

DEPT OF BIOTECHNOLOGY

UG – SYLLABUS

(With effect from the academic year 2016-2017 onwards)



J.J.COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS)

(Reaccredited at 'A' Grade by NAAC)

PUDUKKOTTAI – 622 422

J.J COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), PUDUKKOTTAI.

DEPARTMENT OF BIOTECHNOLOGY

B.Sc Biotechnology

Proposed Course Structure under Autonomous Status

Under Choice Based Credit System

(Applicable for the candidates admitted from academic year 2016-2017 onwards)

SEM	Part	Course	Course Title	Hrs/ Week	Credit	Exam Hours	Marks		Total
		Code					Int	Ext	Marks
I	I	U1RTL1	Language Course – I	6	3	3	25	75	100
	II	U1REL1	English Language Course – I	6	3	3	25	75	100
	III	U1RBTCC1	Cell biology	6	5	3	25	75	100
		U1RBTCC2P	Major Practical I (Covering CC I)	3	5	3	40	60	100
		U1RBTAC1	Allied Course - I Biochemistry-I	6	3	3	25	75	100
		**	Allied Course – II (Allied Practical AC I & AC III)	3	*	*	*	*	*
TOTAL				30	19	-	-	-	500
II	I	U2RTL2	Language Course – II	5	3	3	25	75	100
	II	U2REL2	English Language Course – II	5	3	3	25	75	100
	III	U2RBTCC3	Bioinstrumentation	5	5	3	25	75	100
		U2RBTCC4P	Major Practical II (Covering Core Paper III)	3	5	3	40	60	100
		U2RBTAC2P	Allied Course – II (Allied Practical AC I & AC III)	3	3	3	40	60	100
		U2RBTAC3	Allied Course - III Biochemistry-II	4	3	3	25	75	100
	IV	U2RES	Environmental Science	3	2	3	25	75	100
		U2RVE	Value Education	2	2	3	25	75	100
TOTAL				30	26	-	-	-	800

SEM	Part	Course Code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks		Total Marks
							Int	Ext	
III	I	U3RTL3	Language Course – III	5	3	3	25	75	100
	II	U3REL3	English Language Course III	5	3	3	25	75	100
	III	U3RBTCC5	Genetics and Molecular Biology	6	5	3	25	75	100
		U3RBTCC6P	Major Practical- III (Covering CC-V)	5	5	3	40	60	100
		U3RBTAC4	Allied Course – IV Basic Microbiology	6	3	3	25	75	100
		**	Allied Course – V (Covering AC-IV & VI)	3	*	*	*	*	*
TOTAL				30	19	-	-	-	500
IV	I	U4RTL4	Language Course – IV	5	3	3	25	75	100
	II	U4REL4	English Language Course – IV	5	3	3	25	75	100
	III	U4RBTCC7	r-DNA technology	6	5	3	25	75	100
		U4RBTCC8P	Major Practical- IV (Covering CC - VII)	3	5	3	40	60	100
		** U4RBTAC5P	Allied Course - V (Covering AC- IV & VI)	3	3	3	40	60	100
		U4RBTAC6	Allied Course - VI Applied Microbiology	5	3	3	25	75	100
	IV	U4RBTSBE1	Skill Based Elective Course I Vermitechnology	3	2	3	25	75	100
TOTAL				30	24	-	-	-	700

SEM	Part	Course Code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks		Total Marks
							Int	Ext	
V	III	U5RBTCC9	Immunology	7	5	3	25	75	100
		U5RBTCC10	Plant & Animal Biotechnology	7	5	3	25	75	100
		U5RBTCC11P	Major Practical - V (Covering CC- IX & X)	7	5	3	40	60	100
		U5RBTMBE1	Major Based Elective Course – I Medical Laboratory Technology	5	4	3	25	75	100
	IV	U5RBTSBE2	Skill Based Elective Course – II Organic Farming	2	2	3	25	75	100
		U5RBTIDC1	Inter Disciplinary Course – I Biofertilizers	2	2	3	25	75	100
	TOTAL			30	23	-	-	-	600
VI	III	U6RBTCC12	Environmental Biotechnology	5	5	3	25	75	100
		U6RBTCC13	Biostatistics, Bioinformatics, Bioethics & IPR	5	5	3	25	75	100
		U6RBTCC14P	Major Practical-V (Covering CC - IX & X)	5	5	3	40	60	100
		U6RBTMBE2	Major Based Elective Course – II Food Technology	5	4	3	25	75	100
		U6RBTMBE3	Major Based Elective Course –III Industrial Biotechnology	5	4	3	25	75	100
	IV	U6RBTSBE3	Skill Based Elective Course – III Mushroom technology and Value Addition	2	2	3	25	75	100
		U6RBTIDC2	Inter Disciplinary Course - II Personal Hygiene And Health	2	2	3	25	75	100
	V	U6RGS	Gender Studies	1	1	3	25	75	100
			Extension Activities		1				

TOTAL	30	29	-	-	-	800
GRAND TOTAL	180	140	-	-	-	3900

****Carried Over Paper – Exam at the End of the Next Semester**

CC-Core Course / AC – Allied Course /MBE – Major Based Elective / SBE – Skill Based Elective/ IDC – Inter Disciplinary Course/P – Practical* / T – Theory

Total Credit – 140 / Total Marks – 3900

Extension Activities Shall Be Outside the Instruction Hours.

PART III - TOTAL NO OF CORE COURSES - 14

1. CC1 – Cell Biology
2. CC2P – Major practical I (covering CC1)
3. CC3 – Bioinstrumentation
4. CC4P – Major practical II (covering CC3)
5. CC5 – Genetics and Molecular biology
6. CC6P – Major practical III (covering CC5)
7. CC7 – r-DNA Technology
8. CC8P – Major practical IV (covering CC7)
9. CC9 – Immunology
10. CC10 – Plant & Animal biotechnology
11. CC11P – Major practical V (covering CC9 and CC10)
12. CC12 – Environmental biotechnology
13. CC13 – Biostatistics, Bioinformatics, Bioethics and IPR
14. CC14P – Major practical VI (covering CC12 and CC13)

PART III - TOTAL NO OF ALLIED COURSES – 06

1. AC1 - Biochemistry I
2. AC2P - Allied Practical I - Covering AC 1 and 3
3. AC3 - Biochemistry II
4. AC4 - Basic Microbiology
5. AC5P - Allied Practical II - Covering AC 4 and 6
6. AC6 - Applied Microbiology

PART-III - Major Based Elective Papers

1. Medical Laboratory Technology
2. Food Biotechnology
3. Industrial Biotechnology
4. Enzyme Technology
5. Microbial Biotechnology

PART-IV - Skill Based Elective Papers

1. Vermitechnology
2. Organic Farming
3. Mushroom Technology and Value addition
4. Agricultural Biotechnology
5. Marine Biotechnology

PART-IV - Inter Disciplinary Course (Offered by the Department)

1. Food and Nutrition
2. Stem cell Technology
3. Mushroom Technology and Value addition

PART-IV Inter Disciplinary Course (taken from other Departments)

1. Biofertilizers - **Microbiology**
2. Hygiene and Family Health - **Biochemistry**

SEMESTER I: CELL BIOLOGY

Course code: U1RBTCC1

Hours/Week: 6

Credits: 5

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To acquire the basic knowledge on the fundamentals of the cell biology
- To study the principles on cell theory and cell organelles.
- To understand the nutritional transports among the cells.
- To study the cell divisions, cell cycle and cellular organelles at structure and functional level
- To understand the signal transduction and secondary messengers.

UNIT - I : Cell theory

Cell as a basic unit - classification of cell types - cell theory - organization of plant and animal cells - comparison of microbial, plant and animal cells. An Overview of Cells: prokaryotic and eukaryotic cells, cell size and shape, Phages, Virioids and Mycoplasma.

UNIT - II : Structure of Cell and its organelles

Molecules of cell, Plasma membranes (Structure, models, functions, channels, pumps and receptors) Membrane lipids, proteins and carbohydrates - Plasmodesmata. Ultra structure of organelles: ribosome, ER and golgi body. Nucleus - Nuclear Envelope- structure of nuclear pore complex, nuclear lamina, Transport across Nuclear Envelope, Chromosomes and its types.

UNIT - III : Mitochondria, Chloroplasts and Peroxisomes

Structural organization, Function, Marker enzymes, Mitochondrial biogenesis, Protein import in mitochondria, Semiautonomous nature of mitochondrial DNA and chloroplast, chloroplast DNA, Peroxisomes assembly.

UNIT - IV: Cell Division and Nutrition

Solute transport by Simple diffusion, Facilitated diffusion and Active transport. Cell divisions: - mitosis, meiosis, Intracellular and Extra-cellular control of cell division.

UNIT V : Cell cycle

An overview of cell cycle: Components of cell cycle control system - Programmed cell death, Apoptosis, tumor and Cancer, intrinsic & extrinsic pathways of cell death, Necrosis and senescence.

Text Books

1. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott.
2. Gupta, P.K. (2015) - A Text Book of Cell & Molecular Biology, Rastogi Publications.
3. Singh, S.P. and B.S. Tomar, 10th Edition, (2015). Cell Biology, Rastogi Publications.
4. Gupta, P. K. (2015) Genetics & Molecular Biology, Rastogi Publications
5. Free-E-book:<http://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010/what-is-a-cell-what-are-the-14751770>
6. Ajoy Paul, (2011), Textbook of Cell and Molecular Biology.

References

1. Rost, T.L. Gifford, Jr. & Ernest, M. (1977) – Mechanism and control of cell division – Academic Press, N.Y. Encyclopedia of Cell Biology.
2. Gomperts, B.D. (1976) – The Plasma membrane: Models for its structure & Function Academic Press.

SEMESTER I: MAJOR PRACTICAL - I
CELL BIOLOGY

Course code: U1RBTCC2P

Hours/Week: 3

Credits: 5

Max Marks: 100

Internal Marks: 40

External Marks: 100

OBJECTIVES

1. Demonstration of instrumentation methods for cell biology, (Microscope, Micrometry and Microtome).
2. Equipments used in cell culture laboratory general practice and maintenances (demo only).
3. Morphological characterization of various types of cells –Prokaryotes & Eukaryotes
4. Histochemical staining techniques (students are advised to familiarize various staining techniques) - Demo
5. Chemical/enzymatic disaggregation of tissue cells.
6. Cell organelle separation by centrifugation methods.
7. Isolation of Leydig cells (testis) and Islet cells.
8. Enumeration of cell (any type of prokaryotic/eukaryotic cells).
9. Identification and characterization of different types of Blood cells.
10. Enumeration of Red Blood Cells.
11. Enumeration of White Blood Cells.
12. Identification of various stages of cell division (mitosis and meiosis).

Text books & References:

1. Sambrook et al., (1989), A manual on Molecular cloning.
2. K.V. Chaitanya, (2013), Cell and Molecular Biology: A Lab Manual.

SEMESTER I: ALLIED COURSE - I
BIOCHEMISTRY-I

Course code: U1RBTAC1

Hours/Week: 6

Credits: 3

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To have a detailed knowledge about the structure and function of biomolecules
- To know the functions of carbohydrates, proteins, vitamins and lipids

Unit I: Carbohydrates: Structural aspects – Introduction & Occurrence, Classification of Mono, Di and Polysaccharides, Reducing & Non-reducing Sugars, Constitution of Glucose & Fructose, Osazone - formation, Pyranose & Furanose forms, Determination of ring size, Inter-conversion of monosaccharides.

Unit II: Proteins: Structural aspects – Introduction, Classification & General characteristics, Structure of Primary, Secondary, Tertiary & Quaternary proteins (elementary idea)

Unit III: Lipids: Structural aspects – Introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, Membrane protein – Structural aspects, Lipoproteins (elementary idea).

