B. 2

Books for References:

1. Rao, D.G. (2010). Fundamentals of Food Engineering – PHI Learning Pvt Ltd.
2. Siva, B. (2011). Food Processing & Preservation – PHI Learning Pvt Ltd.

**SEMESTER V: CORE XIV:
PLANT BIOTECHNOLOGY AND FOOD BIOTECHNOLOGY-PRACTICAL**

Course Code: 14UBT6C14P
Hours/week: 5
Credit: 4

Max Marks: 100
Internal Marks: 40
External Marks: 60

Objectives:

1. Laboratory requirements and general techniques.
2. Plant Tissue culture media preparation (MS medium, Nitsch's medium, White's medium)
3. Callus induction
4. Micro propagation – shoot tip, node, axillary bud
5. Protoplast isolation
6. Anther and Pollen culture
7. Synthetic seed preparation
8. Green house visit
9. Identification of microorganism - Yeast, mould, algae.
10. Identification of mould in bread.
11. Preservation using low temperature, high temperature and chemical preservatives.
12. Assessment of milk quality by methylene blue reduction test
13. Isolation of bacteria from bread, tomato and any one beverage.
14. Wet mounts preparation of spoiled bread, tomato, grapes, potato.
15. Food Adulteration tests.

Text Books:

- 1 .KalyankumarDe..An Introduction to Plant Tissue Culture Techniques.New Central Book Agency, Kolkata.(2007)

**SEMESTER VI: CORE XV
ANIMAL BIOTECHNOLOGY**

Course Code: 14UBT6C15

Hours/week: 4

Credit: 4

Objective:

To provide an overview and current developments in different areas of animal biotechnology.

Max Marks: 100

Internal Marks: 40

External Marks: 60

UNIT I

12 hours

Structure and organization of animal cell, cell physiology. Equipments and materials for animal cell culture technology. #Aseptic Technique for cell cultures#; Cryopreservation.

UNIT II:

12 hours

Preparation and Sterilization of cell culture media and reagents. Introduction to the balance salt solutions and simple growth medium. #Chemical, physical and metabolic functions of different constituents of culture media#. Role of carbon dioxide in animal cell culture.

UNIT III:

12 hours

Role of serum and supplements, Serum & protein free defined media and their applications. Primary cell culture techniques, Measurement of viability and cytotoxicity. Biology and characterization of cultured cells, #Application of animal cell culture#.

UNIT IV:

12 hours

Embryo Technology & Animal Breeding. In vitro fertilization, Embryo transfer, ICSI, Embryo splitting, Fertility control & regulation, test tube babies. Cell cloning, #Transgenic animals#-sheep, goat, Mice, fish.

UNIT V:

12 hours

Sericulture & Aquaculture: Definition-Types of silk-Stages of Production-life cycle of silkworm-Biotechnological applications in sericulture-Aquaculture definition-species group-Principles and methods-Freshwater Aquaculture-Aquaculture nutrition-Value added fishery products-#Genetic modifications#.

#Self -study portion

Text Books:

1. John and R.W. Masters, . Animal Cell Culture - Practical Approach. 3rd Edition. Oxford University Press.(2000)
2. Yadav, P.R. and Rajiv Tyagi, . Biotechnology of Animal Tissue -Discovery Publishing House, New Delhi. (2006).
UNIT 1: Chapter 4 T.B 1
UNIT 2: Chapter 8 T.B 1
UNIT 3: Chapter 9 T.B 1
UNIT 4: Chapter 13 T.B 1
UNIT 5: Chapter 26 T.B 1

Books for References:

1. R. Ian Freshney, . Culture of Animal Cells – A manual of Basic techniques. Wiley Publication Pvt. Ltd. (2005)

**SEMESTER VI: CORE XVI
BIOINFORMATICS**

Course Code: 14UBT6C16
Hours/week: 4
Credit: 4

Max Marks: 100
Internal Marks: 40
External Marks: 60

Objective:

This paper introduces the modern fields of Bioinformatics and helps the students to understand the range of applications.

UNIT I

12 hours

Introduction: Bioinformatics-Definition, History of Bioinformatics, Scope and Applications. Current Status of Bioinformatics. #Bioinformaticsdivisions#.

