

SHIVAJI UNIVERSITY, KOLHAPUR



Accredited By NAAC with 'B' Grade

Revised Syllabus for Bachelor of Science

Part-II BIOTECHNOLOGY (ENTIRE)

Sem. III and IV

Syllabus to be implemented from June, 2014 Onwards

1. TITLE: Biotechnology (Entire)

2. YEAR OF IMPLEMENTATION:- Revised Syllabus will be implemented from June, 2014 onwards.

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Biotechnology to undergraduate students at Second year of three years of B.Sc. degree course.

The goal of the syllabus is to make the study of Biotechnology popular, interesting and encouraging to the students for higher studies including research.

The new and updated syllabus is based on a basic and applied approach with vigour and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE / PAPER:

- 1) To make the students knowledgeable with respect to the subject and its practicable applicability.
- 2) To promote understanding of basic and advanced concepts in Biotechnology.
- 3) To expose the students to various emerging areas of Biotechnology.
- 4) To prepare students for further studies, helping in their bright career in the subject.

- 5) To expose the students to different processes used in industries and in research field.
- 6) To prepare the students to accept the challenges in life sciences.
- 7) To develop skills required in various industries, research labs and in the field of human health.

5. DURATION

- The course shall be a full time course.

6. PATTERN:-

Pattern of Examination will be Semester.

7. MEDIUM OF INSTRUCTION :

The medium of instruction shall be in English.

8. STRUCTURE OF COURSE-

THIRD SEMESTER ----- (NO.OF PAPERS 6)

SEMESTER -III

Course Code	Title of Course	Theory
BTE-301	Genetics	50
BTE-302	Fundamentals of Biophysics	50
BTE-303	Metabolic Pathways	50
BTE-304	Ecology	50
BTE-305	Molecular Biology-I	50
BTE-306	Plant Tissue Culture	50

FOURTH SEMESTER ----- (NO.OF PAPERS 6)

SEMESTER -IV

Course Code	Title of Course	Theory
BTE-401	Immunology	50
BTE-402	Advances in Cell Biology	50
BTE-403	Plant Biochemistry	50
BTE-404	Environmental Biotechnology	50
BTE-405	Molecular Biology-II	50
BTE-406	Animal Tissue Culture	50

Practicals:- Annual

BTE-407	Techniques in Genetics, Immunology and Cell Biology	100 Marks
BTE-408	Techniques in Molecular Biology and Metabolic Pathways	100 Marks
BTE-409	Techniques in Plant Tissue Culture and Environmental Biotechnology	100 Marks

(Note:- Practical Examination will be Annual)

9) OTHER FEATURES :

(A) LIBRARY :

Reference and Text Books, Journals and Periodicals, for Advanced studies. – List Attached

(B)SPECIFIC EQUIPMENTS : Necessary to run the Course- OHP, Computer, L.C.D. Projector

(C)LABORATORY SAFETY EQUIPMENTS :

- 1) Fire extinguisher
- 2) First aid kit
- 3) Fumigation chamber
- 4) Stabilized power supply
- 5) Insulated wiring for electric supply.
- 6) Good valves & regulators for gas supply.
- 7) Operational manuals for instruments.
- 8) Emergency Exits.

BIOTECHNOLOGY (ENTIRE)

Semester-III

Course Code	Title of the Course	Theory
BTE-301	Genetics	50
BTE-302	Fundamentals of Biophysics	50
BTE-303	Metabolic Pathways	50
BTE-304	Ecology	50
BTE-305	Molecular Biology- I	50
BTE-306	Plant Tissue Culture	50

(Note :- Practical Examination will be Annual)