Unit IV: Nucleic acids: Structural aspects – Components of DNA and RNA, Nucleosides & Nucleotides (Introduction, structure & bonding), Double helical structure of DNA (Watson & Crick model) different forms of DNA

Unit V: Vitamins and Minerals :**Vitamins:** Source, structure, biological role, daily requirement and deficiency - Manifestation of the fat soluble vitamins and water soluble vitamins. **Minerals:** requirement, essential micro and macro minerals, sources and functions.

Text Books

1. Nelson, D.L and Cox, M.M. 2013. Principles of Biochemistry, Lehninger, 6th Edition, W.H.Freeman & Co.
2. Berg, J.M *et al.*, 2012. Biochemistry, 7th Edition, W. H. Freeman & Co.
3. Voet, D. *et al.*, 2012. Fundamentals of Biochemistry: Life at the Molecular level, 4th Edition, John Wiley and Sons.

Reference Books

1. Zubay,G.L. 1998. Biochemistry, Wm.C. Brown Publishers.
2. Sinden,S.R. DNA structure and function, First Edition, Academic Press, 1994.
3. Carl Branden and John Tooze, Introduction to Protein Structure, Second Edition, Garland Publishing, 1999.
4. Garrett.R and Grisham.C 2010. Biochemistry, 4th Edition, Saunders College Publishing.

SEMESTER II: CORECOURSE - III
BIOINSTRUMENTATION

Course Code: U2RBTCC3

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

1. To understand the analytical techniques and equipment used in Biological science.
2. To have a fundamental knowledge regarding the Microscopy, Spectroscopy, Centrifugation.
3. To acquire knowledge on the Chromatographic method for the separation of biological products.

UNIT - I: BASIC INSTRUMENTS:

Physical balance, pH meter, Autoclave, Hot air oven, isoelectric point. Principles and application of light microscopy, phase Contrast, Bright and Dark field Microscopy fluorescence Microscopy, Electron Microscopy- TEM, SEM, Confocal microscopy.

UNIT - II: SEPERATION TECHNIQUES:

CENTRIFUGES:

Basic principle of centrifugation: and its types - Ultra Centrifugation (Preparative and analytical) Density gradient Centrifugation, Rate zonal centrifugation, Differential centrifugation. Standard Sedimentation coefficient.

CHROMATORAPHY:

Chromatography – Principle and instrumentation of paper chromatography and application of Chromatography, HPLC and GC chromatography,.

UNIT - III: DIFFRACTION METHODS

Principles, Components and applications of X-Ray Crystallography. Braggs equation, Reciprocal lattice concept, Miller index and Unit cell, Determination of crystal structure, colorimeter, Spectroscopy – Raman effect, UV-Visible, Mass spectroscopy, Atomic

Absorption spectroscopy, NMR –Experimental techniques and instrumentation, ESR. LASER and MASER - Principle and applications

UNIT - IV: TRACER TECHNIQUES:

Radio active and stable isotopes: Pattern and rate of radioactive decay isotope-Half life, GM Counter, solid and Liquid scintillation counter, Radiation dosimetry, Radio tracer technique, Autoradiography. Application of isotopes in Biology.

UNIT - V: ELECTROPHORETIC TECHNIQUES

Electrophoresis- Agarose Gel Electrophoresis, SDS-PAGE, Native Gel, 2D gel and gradient Gel Electrophoresis, Pulsed field Gel Electrophoresis (PFGE).

Text Books

1. Analytical biochemistry and separation techniques-A laboratory manual, P.Palanivelu 2nd edition 2001 Tulsi books centre.
2. Biophysical chemistry – principles and techniques, Upadhyay and Nath, 3rd edition, 2002, Himalaya publishing home.
3. Laboratory manual in biochemistry, J. Jayaram 1981, Wiley publisher.
4. Bioinstrumentation, L. Veerakumari, 2011, MJP publishers.

Reference Books

1. P.Palanivelu, 2001. Analytical biochemistry and separation techniques-A laboratory manual, 2nd edition. Tulsi books centre.
2. Keith Wilson and John walker, 2000. Principles and techniques of practical biochemistry, 5th edition, Cambridge University press.
3. Freifelder, 1982. Physical biochemistry- application to biochemistry and molecular biology, 2nd edition,
4. W.H.Freeman and company, San Fransisco.

Net References

1. www.explainthe stuff.com.www.chemguide.co.uk

SEMESTER II: CORECOURSE- IV
MAJOR PRACTICAL II - BIOINSTRUMENTATION

Course Code: U2RBTCC4P

Max Marks: 100

Hours/Week: 3

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

- To know the operations and application of basic instruments.
 - To learn the various techniques in biology.
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1. Determination of pH of Biological samples (Blood, Plasma, Urine & Saliva).
 2. Preparation of Buffers.
 3. Estimation of Protein by Lowry/ Burette method
 4. Estimation of Amino acid by Ninhydrin method.
 5. Separation of pigments by Paper Chromatography and Column Chromatography.
 6. Separation of amino acid by Thin layer Chromatography.
 7. Demonstration of Agarose gel Electrophoresis.
 8. Poly Acrylamide Gel Electrophoresis.
 9. Biochemical Estimation of DNA/ RNA using Spectrophotometer.

Reference Books:

1. Analytical biochemistry and separation techniques-A laboratory manual, P.Palanivelu, 2nd edition 2001, Tulsi books centre.
2. Laboratory manual in biochemistry, J.Jayaram 1981, Wiley publisher.
3. Principles and techniques of practical biochemistry, Keith Wilson and John walker, 5th edition 2000, Cambridge University Press.

SEMESTER II: ALLIED COURSE - III

BIOCHEMISTRY-II

Course Code: U2RBTAC3

Hours/Week: 4

Credits: 3

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To have a detailed knowledge about the bio-molecules.
- To have a basic knowledge about the enzymes and endocrine system.

UNIT-I

Buffers and conversions

Percentage solutions, molarity, normality, Unit conversions, properties of water - hydrogen ion concentration - acids, bases and their concept - buffers and electrolytes and their functions - acidity, alkalinity and pH determination

UNIT-II

Bioenergetics

Energy and its forms - free energy - laws of thermodynamics - enthalpy and entropy - redox potential - redox coupling and ATP bioenergetics.

UNIT-III

Enzymes:

Classification and nomenclature of enzymes - physico chemical nature of enzymes - enzyme kinetics - mechanism of enzyme action - factors affecting enzyme activity, Industrially important enzymes.

UNIT-IV

Clinical applications of Biochemistry of secondary metabolites

Alkaloids, flavonoids, anthocyanins, terpenes - Elementary treatment of fractionation of biological materials by chromatography

UNIT-V

Endocrine glands

Pituitary, thyroid, parathyroid, adrenal and pancreas, testes and ovary, Hormones – Definition – classification, functions, diseases associated with deficiency of hormones.

Text Books

1. Hubert, Styer, 1995. Biochemistry-Freeman and Company, New York.
2. Subramaniam, S. and Madhavan Kutty, K. 1971. The Text Book of Physiology, 1st ed., Orient Longman Ltd.
3. Sathyanarayana,U and Charapani,C. (2010). Biochemistry. Books and allied (P) Ltd
4. Deb,A.C., (1989). Fundamentals of Biochemistry (3rd Edition). New central agency.
5. Jain, J.L., (2005). Fundamentals of Biochemistry (6th Edition), S.Chand Publications
6. Sembulingam.K and Prema Sembulingam (2003). Essentials of medical physiology (2nd Edition). Jaypee Brothers Medical Pulishers (P) Ltd.

SEMESTER II: BIOCHEMISTRY- ALLIED PRACTICAL

ALLIED COURSE - II

Course Code: U2RBTAC2P

Max Marks: 100

Hours/Week: 3

Internal Marks: 40

Credits: 3

External Marks: 60

1. Qualitative and quantitative estimation of carbohydrates, amino acids, proteins, lipids and Nucleic acids.
2. Estimation of ascorbic acid (from biological sample)
3. Estimation of protein by Folin Lowry method
4. TLC separation of Amino acids /sugars
5. Determination of Iodine number of a fat
6. Estimation of RNA by Orcinol method
7. Estimation of DNA by diphenyl amine method
8. Verification of Beer's Law Spectrophotometrically
9. Testing of Blood Sugar (3 Periods)

Reference:

1. Keith Wilson and John Walker. (1995). Principles & Techniques of Practical Biochemistry.(4th edition).Cambridge University press, Britain.
2. Oser, B.L.Hawks, (1965). Physiological Chemistry, TATA Mc Graw Hill.Shawn O' Farrell and Ryan T. Ranallo. (2000).
3. Experiments in Biochemistry: A Hands-on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc.,Australia.
4. Strolv, B.A. Makavora, V.C.(1989). Laboratory manual in Biochemistry. MIR Publisher,Moscow.

SEMESTER II: ENVIROMENTAL STUDIES

Course Code: U2RES

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

UNIT- I

The multidisciplinary Nature of Environmental Studies: Definition, Scope and importance – Need of public awareness. **Natural Resources :** Introduction – Renewable and non-renewable resources: Natural resources and associated problem, non-renewable resources, renewable resources – Role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

UNIT – II

Ecosystem: Concept of an ecosystem: understanding ecosystems, ecosystem degradation, resource utilization, Structure and functions of an ecosystem, Producer, Consumers and Decomposers, Energy flow in the ecosystem: The water cycle, the carbon cycle, the oxygen cycle, the nitrogen cycle, the energy cycle, integration of cycles in nature, Ecological succession: food chains, food webs and ecological pyramids- Introduction, types, characteristic feature, structure and functions: Forest ecosystems, grassland ecosystems, desert ecosystems and aquatic ecosystems.

Biodiversity: Introduction – Genetic diversity, species diversity, ecosystem diversity, Biogeography classification of India, Value of biodiversity, Consumptive use value, productive use value , social values, ethical and moral values, aesthetic value, option value. Biodiversity at global, national and local levels, India as a mega-diversity nation, hotspots of biodiversity, threat to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India: common plant species, common animal species. Conservation of biodiversity: *Insitu* conservation and *exsitu* conservation.

UNIT – III

Pollution: definition – causes, effects and control measures of pollution: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. **Solid waste management:** Causes, effects and control measures of urban and

industrial waste. Role of an individual in the prevention of pollution, pollution case studies, disaster management: floods, earthquakes, cyclones, landslides.

UNIT – IV

Social issues and the environment: From unsustainable to sustainable development, urban problems related to energy. Water conservation, rainwater harvesting, watershed management, Resettlement and rehabilitation of people: Its problem and concerns. Environmental ethics: issues and possible solutions: Resource consumption patterns and the need for equitable utilization, equity – disparity in the northern and southern countries, Urban rural equity issues, the need for gender equity, preserving resources for future generations, the rights of animals, the ethical basis of environment education and awareness, the conservation ethic and traditional value systems of India.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust., wasteland reclamation, consumerism and waste products. The environment (protection) act, the air (prevention and control of pollution) act, the wildlife protection act. Forest conservation act, issues involved in enforcement of environmental legislation. Environment impact assessment, citizen's actions and action groups. Public awareness: using an environmental calendar of activities, what can I do?

UNIT – V

Human population and the environment : Population growth, variation among nations, global population growth. Population explosion: family welfare program: methods of sterilization and urbanization. Environment of human health. Environmental health, climate and health, infectious diseases, water related diseases, risks due to chemicals in food, cancer and the environment. Human rights: equity, nutrition, health and human rights, intellectual property right (IPR's) and community, biodiversity registers (CBRs). **Value education:** environmental values, valuing cultures, social justice, human heritage, equitable use of resources, common property resources, ecological degradation. HIV/AIDS. Woman and child welfare, role of information technology in environment and human health.

Field work: Visit to a local area to document environment environmental assets: river/forest/grasslands/hill/mountain. Visit to a local polluted site, study of common plants. Insects, birds, study of simple ecosystems.