UNIT II

12 hours

Workstation: The bioinformatics workstation, UNIX system, Scripting languages- Perl and Python, markup languages- HTML, XML. General Purpose Language C Language, #Basic ideas of C++ and Java based object oriented programming#.

UNIT III

12 hours

Databases: Database concepts- Database, database system, database management systems-Rational and Network, Database. Biological databases including both proteins and nucleic acids – Sequence – EMBL. #Structural databases# - CATH, SCOP.

UNIT IV

12 hours

Database searches and sequence alignment: Database searches: FASTA and BLAST, Sequence Alignment- Pair wise and multiple. Sequences retrieval from database - NCBI and DDBJ. #Protein sequence analysis# - SwissProt and PDB.

UNIT V

12 hours

Applications: Introduction to Drug Design, Drug Design Approaches, #Computer-aided Drug Designing Methods.

#Self -study portion

Text Books:

1. Bergeron B.P., Bioinformatics computing, 1st ed. Printice Hall. (2002)
2. Puneet Mehrotra, Dr. Kumud Sarin Swapna and K. Srivastava., The New Handbook of Bioinformatics.(2005).
3. T.K. Attwood and D.J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Ltd., New Delhi (2004).
4. Arthur M. Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi (2003).

Unit I Chapter I Sections 1, 8-11, T.B.4
Unit II Chapter II Sections 6-9, T.B.1
Unit III Chapter I Sections 1.2, 1.1, 3.2, T.B.2
Unit IV Chapter VIII Sections 180-191, , T.B.1
Unit V Chapter I Sections 1-23, T.B.1

Books for References:

- 1 Rastogi, S.C., N. Mendiratta, P. Rastogi,. Bioinformatics Methods and Application – Genomics, Proteomics and Drug Discovery. (2004)
- 2 Thiagarajan, B., P.A. Rajalakshmi,. Computational Biology.(2009)
- 3 D. Higgins and W. Taylor (Eds), Bioinformatics- Sequence, structure and databanks, Oxford University Press, New Delhi (2000).
- 4 1. S. R. Swindle, R.R.Miller and G.S.A.Myers (Eds.), Internet for the Molecular Biologist, Horizon Scientific Press, Wymondham, UK, (1996).
- 5 2. S.C. RastogiNamitaMendirattaParagRastogi. (Bioinformatics Concepts, Skills & Applications (2003).

ANIMAL BIOTECHNOLOGY AND BIOINFORMATICS- PRACTICAL

Course Code: 14UBT6C17P

Hours/week: 4

Credit: 4

Max Marks: 100

Internal Marks: 40

External Marks: 60

Objectives:

1. Study of Internet resources in Bioinformatics- eg. NCBI,
2. Sequence retrieval from any Databank.
3. Sequence alignment by BLAST.
4. Protein visualization tool- Rasmol.
5. Phylogenetic analysis using web tools.
6. Program to count nucleotide in a sequence.
7. Program to find the percentage of G and C in a DNA sequence.
8. Program to find the percentage of type of amino acid in a sequence.
9. Program to concatenate DNA fragments.
10. Program to convert DNA to RNA.
11. *Web Publishing*: Create a web page for your University / College using HTML. The opening page should provide hyperlinks to other pages (add animation and sound effects appropriately).
12. Animal cell culture Lab maintenance.
13. Preparation of Animal cell culture media.
14. Culture of chick embryo fibroblast.
15. Chick embryo – demonstration.

Text Books:

1. S.C Rastogi, N.Mendiratta, P.Rastogi. Bio informatics Methods and Application Genomics, Proteomics and Drug Discovery, (2004).
2. National Workshop on Techniques in Animal cell culture & In vitro Toxicology December 24, 2011-January 2, 2012 Mahatma Gandhi- Doerankamp Center (MGDC). (2012).
3. Andreas D.Baxevanis B.F.Francis Ouellette. Bioinformatics. A Practical Guide to the Analysis of Genes and Proteins. (Third Edition 2006).
4. S.Parthasarathy (Essentials of Programming in C for Life Science). (2008).
Practical: 1 to 5 T.B. 3
Practical: 6 to 11 T.B. 4

Books for References

1. S.C. Rastogi Namita Mendiratta Parag Rastogi (First Edition 2003). Bioinformatics Concepts, Skills & Applications.
2. Teresa K. Attwood & David J. Parry Smith (1999). Introduction to bioinformatics.
3. Arthur M. Lesk (Internal Student Edition Second Edition (2005). Introduction to Bioinformatics .