BTE 301- Genetics

Topic No.		Lectures 45
	Unit I	
1	<p>1.1 Mendel's law of Inheritance – principal of segregation, independent assortment, Dominance, Mendelian genetics in humans.</p> <p>1.2 Variety of gene expression – modifiers, suppressors, pleiotropic gene, multiple allele.</p> <p>1.3 interaction of gene Epistasis, complimentary gene, duplicate gene.</p>	10
	Unit II	
2.	<p>Linkage</p> <p>2.1 definition, coupling and repulsion hypothesis, linkage groups.</p> <p>2.2 Crossing over –Mechanism and theory.</p> <p>2.3 Structural and numerical changes in chromosomes.</p> <p>2.4 Extra chromosomal inheritance-mitochondrial and plastids.</p>	12
	Unit III	
3.	<p>Mutation</p> <p>3.1 Definition of mutation.</p> <p>3.2 Mutation- a. Basic Concept. b. Types –Spontaneous, Induced. c. Mechanism of mutagenesis – Base analogues, Nitrous acid. hydroxyl amine, alkylating agent, Acridine dyes, U. V. light.</p>	11
	Unit IV	
4.	<p>4.1 Plasmid- Types, Structure properties and applications.</p> <p>4.2 genetic recombination in bacteria – definition, fate of exogenous in recipient cell, transformation, Conjugation, transduction, mechanism of recombination.</p> <p>4.3 Genetic counseling- Introduction.</p>	12

References:

1. Strickberger "Genetics"
2. Freifelder "Genetics"
5. Stanier "General Microbiology"
6. P.K.Gupta "Genetics"
7. C. Sarin "Genetics"
8. Larry Snyder Wendy Champness "Molecular Genetics of Bacteria"

BTE 302- Fundamentals of Biophysics

Topic No.		Lectures 45
	Unit I	
1.	X-ray crystallography: Brief Introduction to Lattice, Basis, Space lattice, Crystal planes and Miller indices, Fundamental planes in cubic system, Expression for Interplaner distance, , Bragg's law in direct lattice, X-ray diffraction by crystals , Determination of crystal structure using powder method, Laue method, Rotating crystal method.	10
	Unit II	
2.	Spectrophotometry I : Microwave Spectroscopy: Introduction, rotation spectra (without proof), Instrumentation, Applications. IR spectroscopy – Introduction, vibration spectra (without proof), possible modes of vibrations of atoms in polyatomic molecules, Instrumentation, Applications.	13
	Unit III	
3.	Spectrophotometry II : Nuclear Magnetic Resonance Spectroscopy: Introduction, Quantum Description of NMR, spin spin coupling, Chemical shift, Instrumentation, Applications. Electron Spin Resonance Spectroscopy: Introduction, Theory of ESR, Presentation of ESR spectrum, Hyperfine splitting, Instrumentation, Applications. Mass Spectroscopy: Introduction, Theory, Instrumentation, Applications.	12
	Unit IV	
4.	Spectrophotometry III : Atomic Absorption Spectroscopy: Introduction, Principle, Instrumentation, Applications. Optical Rotatory Dispersion and Circular Dichroism : Polarized light, Optically active Molecules, Optical rotatory dispersion, Circular Dichroism Cotton Effect, Instrumentation, Applications.	10

References:

1. Instrumental Methods of Chemical Analysis – Gurudeep R. Chatwal, Sham K. Anand (Himalaya Publishing House).
2. Handbook on Analytical Instruments –R. S. Khandpur. (Mc. Graw Hill).
3. Biophysical Chemistry - Upadhyay, Nath, Upadhyay (Himalaya Publishing House).
4. Introduction to Molecular Spectroscopy – C.N.Banwell.
5. Biophysics ,Mohan P.Arora, Himalaya Publishing House,Delhi

BTE 303 - Metabolic Pathways

Topic No.		Lectures
	Unit I	45
1.	Metabolism:- Introduction to metabolism, anabolism & catabolism ,catabolism & its three stages, types of metabolic reactions, Methods employed to study metabolism(by cell free extract, using auxotrophic mutants,radioisotopes) ,High energy compounds	10
	Unit II	
2.	Carbohydrates Metabolism:- Reactions and energetics of Glycolysis ,TCA cycle Glyoxylate cycle, Gluconeogenesis, Glycogenesis and Glycogenolysis, HMP and its significance.	13
	Unit III	
3.	Lipid Metabolism:- Biosynthesis of fatty acid with respect to Palmitic acid & degradation of fatty acid(β -oxidation)with respect to Palmitic acid.	11
	Unit IV	
4.	Introduction to Hormones- Definition ,Types as Steriod, Peptide, Amino acid Nitrogen Metabolism: - Role of nitrogen in plants, source of nitrogen, nitrogen fixation- symbiotic & Non-symbiotic nif gene-concept and significance. Biosynthesis of amino acids- Transamination reactions.	11