REFERENCE:

1. Erach Bharucha.2005. Textbook of Environmental studies for Undergraduate Courses.
University Grant Commission, Universities Press (India) Private Limited, Hyderabad.

SEMESTER III: CORE COURSE - VI
GENETICS AND MOLECULAR BIOLOGY

Course Code: U3RBTCC5

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

- To make the student to understand the concept of genes and genetic material
- On successful completion of the subject the student should have understood: DNA, chromosome, plasmids and their replication
- To make the students to understand the genetic disorders
- To get employability in medical diagnosis and genetic counseling

UNIT – I: Classical Genetics

Gregor Mendel's work and contribution, **Laws of inheritance:** Mendel's Laws, test cross, monohybrid and dihybrid, concept of dominance, segregation, independent assortment; Chromosome theory of inheritance.

Allelic and non-allelic interactions: Concept of alleles, types of dominance - Over dominance and co dominance, lethal alleles, Pseudo alleles, multiple alleles, Epistasis.

UNIT – II: Prokaryotic Genetics

DNA and RNA as a genetic material. Discovery of DNA. Types, Forms, structure and functions of DNA and RNA. - Details of *E.coli* chromosome, Brief account of plasmid – structure, properties, types and significance. Transposable elements in bacteria- Transposons. Genetic code, Gene Structure, concept of Gene-expression, transcription, translation, posttranslational and transcriptional modification Gene regulation - Lac operon, trp operon **Gene transfer mechanism** in bacteria-conjugation-transformation - transduction - generalized and specialized.

UNIT – III: Eukaryotic Genetics

Chromatin structure: Histones, DNA, nucleosome, Repetitive DNA, Giant chromosomes: Polytene and Lampbrush chromosomes, RNA splicing and transcription,

Ribozyme, Translation Linkage and Crossing over, Population genetics, life cycle of *Neurospora crassa* types, breakage, Rejoining and models of recombination- the Holliday model.

UNIT – IV: Replication of DNA, Mutation & DNA repair mechanism

Replication of DNA –enzymes involved, models, Rolling circle model – Theta Model. Replication of RNA – reverse transcriptase. **Mutation** - mutants, Types and significance of mutation- Frame shift, Silent, Point, Sense and Nonsense mutation. **DNA repair mechanism** - Photoreactivation, Excision repair, Proof reading activity of DNA polymerases. Transposable elements in eukaryotes

UNIT – V: Human Genetics

Introduction to Human Genetics-Human Chromosomes: Structure and organization of DNA. Chromosome abnormalities – Euploidy, Polyploidy. Genetic disorders - autosomal dominant and autosomal recessive disorders, Sex linked inheritance – X - linked and Y linked disorders, Cancer and Diabetes. Inborn errors of metabolism, Eugenics and genetic counseling.

Text Books

1. Essential of molecular biology, Freifelder D. 2008, 4th edition, Jones and Bartlett publishing (Unit I-IV)
2. Cell Biology and Genetics: 1 by Cecie Starr & Ralph Taggart , 11th Revised edition (2005), Publisher: Brooks/Cole(Unit I,II &IV)

References

1. Molecular cell Biology, by Darnell, Lodish, Baltimore, Scientific American Books, Inc., 1994.
2. Recombinant DNA technology- Watson J.D, M Gil man et al., scientific American books-WH free man publishers
3. Cell Biology : Organelle Structure And Function Sadava D. E Released: 2009 Publisher: Cbs

4. Human genetics, A.Gardner, R.T.Howell and T.Davies, Published by Vinod Vasishtha for Viva Books private limited, 2008.
5. Molecular spectroscopy. 1st rev.ed (english) 1st edition (s) j. D. Graybea 2014,Mcgraw hill

Net References

1. <http://agridr.in/tnauEAgri/eagri50/GBPR111/index.html>
2. <http://www.genome.gov/10000013>

SEMESTER III: CORE COURSE - VI

MAJOR PRACTICAL III - GENETICS AND MOLECULAR BIOLOGY

Course Code: U3RBTCC6P

Max Marks: 100

Hours/Week: 5

Internal Marks: 40

Credits: 5

External Marks: 60

1. Isolation of Genomic DNA
2. Estimation of DNA
3. Isolation of plasmid DNA
4. Isolation of Auxotrophic mutants.
5. Mutagenesis in Bacteria
Physical method-UV Rays
Chemical method- N-methyl-W-nitro-N nitrosoguanidine
6. Qualitative analysis of DNA-Agarose gel electrophoresis
7. Demonstration of Electrophoresis, Gel doc and Electrophorator

References

1. Laboratory Manual of Genetics by A.M. Winchester, Publisher: Brown (William C.) Co, U.S.; 3rd Revised edition (1 January 1979)
2. Robertson, Dominique, Shore, Scott and Miller, David M. Manipulation and Expression of Recombinant DNA a Laboratory Manual. London: Ap Professional, 1997. (574.873282, ROB.D)
3. Miller, Jeffrey H. Short Course in Bacterial Genetics a Laboratory Manual and Handbook for Escherichia Coli and Related Bacteria. USA: Gold Spring Harbar, 1992. (589.9015, MIL.J)
4. Cell and Molecular Biology: A Lab Manual (English) Author: Chaitanya K V Released: 2013 Publisher.
5. Surzycki, Stefan. Laboratory Manual Human Molecular Biology. USA: Blackwell Publishing, 2003. (574.87078, SUR.S)

Net References

1. wiki.mcmaster.ca/Biology.../2013:day_1-1-introduction.pdf?...pages.

2. [http://www.freebookcentre.net/biology-books-download/Molecular-Biology-Techniques-Laboratory-Manual-\(PDF-189P\).html](http://www.freebookcentre.net/biology-books-download/Molecular-Biology-Techniques-Laboratory-Manual-(PDF-189P).html)

SEMESTER III: ALLIED COURSE - IV

BASIC MICROBIOLOGY

Course Code: U3RBTAC4

Hours/Week: 6

Credits: 3

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To get a basic idea about Microbiology.
- To learn about the classification of Microorganisms.
- To know about the general characteristics of Microorganisms.

UNIT-I:

Introduction to Microbiology: Introduction, Important terminologies, History and Scope of microbiology. Methods of Sterilization: Physical and Chemical methods. Isolation of Microorganisms: Plating techniques, Identification of Microorganisms: Staining techniques, Motility test, IMViC tests.

UNIT-II:

Classification of Micro organisms : Classification of microorganisms - Hackels Three kingdom concept, Whittaker's Five kingdom concept. General Methods of classifying Bacteria: The intuitive method, numerical taxonomy and genetic relatedness. Classification of bacteria according to Bergey's manual, - Classification of Viruses, Algae, Fungi and Protozoa.

UNIT III:

Ultra Structure of Bacteria: Capsule, Cell wall, Cell membrane, Cytoplasmic membrane, Cytoplasm, Cell inclusions- Mesosomes, Ribosomes, Magnetosomes, Flagella and Pilli.

UNIT IV:

Nutrition and Growth: Aerobic and anaerobic nutritional requirements, Micronutrients, Macronutrients, Nutritional types of Microorganisms. Types of media: simple media, differential media, enriched media. Growth factors, Growth curve, Factors influencing and affecting microbial growth. Methods for preservation and storage of Microbial cultures.

UNIT-V:

Structure, Reproduction and Physiology of Microorganisms:

Introduction, Habitat, Structure and Reproduction of Microorganisms: Viruses, Algae, Fungi and Protozoa. Physiology of Microorganisms: Glycolysis, Pentose phosphate pathway, ED pathway, Krebs's cycle. Mechanism of ATP synthesis.

Text Books:

1. Text book of Microbiology – Dr.R.Arora, CBS Publisher 3rd Edition (2008).
2. A text book of Microbiology – R.C.Dubey, K.Maheswari, M.Chand publishers 1st Edition (2012).
3. Microbiology – Bernard Davis, Lippincott Publishers 4th Edition (2011).

References:

1. Microbiology - M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1986).
2. Microbiology - Concepts and Applications, J.Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1993).
3. Microbiology L.M. Prescott, J.P. Hareley D.A. Klein W.M.C. Brown publishers. Dutique. Jawa. Melbourne. (1993).
4. Basic and Practical Microbiology-Ronald M. Atlas, Mac. Millen Company, New York.
5. Text book of Microbiology – Ananthanarayanan and Paniker, University Press, 8th Edition.

Net References:

1. www.microbeworld.org
2. www.microbiologyonline.org.uk/links.html
3. www.sheffcol.ac.uk/link/science/biology/microbiology.

SEMESTER IV: CORE COURSE - IV

r-DNA Technology

Course Code: U4RBTCC7

Hours/Week: 6

Credits: 5

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To acquire knowledge on basic principles in genetic engineering and vectors in gene cloning.
- To expose students to application of rDNA technology to various fields of biotechnology.
- To get a grasp on the latest advances in recombinant DNA technology, which is a powerful tool in modern Biotechnology

Unit I: Vectors and Enzymes:

Vectors in Gene Cloning: Plasmids - Types, Bacteriophages, Phagemids, Cosmids - Artificial Chromosomes: PAC, BAC, YAC. Enzymes used in gene manipulation-restriction enzymes, DNA Polymerases, Reverse Transcriptases, Ligases, Poly Nucleotide Kinases, Alkaline Phosphatases and Nucleases, Topoisomerases, Gyrases, Methylases.

Unit II-Principles and methods in genetic engineering:

Isolation and purification of Nucleic Acids - Agarose Gel Electrophoresis - Southern, Northern and South-Western blotting techniques - Principles and techniques of nucleic acid hybridization and cot curves.

Unit III -Cloning strategies:

Genomic libraries, cDNA libraries-construction, cDNA cloning, Shot gun cloning, Reverse transcription, DNA primers, Linkers and Adaptors. Library construction and screening. Cloning in Prokaryotes (*E.coli*), Cloning in Organisms other than *E.coli* (*Pseudomonas*, *Bacillus subtilis*), Yeast and Fungi, Human genome project - its applications.

Unit IV-Recombinant selection and DNA Sequencing:

Recombinant clones - methods for selection and screening of recombinant clones, Detection of rDNA and its products, site directed mutagenesis - DNA sequencing – Maxam Gilbert, Sanger's Automated sequencing - PCR – types and applications.

Gene transfer techniques: Transformation - Electroporation, Transduction, Micro injection and Gene gun.

Unit V -Applications of genetic engineering:

Applications in medicine-in forensic science-in agriculture and in pharmaceutical industry-vaccine production-transgenic plants and animals and their applications, Gene Therapy: Strategies for gene delivery gene replacement/augmentation- Gene therapy for inherited diseases, ADA, FH, Cystic Fibrosis.

TEXT BOOKS

1. Recombinant DNA Technology. 2012 by Keya Chaudhuri Publisher: The Energy and Resources Institute, TERI
2. Recombinant DNA Technology by Sardul Singh Sandhu, 2010. I K International Publishing House Pvt. Ltd
3. Primrose. S.B., Twyman R.M., Old. R.W. (2001) Principles of Gene Manipulation. Blackwell Science Limited.

REFERENCES

1. LEWIN'S Gene X, J E. Krebs, E.S. Goldstein and S.T. Kilpatrick, Jones and Bartlett Publishers, London. 2014
2. Methods in Enzymology Vol.152, guide to molecular cloning Techniques, S.L. Berger and A.R.Kimmel, Academic Press, Inc. San Diego, 2012
3. Methods in Enzymology Vol 185, Gene Expression Technology, D.V. Goeddel, Academic Press, Inc., San Diego, 1990
4. DNA Science, A First Course in Recombinant Technology, D.A.Mickloss and G.A.Freyar, Cold, Spring Harbor Laboratory Press, New York, 2013
5. Molecular Biotechnology (2nd Edition), S.B.Primrose, Blackwell Scientific Publishers, Oxford, 1994.
6. Human Molecular Genetics, Tom Strachan and Andrew P.Read, Bios Scientific Publishers, 1996.