SEMESTER VI: SKILL BASED ELECTIVE - IV

FORENSIC SCIENCE

Course Code: 14UBT6S4
Hours/week: 2
Credit: 2

Max Marks: 100
Internal Marks: 40
External Marks: 60

Objectives:

To understand the molecular techniques for identification of the evidences from the criminal.

UNIT I

6 hours

Crime Scenario in India: Introduction to crime and history, Sociological aspects of crime and criminals in society, Types of crime and its causes – property crimes, public order crimes, violent crimes, #cyber-crimes#.

UNIT II

6 hours

Forensic Examination of Body and Semen Fluids: Molecular mechanisms for identification of the evidences from the criminal.

UNIT III

6 hours

Forensic Examination of Hair and Tissue: Molecular mechanisms for identification of the evidences from the criminal.

UNIT IV

6 hours

Personal Identification: Personal identification techniques as somatoscopy, somatometry, osteometry and #craniometry their importance in determination of age and sex#.

UNIT I

6 hours

Techniques and Applications: New and future technologies; DNA chips - SNPs and limitations of DNA profiling. # Application of Molecular techniques to Forensic#.

#Self -study portion

Text Books:

1. Dr. (Mrs.). Rukmani Krishnamurthy,. Introduction to Forensic Science in Crime Investigation.(2005)
2. Kirby,. DNA Fingerprinting Technology.(2009)

Unit I – Chapter 3, T.B. 1

Unit II – Chapter 4 - 14, T.B. 1

Unit III – Chapter 6, section 49, T.B. 2

Unit IV – Chapter 7, Section 50, T.B. 2

Unit V – Chapter 8, Section 51, T.B. 2

Books for References:

1. Richard Saferstein,. Criminalistics: An Introduction to Forensic Science, 9th Ed. (2001)
2. Sharma, B.R.,. Forensic Science in Criminal Investigation and Trial, 4th ed. (2008)
- 3.Stern C.,. Principles of Human Genetics, Freeman,California.(1964).

Course Code: 14UBT6EC4

Max. Marks:100*

Hours/week:

Internal Marks: --

Credit :4*

External Marks:100*

Objective:

To study the intellectual property rights and ethical implications in biotechnological applications.

UNIT I

Intellectual Property Rights: TRIP International conventions patents and methods of application of patents - Legal implications Biodiversity and farmer rights.

UNIT II

Patents and Patent Laws: Objectives of the patent system - Basic principles and general requirements of patent law - biotechnological inventions and patent law - Legal development - Patentable subjects and protection in biotechnology - The patentability of microorganisms - IPR and WTO regime.

UNIT III

Biotechnology Management: Introduction - Designing a manuscript- grant experimental protocols & experimental methods. Selection of a Biotechnology company.

UNIT IV

LaboratorySet-up: laboratory administration – collaborations - inventories and inspections – personnel – Recruitment hiring – mentoring - promoting and terminating

UNIT V

Good Manufacturing Practices Ensuring Biosafety: Biosafety regulations - Good laboratory practices. Storage and disposal of hazardous wastes: radioactive materials - pathogenic strains.

Text Books

T.B. 1. C. R. Kothari. Research Methodology – Methods and Techniques, New Age International Pvt. Ltd Publishers, New Delhi, 2004.

T.B. 2.M.K. Sateesh, Bioethics and Biosafety, International Publishing House Pvt. Ltd. 2008.

Unit I Chapter I – III, T.B. 1

Unit II Chapter III

Unit III Chapter I, VII & XIX, T.B. 2

Unit IV Chapter VII, T.B. 2

Unit V Chapter XV & XVI, T.B.2

Books for References:

1. Sasson A., Biotechnologies and Development, UNESCO Publications.(2001).