References:-

- 1) Biochemistry- Lubert Stryer
- 2) Biochemistry- Nelson and Cox
- 3) Practical Biochemistry- Wilson and Walker
- 4) Fundamentals of Biochemistry – J. L. Jain
- 5) Principals of Biochemistry- Voet and Voet
- 6) Fundamentals of Plant Physiology- V. K.Jain

BTE 304 - Ecology

Topic No.		Lectures 45
Unit I		
1.	Our environment-geological consideration 1.1 Scope of ecology 1.2 Atmosphere 1.3 Hydrosphere 1.4 Lithosphere 1.5 Concept of ecosystem, structure ,function& kinds of productivity 1.6 Food chain food web, tropic level, ecological pyramids	12
Unit II		
2.	Biogeochemical cycle 2.1 carbon cycle 2.2 Nitrogen cycle 2.3 Sulphur cycle 2.4 Phosphorus cycle Biodiversity 2.5 Types of biodiversity 2.6 causes of loss of biodiversity 2.7 conservation of biodiversity 2.8 use & importance of biodiversity 2.9 Hot Spots	11
Unit III		
3.	Natural resourses- conservation and management 3.1 Classification 3.2 water resource management 3.3 Forest resource management 3.4 Energy flow in ecosystem Concept of energy, unit of energy, ecological energetics, laws governing energy transformation, Lindeman’s trophic dynamic concept, ecological efficiency.	11
Unit IV		
4.	Evolution :- 4.1 Lamarckism, Darwinism, Modern synthetic theory & mutational theory 4.2 Gene pool, Gene frequency 4.3 Hardy-Weinberg law 4.4 Adaptive radiation & macroevolutions	10

References:

1. Fundamentals of ecology ; E.P Odum.
2. Concept of ecology ; Dash.
3. Enviornmental Biology, Verma Agerwal
4. Enviornmental Science., Saigo, Canninhham
5. General ecology., H.D.Kumar

BTE 305 - Molecular Biology- I

Topic No.		Lectures 45
Unit I		
1.	<p>Experimental Evidences for DNA as a genetic material:-</p> <p>1.1 Griffith's Exp. 1.2 Avery, Macleod, McCarty Exp. 1.3 Blender Exp. 1.4 RNA As a genetic material .Gierer and Schram expt.</p> <p>Properties and Function of DNA:-</p> <p>2.1 Tm, Cot Curve, Purity of DNA, Acid- Base Nature, Buoyant Density 2.2 Concept of Gene 2.3 Unit of Gene (Cistron, Recon, Muton) 2.4 Fine Structure Of gene 2.5 One gene One Polypeptide Hypothesis 2.6 interrupted gene</p>	12
Unit II		
2.	<p>Nucleic Acid biosynthesis:-</p> <p>3.1 De novo synthesis of Purine and Pyrimidine ring 3.2 Salvage Pathway 3.3 Synthesis of Deoxyribonucleotide 3.4 Feedback inhibition.</p> <p>Organization of genome:-</p> <p>4.1 Viral (Lambda,T4) 4.2 Bacteria (E.coli.) 4.3 Eukaryote 4.4 Typical Structure Of chromosome (Euchromatin & Heterochromatin) 4.5 Packaging of DNA (Nucleosome, Solenoid Model) Radioisotope. 4.6 Karyotype study</p>	12
Unit III		
3.	<p>DNA Replication-</p> <p>5.1 Semi conservative model of replication (M.S Expt.) 5.2 Direction of replication (Uni & Bidirectional) 5.3 Mechanism of phosphodiester bond formation 5.4 Overall process of replication (Enzymes involved in replication and their action) 5.5 Variation in prokaryote and Eukaryote polymerases. 5.6 D loop model 5.7 Rolling circle model</p>	11
Unit IV		
4.	<p>DNA damage & Repair</p> <p>6.1.1 DNA damage 6.1.2 Chemical damage 6.1.3 UV radiation</p>	10