NET REFERENCES:

<http://www.britannica.com/science/recombinant-DNA-technology>

SEMESTER IV: CORE COURSE - VII
MAJOR PRACTICAL IV- r-DNA Technology

Course Code: U4RBTCC8P

Max Marks: 100

Hours/Week: 3

Internal Marks: 40

Credits: 5

External Marks: 60

OBJECTIVES

- To acquire practical knowledge on genetic engineering and vectors in gene cloning.
- To expose students to application of rDNA technology to various fields of biotechnology.

1. Isolation of genomic DNA from Plant and Animal tissues.
2. Preparation of Competent Plasmid.
3. Restriction digestion of λ -phage DNA
4. Ligation.
5. Screening of recombinants.
6. Electroporation.
7. Polymerase Chain Reaction (Demo).
8. SDS-PAGE.
9. RFLP.
10. RAPD.

References:

1. Molecular biology and Recombinant DNA technology: Practical manual series (Volume II) Ist Edition, Ashok kumar, Narendr Publishing House (2011).
2. Recombinant DNA and Biotechnology (A guide for teachers), 2nd Edition, 2013, Helen kreuzer and Adnanne Massey (ASB press).
3. Molecular cloning – A Laboratory Manual, 2010 (3rd Edn) P Sambrook and Russell.D.W.

SEMESTER IV: ALLIED COURSE - VI

APPLIED MICROBIOLOGY

Course Code: U4RBTAC6

Hours/Week: 5

Credits: 3

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To know about the distributions of Microorganisms.
- To know the application of Microorganisms in various fields.
- Motivate the Students to become an Entrepreneur.

UNIT-I:

FOOD AND DAIRY MICROBIOLOGY:

Introduction, History, Occurrence of microorganisms in food, intrinsic and extrinsic Factors influencing microbial growth. Contamination, spoilage, and preservation of foods: Fruits, Vegetables, Eggs, Meat, Poultry, fishes, Milk and Milk products. Fermented foods: Sauerkraut, Pickles, Buttermilk, Yogurt and Cheese.

UNIT – II:

INDUSTRIAL MICROBIOLOGY:

Industrial products from microorganisms - Antibiotics: production of Penicillin, Streptomycin. Enzymes from microbes: Amylase, Protease. Organic acids - citric acid, acetic acid. Amino acids - Glutamic acid, lysine. Production of alcoholic beverages - Beer and wine. Biofuels - Ethanol, Methane, Biogas.

UNIT III:

MEDICAL MICROBIOLOGY:

Morphology, cultural characteristics, Pathogenicity, Laboratory diagnosis prevention, control and treatment of diseases caused by the following organisms: *Mycobacterium tuberculosis*, *Clostridium tetani*, *Salmonella typhi*, *Vibrio cholera*, swine flu, Rota, Ebola, HIV, Dengue virus and Chicken guinea virus and Hepatitis viruses.

UNIT-IV:

ENVIRONMENTAL MICROBIOLOGY:

Soil as dynamic ecosystem, Microbial flora of soil, Interactions among soil microorganisms (Neutralism, commensalism, mutualism, antagonism, competition, parasitism and predation). Biogeochemical cycles (carbon, nitrogen, sulphur and phosphorus cycle). Air Microbiology: Sampling of air micro flora, Biodiversity in Air. **Water Microbiology:** Types of water (atmospheric, surface and stored constituents), Biodiversity of aquatic environments.

UNIT V:

MARINE MICROBIOLOGY:

Methods of studying the marine microorganisms: Methods of collection, enumeration (total and viable counts), Isolation, culture and identification based on morphological, physiological and biochemical characteristics; Marine Microorganisms as food, Preservation of marine microbes.

Text books:

1. A text book of Microbiology – R.C.Dubey, Dr.K.Maheswari, M.Chand publishers 1st Edition (2012).
2. Food Microbiology – William C.Frazier and Dennis C.Westoff, Tata Mc Graw Hill Education (2013).
3. Industrial Microbiology – L.E. Casida, New age international publisher Ltd., New Delhi (2009)
4. Marine Microbiology – A.Mitra and Kakoli Banerjee, Narendra publishing house (2004).

References:

1. Microbiology- M.J. Pelczar, Jr., E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1986).
2. Microbiology-Concepts and Applications, .J.Pelczar, Jr. ,E.C.S. Chang and N.R. Krieg, McGraw Hill Company, New York (1993).
3. Microbiology L.M. Prescott, J.P. Hareley D.A. Klein W.M.C. Brown publishers. Dutique. Jawa. Melbourne. (1993).
4. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987.

5. Stanbury P.F., and Whitaker A., Principles of Fermentation Technology, Pergamon Press, 1984.
6. Text book of Microbiology – Ananthanarayanan and Paniker, University Press, (9th Edition).
7. Basic and Practical Microbiology-Ronald M. Atlas, Mac. Milleen Company, New York.
8. Gerard J. Tortora, Berdell R. Funke, Christian L. Case, (2006), Microbiology: An introduction to Microbiology, 9th edition, Benjamin Cummings Publications.

Net References:

1. www.microbeworld.org
2. www.microbiologyonline.org.uk/links.html
3. www.kensbiorefs.com/microbio.html.

SEMESTER IV: ALLIED COURSE - V

BASIC MICROBIOLOGY AND APPLIED MICROBIOLOGY PRACTICALS

Course Code: U4RBTAC5P

Max Marks: 100

Hours/Week: 3

Internal Marks: 40

Credits: 3

External Marks: 60

OBJECTIVES

- To know about the basic rules and safety regulations of Microbiology and Biotechnology laboratories.
- To learn the technique of isolation, identification and measurement of Microorganisms.
- To help the students to build-up a progressive and successful career Eligibility.

1. Laboratory regulations and dos and don'ts
2. Maintenance of hygienic conditions in the laboratory and legal disposal of laboratory wastes.
3. Handling of Microscope.
4. Preparation of Culture media.
5. Disinfection: Phenol co-efficient method.
6. Isolation of Microorganisms-Pour Plate, Spread Plate and Streak Plate methods.
7. Quantitative estimation of Microorganisms (Counting chamber).
8. Measurement of microorganisms – Micrometry.
9. Identification of Microorganisms: Macroscopic, Microscopic, Motility tests, staining techniques, Biochemical tests, Serological and Molecular tests.
10. Growth curve of Bacteria: Lag phase, Log phase, Stationary phase and Decline phase.
11. Growth factors: pH, temperature, time, Carbon and Nitrogen sources.

References:

1. Sundaraj T, Mrs. Aswathy Sundararaj. (2002) Microbiology Laboratory Manual, First edition, Chennai.
2. Laboratory Manual in General Microbiology (2002) by N. Kannan. Panima Publishers.
3. Dubey, R.C. and Maheshwari, O.K. (2005) Practical Microbiology. S, Chand and Co.Ltd., First edition. New Delhi.

4. Baron E J and Finegold S M. (1995). Diagnostic Microbiology. Blackwell Scientific Systems.
5. Cappuccino, J and Sherman, N. (2002) Microbiology. A Laboratory Manual . 6th Edition. Pearson Education Publication, New Delhi.
6. Bucker, J.M, Caldwell, C.A., Zachgo, E.A.1990. A Laboratory course, Academic Press.
7. Harold J.Berson. Microbial applications. WM.C.Brown Publishers.(1994).

Net References:

1. [www.cat.cc.md.us/course/bio141/lab manual/index.html](http://www.cat.cc.md.us/course/bio141/lab%20manual/index.html)

SEMESTER IV: SBE - I
VERMI TECHNOLOGY

Course Code: U4RBTSBE1

Max Marks: 100

Hours/Week: 3

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES

- To learn the basic principles of biological, chemical and environmental concepts pertaining to vermitechnology.
- To create knowledge on Environmental degradation.
- To get the theoretical knowledge on vericompost bed preparation.
- To create knowledge on Self -Employment Opportunity.

UNIT-I

Vermiculture: definition, scope and importance - common species for culture - Environmental requirements - culture methods – Benefits and constraints of vermicomposting.

UNIT-II

Earthworms: Taxonomic position and diversity – Types - morphology and physiology of earthworm - Ecological roles and needs for earthworm culture- wormery breeding techniques - indoor and out door cultures - monoculture and polyculture - relative merits and demerits.

UNIT-III

Applications of vermiculture - vermin-composting, use of vermicastings in organic farming / horticulture - earthworms for management of biomedical solid wastes - feed / bait for capture / culture fisheries – forest regeneration.

UNIT-IV

Marketing the products of vermiculture - quality control, market research, marketing techniques - creating the demand by awareness, demonstration, and advertisements - packaging and transport - direct marketing.

UNIT-V

Future perspectives - Predator / pathogen control in wormeries - Cost-benefit analysis of vermi-composting - Potentials and constraints for vermiculture in India.

TEXT BOOKS & REFERENCES

1. Sultan Ahmed Ismail, 2005, The Earthworm Book, Second Revised Edition. Mother India Press, Goa.
2. Edwards, C.A. and Bohlen, P.J 1996, ecology of earthworms – 3 rd Edition, Chapman and hall.
3. Jsmail, S.A., 1970, Vermicology, The biology of earthworms, Orient Longman, London
4. Lee, K.E., 1985. Earthworms - Their ecology and Relationship with Soil and Land use, Academic Press, Sydney (Unit- II-III).
5. Shukla, G.S 1994. Economic Zoology. Meerut Rastogi publication

SEMESTER V: CORE COURSE - IX

IMMUNOLOGY

Course Code: U5RBTCC9

Hours/Week: 7

Credits: 5

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To learn about the Immune system of human beings.
- Make awareness about immune diseases, its prevention and treatment methods.
- To know the principles and applications of different types of immuno techniques.

UNIT I:

Introduction to Immunology:

Introduction - History and scope of immunology. Important terminologies. Antigen-structure, types- Antibodies-structure and function. Immune system – organs, cells, tissues and mediators. Types of immunity: Innate and acquired. Primary and Secondary immune response.

UNIT II

Immune System:

Non specific immunity - the complement systems: mode of activation, classical and alternate pathway, NK cells, phagocytosis, Cell mediated immunity and Humoral immunity. Immunoglobulins: Types, structure , properties and functions. Haematopoiesis. Ontogeny, origin, development and differentiation of T and B cells.

UNIT III

Immune Diseases:

Hypersensitivity reactions-General character, activation, effectors phases, clinical aspects. Tumour immunology, immunodeficiency diseases-Auto immune diseases - Immunological tolerance - Immunosuppression.

UNIT IV

Immuno Technology:

Immuno diagnosis – Precipitation , Agglutination, Neutralization, Complement fixation and Coombs test.Introduction , Principle, Methodology and applications of ELISA,

ELISPOT, RIA, RIST, RAST, Labeled assay, Immunofluorescence, blotting techniques. Hybridoma Technology.

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UNIT V

Prevention and Treatment:

Organ transplantation and HLA tissue typing, Bone marrow transplantation - Cytokines, Interleukins, Interferons. Applications of Monoclonal antibodies - Recombinant antibodies. Vaccines: Introduction, types and applications – schedule for vaccination

Text Books

1. K. R. Joshi, N.O. Osama (2000) Immunology, Agrobios Ltd, India.
2. An Introduction to Immunology (2002) by C.V. Rao, Narosa Publishing House, India.

References

1. Kuby Immunology (2002) by R.A. Goldsby, T.J. Kindt and B.A. Osborne, W.H. Freeman and Company,
2. New York.
3. Immunology by I.M. Roitt, J. Brostoff and D.K. Male (1993) Gower medical publishing, London
4. Peter Wood, (2001). Understanding Immunology University of Manchester, Pearson Education Ltd, Essex.
5. Richard M. Hyde 1995 Immunology III edition ELBS London.
6. Immunology introductory textbook- Nadini Shetty, New Age International (P) Limited, publishers, (2012).

Net References

1. www.immunopath.com.ac.uk/-immuno/part1.html,
www.immuneweb.xxmc.edu.cn/immunology/immunology.html

SEMESTER V: CORE COURSE - X
PLANT AND ANIMAL BIOTECHNOLOGY

Course Code: U5RBTCC10

Max Marks: 100

Hours/Week: 7

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

- To study the details of plant cells, organ, tissue culture.
- To learn and gain the knowledge about the plant tissue culture for transgenic plant production.
- To make the student understand conservation of biological resource through plant biotechnology
- To get knowledge on secondary metabolite production to meet the global competence
- To understand the principles of Animal cell culture and its applications.
- To understand and develop new technologies using molecular biology, embryo manipulation and cell culture.

UNIT-I

Plant tissue culture: History – Introductory - Scope and importance - laboratory organization – types of tissue culture medium - growth regulators – Auxins, Cytokinin and Gibberellins - sterilization techniques – Explant - preparation - Direct and Indirect organogenesis. Somatic embryogenesis, Hardening- plant let acclimatization.

UNIT - II

Haploid production: Anther – Ovule cultures. Protoplast isolation, fusion and culture - Somatic hybridization. Somaclonal variation. Synthetic seeds. Cryopreservation and *ex situ* conservation of germplasm- Commercial production of secondary metabolites- Production of therapeutic antibodies and edible vaccine from plants.

UNIT - III

Biodiversity and conservation: Plant genome organization - Selection of Molecular markers (RAPD, RFLP & AFLP). **Agricultural biotechnology:** Ti- & Ri- plasmid – Reporter genes, promoters, SARs. Gene transfer methods - nuclear transformation methods (Direct gene transfer through protoplasts).

UNIT IV

Animal Cell Culture: Equipments and materials for animal cell culture technology. Various systems of tissue culture, their distinguishing features, advantages and limitations. Culture medium: natural media, synthetic media, sera. Introduction to balanced salt solutions and simple growth medium. Characteristics of cells in culture: Contact inhibition, anchorage dependence, cell-cell communication - Cell senescence.

UNIT V

Transgenic Animals: Cloning, Gene transfer methods in Animals – Microinjection, Embryonic Stem cell gene transfer, Retrovirus & Gene transfer. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Applications of Transgenic animals.

Text Books

1. Satyanarayanan, U. 2005. Biotechnology, Books and allied (p) Ltd.,
2. Bhojwani, and Razdan, M.K . 2004. Tissue Culture Theory and Practice.
3. Chawla, H.S. Biotechnology in crop improvement. International Book distributing Company (1998).
4. Gupta, P.K. Elements of Biotechnology. Rastogi and Co. Meerut, (1996).
5. Animal biotechnology, R.Sasidhara, 2006, MJP Publishers.
6. Text book of Animal Biotechnology, Dr.P.Ramadass, Dr.S.Meera rani, 2nd Edition, 2002, MJP publishers.

References

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. Hammond, J., McGarvey, P. and Yusibov, V. (Eds.). 2000. Plant Biotechnology. Springer Verlag.
3. Henry, R.J. 1997. Practical Application of plant Molecular biology. Chapman and hall.
4. Paul Christou and Harry Klee. 2004. Hand Book of Plant Biotechnology. Vol I& II. John Wiley & Sons. Ltd.
5. Biotechnology ,M.M.Ranga,2nd Edition ,2003,Agrobios India.
6. Animal Cell Culture:A practical approach, Freshney, E.D., 2000, John Wiley Pub., New York.

Net References

1. www.qIagen.com
2. [www. Animal lifescience.roche.com](http://www.Animal.lifescience.roche.com)

SEMESTER V: CORE COURSE - VI
MAJOR PRACTICAL V
(COVERING CC9 AND CC10)

Course Code: U5RBTCC11P

Max Marks: 100

Hours/Week: 7

Internal Marks: 40

Credits: 5

External Marks: 60

OBJECTIVES

- To learn the basic and advanced techniques of Immunology and Immunotechnology.
- To get an awareness about the pathogens and its diagnostic tools.
- Motivate the students to get self employability by forming immunodiagnostic laboratories.
- To understand plant and Animal tissue culture concepts

IMMUNOLOGY

1. Agglutination: ABO blood grouping, Rh Typing, WIDAL test, CRP and ASO.
2. Precipitation -Immune diffusion: Double immuno diffusion and Radial immuno diffusion.
3. Electrophoresis: pre-counter immuno electrophoresis, single immuno electrophoresis and Rocket immuno electrophoresis.
4. Enumeration of blood cells: RBC, WBC, platelets and its sub types.
5. Differential staining of Blood cells
6. Labeled assay- Demonstration of ELISA and RIA.
7. Demonstration of Lymphoid organs in rat

PLANT BIOTECHNOLOGY

1. Preparation of plant tissue culture medium for organ culture (Node, internode, leaf and shoot tip)
2. Initiation of regeneration of callus culture
3. Production of Synthetic seeds
4. Isolation, fusion and Culture of Protoplast
5. Demonstration of RFLP and RAPD in plants

ANIMAL BIOTECHNOLOGY

1. Preparation of Media for cell culture.
2. Trypsinization.
3. Cell viability test.
4. Cell counting.

References

1. Microbiology - James, C. Cappuccino, The Benjamin/Cummings Pub. Co. California (1996).
2. Experiments in Microbiology, Plant Pathology and Biotechnology Aneja, K.R. , 4th Edition 2013, Narosa publication house Delhi.
3. Immunology methods manual – vol 1 – lefkovits, Ivan. London Ap professional, 1997
4. Text books of practicals and clinical Immunology – Talwar.G.P. New delhi :CBS , 2005
5. Practical microbiology – R.C. Dubey and D.K. Maheswari. S.Chand and company ltd., (2002) M.J.1995.
6. Cappuccino, J and Sherman, N. (2002) Microbiology. A Laboratory Manual . 6th Edition. Pearson
7. Education Publication, New Delhi.
8. Bhojwani and Razdan, M.K, 2004. Plant Tissue culture theory & practical.
9. Hulse P.I. and Patterson., M.K. Tissue culture, methods and application,
10. Marchan, D,J. Handbook of cell and Organ culture (2nd ed). Burgess Pub. Co., Minneapolis, USA, (1964).

Net References

www.iclark.edu/-reiness/immuno/practicals.html

SEMESTER V: MBE I
MEDICAL LABORATORY TECHNOLOGY

Course Code: U5RBTMBE1

Max Marks: 100

Hours/Week: 5

Internal Marks: 40

Credits: 4

External Marks: 60

OBJECTIVES

1. To understand the basic needs of clinical laboratory
2. To insist the students to start clinical Laboratory for employment by knowing all pathogens and biochemical diagnosis.

UNIT-I: Introduction - Organization of Clinical laboratory

Basic needs, functional components-Basic laboratory safety, Carcinogens, Chemicals and radioactive substances, Corrosive chemicals, Explosive chemicals, Fire fighting equipment, First aid in laboratory accidents, Flammable chemicals-First Aid in laboratory accidents.

UNIT-II: General comments on Specimen collection

Transport, Handling and preservation of Sputum, Blood, Urine and faeces. Units of measurement: The Metric system-Preparation of reagent Solutions (Molar, percentage)-Laboratory calculations.

UNIT-III: Haematology:

Components of Blood and their functions-Human Blood group systems-Rh Blood group-Collection of Blood-transportation of Blood-storage of Blood-Haematopoietic system of the body-Determination of Haemoglobin concentration.

UNIT-IV: Bacterial diseases

Pathology, Laboratory Diagnosis, Prevention and treatment of Typhoid, Cholera, Tuberculosis and Botulism

UNIT-V: Fungal and Viral Diseases

General account on Mycosis, Aspergillosis, Candidiasis and Fungal eye infections

Pathology, Laboratory Diagnosis, Prevention and treatment of Rabies AIDS and Dengue fever.

Text Books

1. Textbook of Medical Laboratory Technology Vol 1 & 2 by Darshan P. godkar Praful B. Godkar, Bhalani Publishing House; 3rd edition (2014)
2. A Handbook Of Medical Laboratory Technology (English) 2nd Edition ,Jaypee Brothers Medical Publishers,2015
3. Text book of Microbiology by Ananda Narayanan and Paniker,1998

References

1. Medical Laboratory Technology (Volume I): Procedure Manual for Routine Diagnostic Tests , 2010, by Kanai, L Mukherjee and Swarajit Ghosh
2. Basic and Practical Microbiology-Ronald M.Atlas, 2003.Mac.Milleen Company,New York.

Net References

1. <http://www.getfreebooks.com/?p=2970>
2. <http://libguides.usd.edu/content.php?pid=309677&sid=2538615>

SEMESTER V: SBE II

ORGANIC FARMING

Course Code: U5RBTSBE2

Hours/Week: 2

Credits: 2

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To study the principles and practices of organic farming for sustainable crop production.
- To develop an understanding of the historical, biological and ecological basis for Organic farming including crops and live stocks management.
- To learn the basic principles of organic matter management by utilizing cover crops and compost.
- To develop critical and creative thinking with a system of approach for multiple and diverse farming systems, including vegetables, fruit, field crops and livestock and use the skills for development of a group farming systems plan.
- To understand and realize the social, economic, political and environmental context for current and future organic agricultural production and sales.

UNIT – I

Introduction to Organic Farming – Principles, types, need and development of organic farming — Conventional farming v/s Organic farming. Biodynamic farming – Scope of organic farming in Tamil Nadu, national and international status – Agencies and institutions related to organic agriculture.

UNIT – II

Organic farming systems: Land preparation – Soil tillage – Choice of Propagation (Seed & planting materials) Seed treatments – crop rotations, multiple and relay cropping systems – Water management. Manure: Green manure - Composting and factors – Composting methods.

UNIT - III

Bio-fertilizers: types – methods of application – advantages and disadvantages. Weed management, diseases and insect pest management, bio-pesticides – Vermicomposting –

organic manures – Concentrated organic manures – Organic amendments and sludges.

UNIT - IV

Organic crop production: methods – Rice – Coconut – Cashew – Okra – Pulses – Amaranthus – Solanaceous – Cucurbits – Mango – Banana – Pepper – Ginger – Turmeric – Ornamental crops– Livestock component in organic farming.

UNIT – V

Farm economy: Basic concept of economics- Demand, supply – Economic Viability of a farm – Marketing, Imports and exports – Farm inspection and certification. Entrepreneurship Development: Entrepreneurship – Concept – characteristics – approaches – need for entrepreneurship – Agri Enterprises – Stages of establishing enterprise – Project Identification.

Suggested Readings

1. Palaniappan SP & Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publ (Unit-I -V).
2. Ananthakrishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
3. Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socioeconomic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, Bangalore.
4. Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
5. Sharma A. 2002. Hand Book of Organic Farming. Agrobios (Unit- I-V).
6. Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore (Unit- I-V).
7. Free- E-book: <http://agridr.in/tnauEAgri/eagri50/GBPR111/index.html>

SEMESTER V: IDC-I

BIO-FERTILIZERS

Course Code: U5RBTIDC1

Hours/Week: 2

Credits: 2

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To understand the microorganisms are used as biofertilizers.
- To have knowledge on technologies for production of bioinoculum.
- To get full confident to become an entrepreneur.

UNIT - I

Introduction to Biofertilizers: Microbes used as bio-fertilizer – Classification – Symbiotic N₂ Fixers: Rhizobium – Isolation, characterization, and Identification- application – large scale production.

UNIT – II

Symbiotic N₂ fixers: Isolation, Identification large scale production, crop response, and field application of *Cyanobacteria* and *Azolla*. Isolation and characterization of Frankia – Actinorhizal nodules – non-leguminous crop symbiosis.