	6.1.4 Physical breakdown 6.2.1 DNA repair 6.2.2 Excision repair 6.2.3 Mismatch repair 6.2.4 SOS repair 6.2.5 Photo reactivation 6.2.6 Recombination repair	
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References:

- 1) Molecular biology- Watson
- 2) Genetics- Strickberger
- 3) Molecular Biology- Glickpastornack
- 4) Molecular biology- Geralad Carp
- 5) Gene- Levin
- 6) Genome- T.A. Brown

BTE 306 - Plant Tissue Culture

Topic No.		Lectures 45
	Unit I	
1.	<p>Introduction to plant tissue culture- Definition, History ,Cellular totipotency, techniques in plant tissue culture.</p> <p>Infrastructure & Organization Of Plant Tissue Culture</p> <p>Laboratory- General and aseptic laboratory- different work areas, equipments and instruments required, other requirements.</p> <p>Aseptic Techniques- Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization, aseptic workstation, precautions to maintain aseptic conditions.</p> <p>Culture Medium- Nutritional requirements of explant, PGR and their <i>invitro</i> roles, composition of basal M.S. medium and media preparation.</p>	10
	Unit II	
2.	<p>Callus Culture Techniques- Introduction, principle, protocol, morphology and internal structure, genetic variations, applications.</p> <p>Somatic Embryogenesis- Introduction, principle, protocol, factors affecting, applications, limitations.</p> <p>Organogenesis- Introduction, principle, protocol, applications.</p> <p>Organ Culture Technique- Introduction, principle, protocol, applications, with respect to root tip culture, leaf culture, ovary and ovule culture.</p>	11
	Unit III	
3.	<p>Anther & Pollen Culture Technique- Introduction, principle, protocol, factors affecting, applications.</p> <p>Micropropagation- Introduction, stages of Micropropagation, factors affecting, advantages and applications.</p> <p>Different Pathways of Micropropagation- Axillary bud proliferation, somatic embryogenesis, organogenesis, meristem culture.</p> <p>Somaclonal Variation- Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and limitations.</p>	12
	Unit IV	
4.	<p>Suspension Culture Technique- Introduction, principle, protocol, types, growth measurement, viability test, synchronization, applications.</p> <p>Production of Secondary Metabolites- Introduction, types of secondary metabolites, principle, systems of culture, optimization of yield, commercial aspects, applications, limitations.</p> <p>Plant Protoplast Culture:- History, Principle, protocol for isolation-Mechanical and Enzymatic, protoplast culture methods, viability test applications.</p>	12

References:-

- 1] Introduction to plant tissue culture- M.K. Razdan
- 2] Plant tissue culture-Theory & practice-S.S.Bhojwani & M.K. Razdan
- 3] Micropropagation- Deberg & Zimmermann
- 4] Plant tissue culture-Kalyankumar Dey
- 5] Biotechnology- B.D. Singh
- 6] A text book of Biotechnology- R.C. Dubey
- 7] Plant tissue culture-U.Kumar
- 8] Plant cell, tissue & organ culture-Gam Borg & Phillips
- 9] Fundamentals of Biotechnology- S.S. Purohit
- 10] Plants cell Tissue & organ culture-Rennet & Bajaj
- 11] Biotechnology- H.S. Chawla
- 12] Crop Improvement In biotechnology- H.S.Chawla

Semester- IV
BIOTECHNOLOGY (ENTIRE)