UNIT– III

Non symbiotic N₂ fixers: Isolation, Identification large scale production, crop response, and field application of *Azospirillum*, *Azotobacter*, *Clostridium*, *Klebsiella* and *Anabaena*

UNIT – IV

Phosphate solubilizers: Isolation, characterization, mass inoculums production, field application of *Bacillus* sps. and *Pseudomonas*- Phosphate solubilization mechanism.

UNIT - V

Mycorrhizal Biofertilizers: Classification, Isolation, Identification, Mass inoculums production, field application of Ecto and Endo mycorrhizae – VAM

Text Books

1. Kannaiyan S, 2003. Biotechnology of Biofertilizers, CHIPS, Texas (Unit- I-V).
2. Subbu Rao, N.S, 2000. Biofertilizers in Agriculture, Oxford & IBH Publishing Co, New Delhi (Unit- 1-II).
3. http://www.fnca.mext.go.jp/english/bf/bfm/pdf/4_4_Phosphate_Solubilizers0403.pdf (Unit- III- V)
4. Free e-Book: http://www.fnca.mext.go.jp/english/bf/bfm/pdf/Biofertilizer_Manual.pdf

References

1. Himadri Panda, Dharamvir Hota, 2007. Biofertilizers and Organic Farming, 2007, Gene-Tech Books (Unit- I-V).
2. H. A. Modi, 2012. Microbial Inoculants and Biofertilizer Technology, Neha Publishers & Distributors (Unit- I-V)
3. H.C. Lakshman, Channabasava A, Biofertilizers And Biopesticides, 2014. Neha Publishers & Distributors (I-II).

SEMESTER VI: CORE PAPER-XII
ENVIRONMENTAL BIOTECHNOLOGY

Course Code: U6RBTCC12

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

- To understand the energy sources, environmental pollution and remediation using biotechnology and its control.
- Students will get an idea about the hazards to our environment, solutions to protect and for sustainable development.
- To know the importance in the era of industrialization leading to environmental hazards and it will help students to take up a career in tackling industrial pollution and also who is willing to take up the research in areas like development of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes such as green manufacturing technologies and sustainable development.

UNIT I: Basic concepts of ecology

Interaction between environment and biota; Concept of habitat and ecological niches; Limiting factor; Energy flow, food chain, food web and trophic levels; Ecological pyramids and recycling, biotic community-concept, structure, dominance, fluctuation and succession; N.P.C and S cycles in nature. Population ecology.

UNIT II: Environmental pollution

Types of pollution, methods for the measurement of pollution, air pollution and its control, Air pollution – Source of air pollution, Classification of air pollutants and its control – Electrostatic precipitator Global environmental problems: ozone depletion, green house effect and acid rain, Land and noise pollution.

UNIT III: Water Pollution and control

Need for water management, measurement and sources, water pollution. Waste water treatment: waste water collection, physico-chemical properties of waste water, physical,

chemical and biological treatment processes. Eutrophication. Waste Water treatment: Primary, Secondary and Tertiary treatment.

UNIT IV: Solid waste management

Sewage sludge treatment and utilization, composting and vermi composting; biodegradation of noncellulosic wastes for environmental conservation and fuel- biofuel - General aspect; biodegradation of xenobiotics; bioremediation of contaminated soils and waste lands; radioactive product waste disposal.

UNIT V: Hazardous waste management

Biodegradation of Xenobiotics, Pesticides, Oil biodegradation – Superbug, Bioleaching, Bioremediation – *In situ* and *ex situ* bioremediation. Biotechnological applications for Hazardous waste management, uses and constraints of Genetically Engineered Microorganisms (GEMs) in the environment.

Text books

1. Environmental Biotechnology- Dilip Kumar MarKandey and Neelimn Rajvaidya (APH publishing corporation, New Delhi)
2. Applied Biotechnology – LP Rema (MJP publishers, Chennai).

References

1. Environmental Biotechnology by Alan Scragg. Pearson Education Limited, England.
2. Environmental Biotechnology by S.N. Jogdand. Himalaya Publishing House. Bombay.
3. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf and Eddy, Inc., Tata Mc Graw Hill, NewDelhi
4. Environmental chemistry by A.K. De Wiley Eastern Ltd. NewDelhi

SEMESTER VI: CORE PAPER-XIII

BIOSTATISTICS, BIOINFORMATICS, BIOETHICS AND IPR

Course Code: U6RBTCC13

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 5

External Marks: 75

OBJECTIVES

- Describe basic concepts of probability, random variation and commonly used statistical probability distributions.
- Apply common statistical methods for inference.
- Calculate descriptive statistics related to public health.
- To Understand the basic concept of bioinformatics, bioethics and IPR

UNIT – I : Introduction to Biostatistics

Definition of Statistics and Biostatistics - Development- Application-Role-Data and its collection-Classification of Data - Characteristic of Statistics - Importance and Usefulness of Statistics - Limitation of statistics.

UNIT – II : Tabulation and Graphical representation

Tabulation and Frequency Distribution: Tabulation-Frequency Table of Frequency Distribution-Preparation of a frequency Table.

Graphical representation: Types of Graphs, Line Graph, Bar Diagram, Histogram, Frequency Polygon, Frequency Curve.

UNIT – III: Measures of Central tendency and Dispersion

Measures of central tendency: Characteristics of an Ideal Measures of Central tendency-Arithmetic mean - median and mode (definition, merits and demerits, problems based on raw, discrete and continuous data).

Measures of dispersion: Variability- range - mean deviation - standard deviation - variance and coefficient of variation (definition, merits & demerits, problems based on raw data only).

UNIT – IV: Computers and Bioinformatics

Introduction to Bioinformatics – Scope and Application. Types of Computers. Characteristics of hardware and software. Biochips, Computer network, Internet, Browsing, PUBMED. NCBI data models. MED. **Protein sequence databases** – PIR, Swiss Prot, MIPS, TrEMBL, NRL-3D, **DNA Sequence databases**- Gen Bank, DDBJ, EMBL. Alignment – Pair wise alignment (Global and Local alignment), Multiple sequence alignment, Alignment algorithms.

UNIT – V: Bioethics and IPR- scope of bioethics, Medical ethics, Artificial insemination, Eugenics, Human cloning - **IPR**- Patents and copyrights

Books for Study

1. “Biostatistics” – P.N.Arora and P.K. Malhan, Himalaya Publication House, 2006
2. Introduction to Bioinformatics, Sundarajan. S and R. Balaji (2005) Himalaya Publishing House, Mumbai.
3. Bioinformatics-Concepts, skills and applications, S.C

Reference Books

1. Introduction to Biostatistics – Sokal and Rohlf – Toppan Co. Japan
2. Primer of Biostatistics – Stanton A. Clantz – The McGraw Hill Inc. New York
3. Introduction to bioinformatics, Arthur M. Lesk, 1st Edition, 2002, Oxford University Press.
4. Bioinformatics – Sequence, structure and databanks, D. Higgins and W. Taylor (Eds), Oxford University Press, New Delhi (2000).
5. Introduction to computational Biology Michael S. Watermann, Chapman & Hall (1995).

Net References

1. www.Inderscience.com
2. www.apbionet.org.
3. www.bioinformatics.world.com

SEMESTER VI: CORE PAPER-XIV
ENVIRONMENTAL BIOTECHNOLOGY &

BIostatISTICS, BIOinformatics, BIOethics AND IPR PRACTICALS

Course Code: U6RBTCC14P

Max Marks: 100

Hours/Week: 5

Internal Marks: 40

Credits: 5

External Marks: 60

OBJECTIVES

- To get an idea about the techniques in Environmental Biotechnology, Biostatistics, Bioinformatics
- Motivate the students to get research based knowledge and to study all the advanced techniques available in the concern subjects
- Encourage the students to get self employability by learning all these techniques

ENVIRONMENTAL BIOTECHNOLOGY

1. Detection of Coliforms for determination of purity of fresh & Sewage water – MPN technique.
2. Determination of total dissolved solids of Water.
3. Determination of hardness of water.
4. Determination of Chloride of Water
5. Determination of DO, BOD COD of Water

BIostatISTICS

1. Calculation of arithmetic mean, median and mode for grouped and ungrouped data
2. Calculation of quartile deviation and standard deviation

BIOinformatics

1. Study of Nucleic acid sequence databases- Genbank, EMBL.
2. Exploring and querying SWISS PROT and UNIPROT.
3. Study of Structural databases-PDB, SCOP, CATH.
4. Exploring the integrated databases system at NCBI Server.
5. Exploring tools on EXPASY.
6. Database (Homology) searches using different versions of BLAST and interpretation of results to derive the biologically significant relationship of the query sequences (Protein/DNA) with the database sequences.

7. Studying the format and content structural databases and visualization of structures using SWISS PDB Viewer and RASMOL

SEMESTER VI: MBE-II

FOOD TECHNOLOGY

Course Code: U6RBTMBE2

Hours/Week: 5

Credits: 4

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- This paper adds information about the role of microorganisms in many food industries both in production and spoilage processes.
- To encode the importance processing ,preservation and packaging of many food products
- The students will be able to manipulate this knowledge in prevention of spoilage and also exploit the microbes for improved food quality.

UNIT I - Introduction

Definition and Scope of Food Technology - Components of food industry; Quality factors in food- Functional groups and properties. Nutritive factors of food constituents – protein, carbohydrates, fats in nutrition, Dietary fiber (fibre), Vitamins

UNIT II - Fermentation products

Cheese, Yogurt, Sauer Krant, pickles, Alcohol, wine, brandy and beer. Microbes as direct food (*Chlorella*, *Spirulina*, Mushrooms and Baker's yeast) and mycoprotein.

UNIT III - Food process & preservation

Food preservation: Principles of food preservation – methods of preservation: Physical (irradiation, drying, heat processing, smoking, chilling and freezing. Chemical (Sodium benzoate Class I & II); Biological: Probiotics and bacteriocins – Food processing industries - general aspect.

UNIT IV - Food Packaging

Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, types of packaging-Glass bottles, jars, Cans, Form-Fill-Seal (FFS) packaging

UNIT V - Value-Added Food Products Processing for Micro-income

Banana Chips, Dried Garlic ,Ginger Pickle , Tomato Jam and Orange Syrup **Food spoilage:** *Staphylococcal*, *Salmonellosis*, *E.coli*, Botulism, aflatoxin; Deterioration of foods.

Text Books

1. Food Biotechnology, Varun Mehta, 2007. Neha Publishers & Distributors
2. Food Microbiology- Frazier, 2011, Tata McGraw-Hill Education.

References

1. Food Biotechnology.,Second EditionKalidas Shetty October 11, 2005 by CRC Press
2. Biotechnology, 1983, VI-VIII, Rehm, H.J. and Reed,G, Verlag Chemie,Wainheim.
3. Genetic Engineering Applications for Industry, 1981, Paul,J.K.,Noyer Corporation, New Jersey.

Net references

1. <http://as.wiley.com/WileyCDA/WileyTitle/productCd-1118384911.html>
2. <http://www.ftb.com.hr/>

SEMESTER VI: MBE-III
INDUSTRIAL BIOTECHNOLOGY

Course Code: U6RBTMBE3

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 4

External Marks: 75

OBJECTIVES

- To study the principles and methodologies of Industrial Biotechnology.
- To get an idea about the applications of Biotechnology in Industries.
- Motivate the students to form the Industries and R&D Labs.

UNIT I: INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY

Introduction - history - isolation and screening of industrially important microorganisms, enrichment liquid culture, enrichment cultures using solid media. Preservation and storage of microbial cultures - improvement of the strains for increased yield and other desirable characteristics.

UNIT II: STERILIZATION AND GROWTH KINETICS

Microbial growth kinetics – Batch culture, fed-batch culture and continuous culture, up-stream processing - media formulation for industrial fermentation. Sterilization: Batch and continuous sterilization systems - filter sterilization.

UNIT III: BIOREACTORS

Bioreactors – Basic structure and components of bioreactor, types of bioreactor : continuous stirred tank bioreactor, air-lift bioreactor, packed bed reactor, tower fermentor, and specialized bioreactor – fluidized bed bioreactor, photo bioreactor. Design of bioreactors – measurement and control of bioprocess parameters.

UNIT IV: MICROBIAL PRODUCTS

Industrial production of chemicals : Enzymes (Amylase), acids(citric acid), alcohol (Ethanol), Beverages(wine), Bakery products (Bread), antibiotics (penicillin), vaccine (polio), SCP (spirulina), vitamins(vitamin B12).

UNIT V: DOWN STREAM PROCESSING

Down stream processing – removal of microbial cells and solid media, foam separation, precipitation, filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane process, drying and crystallization.

Text Books

1. Biotechnology: A text book of Industrial microbiology – Wulf crueger and Anne lise crueger (second editon), Panima publishing corporation, New Delhi/Bangalore (2000).
2. Industrial Microbiology – A.H.Patel,Mac Millan India Edition (2011).

References

1. Principles of fermentation technology - P.F. Stanbury, A. Whitaker and S.J. Hall Elsevier publication, second edition, 2005.
2. Reviere, J, 1996, Industrial application of Microbiology, Surey University Press.
3. Demain AL., AL and Solman, NA, 1996, Manual of Industrial Microbiology, American Society of Microbiology, Washington DC.
4. Boetaert, Wim / Vandamme, Erick J. (eds.).Industrial Biotechnology 1st Edition April 2010.
5. Industrial Biotechnology – Dr.Rita Singh and S.K.Ghosh,Global vision publishing., 1st Edition (2013).
6. Industrial microbiology – L.E. Casida, New Age International (P) Ltd, New Delhi.

Net References

1. www.microbes.info
2. www.fsis.usda.gov
3. www.livescience.asu.edu/text/classesbk.html

SEMESTER VI: SBE- III

MUSHROOM CULTIVATION AND VALUE ADDITION

Course Code: U6RBTSBE3

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES

- To study the general characteristics and structure of Mushrooms.
- To know about the importance and need of Mushrooms.
- To acquire knowledge regarding the cultivation and contamination possibilities of Mushrooms.
- Motivate the students to form a Mushroom cultivation unit.

UNIT-I: INTRODUCTION TO MUSHROOMS

Introduction, History of mushroom cultivation, edible and non-edible mushrooms, Classification and distribution of mushrooms, most commonly cultivated mushrooms in the world , life cycle of mushrooms. Research centers : International level, National level and Regional level.

UNIT – II: SPAWN PREPARATION

Spawn preparation : Isolation of pure culture, Nutrient media for pure culture , layout of spawn preparation room , raw material of spawn ; sterilization , preparation of mother spawn and multiplication.

UNIT-III: CULTIVATION OF MUSHROOMS

Cultivation of mushrooms : Layout of mushroom shed , small scale and large scale production unit. Types of raw materials , preparation and sterilization, Mushroom bed preparation , maintenance of mushroom shed , harvesting method, storage and preservation of mushrooms.

UNIT-IV: HARVESTING AND ECONOMIC IMPORTANCE

Harvesting of following types of Mushrooms: Milky Mushrooms; oyster mushrooms, button mushrooms and any one medically valuable mushroom. Economics of mushroom

cultivation : Fixed assets, recurring expenditure, labour, economics of cultivation throughout the year, Cost benefit ratio : Marketing in India and abroad – Export value.

UNIT – V: NUTRITIONAL VALUES AND RECIPIES OF MUSHROOMS:

Nutritional values of mushroom – protein, carbohydrate, fat, fibre, vitamins and amino acid contents and pharmacological values. Mushroom dishes: Soup, cutlet, omlette, samosa, pickles, curry, chutney.

Text Books

1. Marimuthu et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore.
2. Tewari and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.

References

1. Nita Bahl. 1988. Hand book of Mushrooms, II ed., Vol I & II. and environmental impact. 2nd ed., CRC press.
2. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation: A practical guide to growing mushrooms at home, Agarikon Press
3. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms: Cultivation, nutritional value, medicinal effect.
4. Singh, Reeti and Singh, V.C. (2005). Modern Mushroom Cultivation. Agrobios, India.
5. Swaminathan, M 1990. Food and Nutrition,. Bappco. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

Net References

1. www.tnau.ac.in/micro/ug/html
2. www.scienceandsociety-dst.org/highlights.html

SEMESTER VI: IDC- II
PERSONAL HYGIENE AND FAMILY HEALTH

Course Code: U6RBTIDC2

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

UNIT I - Concepts of health

Who definition of health; Determinants of health; Responsibility for health. Health service philosophies: Health case; Health system; Levels of health care. Concepts of disease and concept of causation – germ theory of disease; Epidemiological triad; Multifactorial causation; Web of causation.

UNIT II -

Nutrition and Health – Food defined; Nutrition defined; Classification of foods; Nutrients – Sources and functions of proteins, fats, carbohydrates; sources and functions of vitamins and minerals. Nutritional Profiles of principle foods; cereals, Millets, Vegetables, Fruits, Milk and Milk products, Fish and meat, alcoholic beverages, egg, soft drink. Balanced Diet- PEM Malnutrition and its effects – Kwashiorkor and Marasmus.

UNIT III -

Environment and Health – Basic health requirements in the environment – Water – Sources and uses of water, Water pollution, Water related diseases and purification of water. Air – Composition and cause of discomfort; Air pollution – Sources, Air pollutants, need for proper ventilation. Housing – Social goals of housing and criteria for healthful housing.

UNIT IV -

Maternal and child Health :- Mother and child – one unit; Intrapartum care; Post natal child care- care of the mother, complications of post partum period, restoration of mother to optimum health, Breast feeding; congenital malformations – Definition, incidence, Risk factors, Prenatal diagnosis and prevention. Family planning methods – Family planning definition, Natural family planning methods – BBT Cervical mucous method. Artificial family planning methods – Hormonal contraceptives- progestin only pills; oral pills, Depot formulations.

UNIT V -

Mental Health – Types and causes of mental illness- Preventive aspects; Alcoholism and drug dependence – Definition , agent factors, Host factors, symptoms, environmental factors, prevention, Treatment and Rehabilitation. Health care programmes in India- National AIDS control programme and National Immunization programme.

References

1. Park. K., Social and preventive medicine, Bhanot publishers, 18th edition,2005.
2. Turk and Turk ., Social and preventive medicine.
3. Dash. B.N., Health and physical edition,2003.
4. Ashtekar.S., Health and Healing – A Manual of Primary health care, orient Longmans publishers.2001.
5. Patil. R.S., Practical Community Health,Vora medical publishers,1995.

SEMESTER VI: GENDER STUDIES

Course Code: U6RGS

Hours/Week: 2

Credits: 2

Max Marks: 100

Internal Marks: 25

External Marks: 75

UNIT - I

Concept of Gender: Sex Gender – biological Determinism – Patriarchy –Feminism – Gender Discrimination – Gender Division of Labour – Gender Stereotyping – Gender sensitivity – Gender Equality – Gender mainstreaming – empowerment.

UNIT - II

Women's studies Vs Gender studies: UGC's Guidelines – VIII to XI Plans, Gender studies : Beijing conference and CEDAW – Exclusiveness and inclusiveness.

UNIT - III

Areas of Gender discrimination: Family, Sex ratio literacy, Health, Governance, religion Work Vs employment – Market , Media, Politics, Law, Domestic violence, Sexual Harassment, State politics and planning.

UNIT - IV

Women development and gender empowerment: initiatives, International Women's decade, International Women's Year, National policy for Empowerment of women, Women Empowerment Year 2011, Mainstreaming global policies.

UNIT - V

Women's Movements: In India National/State Commission for Women(NCW), All Women Police station, Family court, Domestic violence Act, Prevention of Sexual Harassment at work

place supreme court guidelines, Maternity Benefit Act, PNDT act, Hindu Succession Act 2005, Eve teasing prevention act, Self help groups, 73rd and 74th amendment for PRIS.

References

1. Bhasin kamala, Understanding Gender: Gender basics, New Delhi: women Unlimited, 2004.
2. Rajadurai, S.v, Geetha V, Themes in caste Gender and Religion, Trichy, Bharathidasn University , 2007.
3. Pauldi, A Michele (ed..) Prager guide to the Psychology of Gender,

IDC - FOOD AND NUTRITION

(Offered by our Department)

Course Code: -

Hours/Week: 2

Credits: 2

Max Marks: 100

Internal Marks: 25

External Marks: 75

UNIT I -

Sources, food composition, properties and storage of common foods. Functions of food in relation to health –classification of foods based on nutrients. New protein, new fat foods. Food preservation-food additive in processed food and their effects. Food groups to provide nutritive requirement for normal health – body building food, energy foods and protective foods.

UNIT II

Essential nutrients: Fats , Carbohydrates and Proteins. Energy value of foods, energy needs. Definition of unit of energy – cal, RQ, SDA, NPU, Basal metabolism-measurements – factors influencing BMR. Role of fibre in diet.

UNIT III

Micro and macro mineral nutrients: Distribution sources, metabolic functions and deficiency manifestations- Ca, P, Na, K, Fe, Cu, Se, Zn.

UNIT IV

Nutrition through life cycle. Infants, Children, Adolescents, Pregnant, Lactating women, Old persons.

UNIT V

Principles of diet therapy. Diet during Stressed conditions- Labours. Patients Therapeutic diets for anemia, malnutrition, obesity, diabetes mellitus and allergy.

References

1. Food chemistry-L.G.Meyer.

2. Food science-Polter.
3. Fundamentals of food chemistry-W.Heimann.
4. Introduction of food chemistry-Garrad.
5. Essentials of food and nutrition-Vol I & II, Swaminathan M.
6. Human nutrition & Dietics – Passemore R and others.

IDC- STEM CELLS BIOLOGY

(Offered by our Department)

OBJECTIVES

- ✓ To learn the unique properties of all stem cells.
- ✓ To understand the embryonic and adult stem cells.
- ✓ To know the potential uses of human stem cells.

UNIT I: INTRODUCTION TO STEM CELLS

Definition, Classification and sources, primary embryonic stem cells ,Umbilical cord stem cells, human embryonic stem cells. Properties of Stem cells-Pluripotent- Totipotent.

UNIT II : EMBRYONIC STEM CELLS

Blastocyst and inner cell mass cells, organogenesis, stem cell differentiation , trophoblast stem cells, identification and lineage specificity, isolation and maintenance of neural precursors.Laboratory test to identify ES cells.

UNIT III: ADULT STEM CELLS

Somatic stem cells,Different type of adult stem cells,Test for identification of adult stem cells,Adult stem cell differentiation, Skin, mammary gland, dental and neural stem cells.Endodermal stem cells-Liver stem cells – GI tract and liver, pancreatic stem cells.

UNIT IV: RECEPTOR AND ITS IDENTIFICATION

Surface antigen markers and its identification, microarray

UNIT V: APPLICATION OF STEM CELLS:

Stem cell therapy for neuro degeneration disease, parkinson's, alzheimer, spinal cord injury and other brain syndrome, tissue system failures, diabetes, cardiomyopathy, kidney failure, liver failure .

Text Books

1. Stem cell technologies , basics and applications, Kaushik D.Deb, 2010 1st edition, McGraw Hill education.
2. Stem cells, Eapen cherian , 2011, 1st edition, Jay Pee brothers medical publishers.