Course Code	Title of the Course	Theory
BTE-401	Immunology	50
BTE-402	Advances in Cell Biology	50
BTE-403	Plant Biochemistry	50
BTE-404	Environmental Biotechnology	50
BTE-405	Molecular Biology- II	50
BTE-406	Animal Tissue Culture	50
BTE-407	Techniques in Genetics, Immunology and Cell Biology	*Practical
BTE-408	Techniques in Molecular Biology and Metabolic Pathways	*Practical
BTE-409	Techniques in Plant Tissue Culture and Environmental Biotechnology	*Practical

(*Note :- Practical Examination will be Annual)

BTE 401 – Immunology

Topic No.		Lectures 45
	Unit I	
1.	Overview Of Immune system- 1.1 Introduction 1.2 Types of immunity-i)Innate (specific and non-specific) ii) Acquired (Active and Passive) 1.3 Types of Defense- a) first line of defense (barriers at the portal of entry, physical and chemical barriers) b) second line of defense c) third line of defense-specific defense mechanism	12
	Unit II	
2.	Introduction to cells and organs of immune system- 2.1 cells of immune system-a) broad categories of leucocytes, their role and properties b) B-lymphocytes c) T-cells-subsets d) other cells (Antigen presenting cell, Null cell, Natural killer cell.) 2.2 organs of immune system-primary and secondary lymphoid organs- structure and their role	11
	Unit III	
3.	Antigen and Antibody 3.1 Antigen- definition , nature,types of antigen,factors affecting antigenicity 3.2 Antibody-definition, nature,basic structure of immunoglobulin ,major human immunoglobulin classes(their properties and functions)	11
	Unit IV	
4.	Immune response 4.1 Immune response-Primary and secondary immune Response 4.2 Theories of Antibody production 4.3 Antigen Antibody reactions-Principle and applications of a) agglutination b) precipitation c) complement fixation d) ELISA e) neutralization	11

References:

1. Essential Immunology- Riott
2. Immunology- Kuby
3. General Microbiology- Stanier
4. Molecular Genetics of Bacteria- Larry Snyder Wendy Champness

BTE 402- Advances in Cell Biology

Topic No.		Lectures 45
	Unit I	
1.	Secretory pathway and protein trafficking 1.1 secretory pathway-ER associated ribosomal translation, co-translational vectoral transport of nascent polypeptide chain to ER lumen 1.2 Transport to Golgi apparatus, secretory granules 1.3 Transport of proteins to- mitochondria, chloroplast, peroxisomes, nucleus	13
	Unit II	
2.	Cell signaling 2.1 Introduction, general principles of cell signaling 2.2 Types of cell signaling-contact dependent signaling, autocrine, paracrine, synaptic, endocrine, gap junctions, combinatorial signaling 2.3 cell surface receptor proteins , Ion channel linked receptors, G-protein linked receptors, enzyme linked receptors , 2.4 signaling through G-protein linked receptors	10
	Unit III	
3.	Cell division cycle 3.1 Introduction, definition, phases of cell cycle 3.2 Control of cell cycle 3.3 Molecular events of cell cycle-CDK and cyclins, s-phase, CDK cyclins complex, M-phase CDK cyclins complex, anaphase promoting complex. 3.4 programmed cell death 3.5 Cancer -types, characteristics of cancer cells, causes of cancer, tumour suppressor genes, p 53	12
	Unit IV	
4.	Mechanism of cell division 4.1 Introduction 4.2 Types of cell division-amitosis, mitosis and meiosis 4.3 Mitosis- history, phases in mitosis, unique features of M-phase, significance. 4.4 Meiosis -history, phases in meiosis, significance 4.5 Role of spindle fibres in chromosome separation. 4.6 Condensation of chromosome. 4.7 Synaptonemal complex.	12

References:-

- 1) Molecular biology of cell-Albert
- 2) Molecular biology & cell biology – Loddish et al
- 3) Cell biology –De Robertis
- 4) Cell biology,Genetics, Molecular Biology-P.S. Verma & Agarwal.
- 5) Genes- Lewin.
- 6) Cell biology –Geral karp
- 7) Practical biochemistry – Keith Wilson and Walker