Reference Books

1. Human Embryonic stem cells, Kiessling AA, 2nd Edition, 2006, Jones and Barlett Publishers.
2. Essentials of Stem cell Biology, Lanza .R, 2005, Academic Press.
3. Adult Stem cell, Turksen, K, 2004, Humana Press, INC

Net references

1. Stem cells.nih.gov/info/basics.
2. www.medicalnewstoday.com/info/stem_cell/

SEMESTER VI: SBE- III

MUSHROOM CULTIVATION AND VALUE ADDITION

Course Code: U6RBTSBE3

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

OBJECTIVES

- To study the general characteristics and structure of Mushrooms.
- To know about the importance and need of Mushrooms.
- To acquire knowledge regarding the cultivation and contamination possibilities of Mushrooms.
- Motivate the students to form a Mushroom cultivation unit.

UNIT – I: INTRODUCTION TO MUSHROOMS

Introduction, History of mushroom cultivation, edible and non-edible mushrooms, Classification and distribution of mushrooms, most commonly cultivated mushrooms in the world , life cycle of mushrooms. Research centers : International level, National level and Regional level.

UNIT – II: SPAWN PREPARATION

Spawn preparation : Isolation of pure culture, Nutrient media for pure culture , layout of spawn preparation room , raw material of spawn ; sterilization , preparation of mother spawn and multiplication.

UNIT-III: CULTIVATION OF MUSHROOMS

Cultivation of mushrooms : Layout of mushroom shed , small scale and large scale production unit. Types of raw materials , preparation and sterilization, Mushroom bed preparation , maintenance of mushroom shed , harvesting method, storage and preservation of mushrooms.

UNIT-IV: HARVESTING AND ECONOMIC IMPORTANCE

Harvesting of following types of Mushrooms: Milky Mushrooms; oyster mushrooms, button mushrooms and any one medically valuable mushroom. Economics of mushroom

cultivation : Fixed assets, recurring expenditure, labour, economics of cultivation throughout the year, Cost benefit ratio : Marketing in India and abroad – Export value.

UNIT – V: NUTRITIONAL VALUES AND RECIPIES OF MUSHROOMS

Nutritional values of mushroom – protein, carbohydrate, fat, fibre, vitamins and amino acid contents and pharmacological values. Mushroom dishes: Soup, cutlet, omlette, samosa, pickles, curry, chutney.

Text Books

3. Marimuthu et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore.
4. Tewari and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.

References

6. Nita Bahl. 1988. Hand book of Mushrooms, II ed., Vol I & II. and environmental impact. 2nd ed., CRC press.
7. Paul Stamets, J.S. and Chilton, J.S. 2004. Mushroom cultivation: A practical guide to growing mushrooms at home, Agarikon Press
8. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms: Cultivation, nutritional value, medicinal effect.
9. Singh, Reeti and Singh, V.C. (2005). Modern Mushroom Cultivation. Agrobios, India.
10. Swaminathan, M 1990. Food and Nutrition,. Bappco. The Bangalore Printing and Publishing Co Ltd., Bangalore.

Net References

3. www.tnau.ac.in/micro/ug/html
4. www.scienceandsociety-dst.org/highlights.html

MAJOR BASED ELECTIVE

ENZYME TECHNOLOGY

Course Code:

Hours/Week: 5

Credits: 4

Max Marks: 100

Internal Marks: 25

External Marks: 75

OBJECTIVES

- To learn enzyme reactions and its characteristics along with the production and purification process.
- To give the student a basic knowledge concerning reactions with the usage of enzymes.

UNIT I: INTRODUCTION TO ENZYME

Classification of enzymes, Mechanism of Enzyme action, Concept of active site, collision theory and transition theory.

UNIT II: KINETICS OF ENZYME ACTION

Estimation of Michelis – Menton parameters, Turn over number, Types of inhibition, Models for substrate and products, Allosteric regulations .

UNIT III: ENZYME IMMOBILIZATION AND BIOSENSOR

Physical and chemical for enzyme immobilization-Adsorption, Matrix, entrapment, encapsulation, cross linking, covalent binding, Designing of enzyme electrode.

UNIT IV: PURIFICATION OF ENZYMES

Production and purification of crude enzymes extracts from Microbes, Chracterization, Enzymatic assays.

UNIT V: APPLICATION OF ENZYMES

Reduction reactions,oxidation reactions,Enzymes in organic synthesis,Artificial enzymes.

Text Books

1. Enzyme technologies, Blazer A., and Zemek J., 1987, Elsevier.

2. Bioreactor immobilized enzyme and cell-Fundamentals and applications, Murray Moo – Young, 1988, Elsevier.
3. The tools of biochemistry, Terrance, G. Cooper, 1977, John Wiley and Son.
4. Enzymes : Biochemistry, Biotechnology and clinical chemistry, Trevor Palmer, East-West press Pvt. Ltd., New Delhi, 2004.

References

1. Fundamentals of enzymology – The cell and molecular biology of catalytic proteins, 3rd edition, Nicholas C. Price and Lewis Stevens, oxford university press, 2003.
2. General enzymology, Kulkarni and Deshpande, Himalaya publishing house, Mumbai, 2007.
3. Enzyme technology, Anusha Bhaskar and V.G. Vidhya, MJP Publishers, Chennai, 2007.

MAJOR BASED ELECTIVE
MICROBIAL BIOTECHNOLOGY

Course Code:

Max Marks: 100

Hours/Week: 5

Internal Marks: 25

Credits: 4

External Marks: 75

UNIT-I

Microbial Biotechnology: Scope and applications – horizons of Microbial Technology.

Microbes: Living factories for macromolecules – Production of proteins in Bacteria and yeast; recombinant and synthetic vaccines; microbial enzymes – application in starch processing. Textile designing, detergents, cheese making, polysaccharides and polyesters – immobilization of cells and enzymes.

UNIT – II

Microorganisms in fermentation – Ethanol from feed stocks to fermentable sugars, from sugars to alcohols, Clostridial fermentation, lactic acid fermentation, acetic acid production and industrial production of various milk products.

UNIT – III

Metabolites from microorganisms – amino acids; antibiotics – antibacterial agents (lactams, tetracyclines, peptides, amino glycosides), antifungal agents, anti – tumor antibodies; Biotechnological potential of micro algae – food – fuel production – pharmaceutically valuable compounds of micro algae. SCP, Mycoprotein.

UNIT – IV

Biopesticides; Bio control of insects – microbial insecticides (*Bacillus.thuringiensis*, *B.spaerinus*, *B.papilliae* and Baculo – Viruses).

Biofertilizers (nitrogen fixing Bacteria, mycorrhiza and phosphate solubilizing Bacteria) – genetically engineered organisms.

UNIT – V

Bioremediation, Biosorption, Environmental clean – up by microbes: Application of microbial biotechnology in sea and waste water treatment, degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents.

Public concerns about the microbial biotechnology and Economics of microbial biotechnology.

References

1. Glick, B.R. and Pasternack, J.J. 1994. Molecular Biotechnology. ASM Press. Washington, D.C.
2. Desmond, S.T., Nicholl. 1994 . An Introduction to Genetic Engineering. Cambridge Univ. Press, Cambridge.
3. Old R.W and Primrose S.B. 1994. Principles of Gene Manipulation. 4th edition. Blackwell Scientific Publication, London,
4. Cresswell RC. Ress TAV and Stah, H 1989. Algal and Cyanobacterial Biotechnology. Longman Scientific and Technical, New York.
5. Prave, P., Faust, U. Sitting, W. Suktasch D. A. 1987 . Fundamentals of Biotechnology. VCH verlasgetell Schafor MBH, Weinheim, Germany.
6. Glazer, A. N. and Nikoido, H. 1995 . Microbial Biotechnology. W.H. Freeman & Co., New York.
7. Encyclopedia of Microbiology. 1992 . Vols. 1-4 . Academic Press, London.
8. Stanbury, P.F. Whittaker, A, Hall, S.J. 1995 . Principles of Fermentation Technology. Butterworth Heinemann, London.

SKILL BASED ELECTIVE IV
AGRICULTURAL BIOTECHNOLOGY

Course Code:

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

UNIT- I: Basic techniques and tools in Plant Tissue Culture

Establishment of plant tissue culture lab: equipment, culture vessels, surface sterilization of various explants, pretreatment of explant, subculture and repeated transfer of explants and cultures. Composition of various tissue culture media and their preparation.

UNIT – II: Establishment of callus

Suspension cultures, organogenesis and embryogenesis, Meristem tip culture, Hardening of plants, Techniques of anther, embryo and ovule culture. Protoplast isolation, culture and fusion. Artificial seed (synthetic seed) Cell line selection using selection pressure, Production of secondary metabolites, Cryopreservation.

UNIT- III: Biotechnology for Crop Improvement

Tissue culture in crop improvement, Micropropagation for virus-free plants, Somaclonal variation, Somatic hybridization, Haploids in plant breeding. Nitrogen fixation, Nutrient uptake efficiency. Genetic engineering for biotic stress tolerance (Insects and fungi). Genetic engineering for abiotic stress (Salt and temperature)

UNIT- IV: Genetic engineering

Genetic engineering for quality improvement of Protein, lipids, carbohydrates, vitamins & mineral nutrients, Plants as bioreactor, Molecular breeding, constructing molecular maps, Molecular tagging of genes/traits. Marker-assisted selection of qualitative and quantitative traits. Physical maps of chromosomes. The concept of gene synteny. The concept of map-based cloning and their use in transgenic.

Unit -V: Plant Metabolic Engineering

The concept of secondary metabolites, Historical and current views, Importance of secondary metabolites in medicine and agriculture, Introduction to various pathways, Flavanoid pathway, Terpenoid pathway, Polyketoid pathway.

Text Books

1. Clark, D. P., Molecular Biology, Elsevier, USA, 2005
2. Henry R. J., Plant Genotyping: The DNA fingerprinting of plants. CABI, New Delhi, 2005
3. Patterson, Molecular dissection of complex traits, CRC Publications, Washington, 1998.

References

1. Anolles, G. C. and Gresshoff, P.M., DNA markers – protocols, applications and overviews. Wiley – Liss, New York, 1997
2. Purohit, S. S., Biotechnology – Fundamentals and Applications, 8th Edition, Agrobios, India, 2007.

MARINE BIOTECHNOLOGY

Course Code:

Max Marks: 100

Hours/Week: 2

Internal Marks: 25

Credits: 2

External Marks: 75

UNIT- I

Introduction to marine environment: Characteristics and classification of Marine habitat, Marine Flora and fauna – scope of Marine biotechnology. Important terminologies- Biodiversity of marine environment- Species, Ecosystem and genetic diversity.

UNIT- II

Marine natural products – Isolation and Identification of bioactive compounds from marine organism, Anti cancer, Anti microbial, Bioadhesives, Biopesticides and enzymes from marine microbes. Microbes of Biotechnological Importance.

UNIT - III

Sources of Marine pollution – oil spills – Impact of pollutants on marine environment – Biomonitoring and assessment of marine pollution – Bioindicators and biomarkers – Biofouling and its control.

UNIT- IV

Control of Marine pollution – Biodegradation – Biostimulation and Bioaugmentation – conservation of marine habitat and its biodiversity resources.

UNIT - V

Genetic modification of marine organisms, Transgenic Fish, Aquaculture, Economic aspects and ethical issues of marine biotechnology.

Reference Books

1. Pharmaceuticals and the sea (1988). Carles W, Jerffored, Kenneth & Rinchart.
2. Recent advances in Marine biotechnology. M.Fingermann, R. Nagabushanam and Mary Fraces Thompson.
3. Trends in Marine Biotechnology. Dr.S.Lazarus & Dr.S.G.Prakash Vincent.

4. Nutrients and Bioactive substances and aquatic organisms. K.Devadasan & M.K.Mukundan.
5. Molecular Biotechnolgy. (Eds).1998 Bernard Glick and Pasternak J.J., ASM Press, Washington .D.C
6. Concepts in Biotechnology. Balasubramanian D Bryce C.R.F Kunthala Jayaraman Dharmalingam.K (2004) COSTED- IBN. University Press, Hyderabad.