BTE 403 - Plant Biochemistry

Topic No.		Lectures 45
	Unit I	
1.	Plant Water Relation:- Introduction, Absorption of water- Mechanism, Theories (Active and Passive), Translocation of water- Mechanism, Theories (Root pressure, Capillary), Transpiration	12
	Unit II	
2.	Photosynthesis:- Ultra structure of chloroplast, Photosynthetic pigments, red drop and Emerson's enhancement effect, mechanism of photosynthesis, light reaction, dark reaction, C-3 pathway, C-4 pathway, CAM, photorespiration	11
	Unit III	
3.	Respiration:- a) Aerobic- Flow of electrons through reducing power in ETC, Redox potential components of ETC, Mechanism of ATP generation- Chemiosmotic hypothesis ATP synthase complex. b) Anaerobic Respiration:- Alcoholic and Lactic acid fermentation.	11
	Unit IV	
4.	Introduction to Plant Hormones Biosynthesis of plant hormones- Auxin, Cytokinin, Gibberellin. Growth:- Definition, phases of growth curve, Photoperiodism, vernalisation.	11

References:-

- 1) Biochemistry- Lubert Stryer
- 2) Biochemistry- Nelson and Cox
- 3) Practical Biochemistry- Wilson and Walker
- 4) Fundamentals of Biochemistry – J. L. Jain
- 5) Principals of Biochemistry- Voet and Voet
- 6) Fundamentals of Plant Physiology- V. K.Jain

BTE 404 - Environmental Biotechnology

Topic No.		Lectures 45
	Unit I	
1.	<p>Water Pollution</p> <ul style="list-style-type: none"> -Definition, Sources and Types-Physical, Chemical and Biological -Hardness [Mechanism, Determination, Types, Numericals], Water softening methods [Clark's method, Use of cation and anion exchange resins] -COD and BOD [Concept, Determination] -Eutrophication [Concept, Types and Control] -Purification of water [Physical Methods-UV Treatment, Distillation. Chemical Methods-Chlorination, Ozonization] <p>Air Pollution</p> <ul style="list-style-type: none"> -Definition, Sources - London and LA Smogs (Mechanisms of Formation) -Greenhouse Effect (Concept, Reasons, Role of dipole moment of gaseous molecules) -Ozone Depletion (Role of CFCs, Control) - Instrumental analysis methods of SO₂, NO_x <p>Soil Pollution</p> <ul style="list-style-type: none"> -Definition, Sources, Role of pesticide in soil pollution, control measures. 	12
	Unit II	
2.	<p>Environmental Toxicology</p> <p>Definition, classification and concept.</p> <ul style="list-style-type: none"> -Pesticide Toxicity –Classification (Organic and Inorganic). - Mode of action of toxicants (Metals, organophosphates, carbamates and mutagens) - Bioconcentration, Bioaccumulation, Biomagnification. - Potentiation and Synergism. - Control of Toxic effects- Biotransformation and excretion 	11
	Unit III	
3.	<p>Energy</p> <ul style="list-style-type: none"> - Renewable and non-renewable energy sources -Fossil Fuels [NG, Crude Oil, Coal] -Fractional distillation of crude oil -Bioethanol from sugary and starchy crops -Petrocrops –Rubber, Biodiesel [Production, Advantages and Limitations] 	11
	Unit IV	
4.	<p>Bioremediation Techniques</p> <ul style="list-style-type: none"> -Definition, Principle -<i>In situ and Ex situ</i> Bioremediation -Bioremediation of waste waters [MSW, BSW and ISW] 	11

	<ul style="list-style-type: none"> -Activated Sludge Process -Solid Waste Treatment [Plastics and Aromatics], Slurry Phase Treatment -Agricultural Bioremediation- Microbial Composting, Biogas, Land Farming and waste Control -Bioremediation of Industrial wastes, Xenobiotics -Bioaugmentation and Biofiltration. -Basic concept of environmental impact assessment. 	
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References:

1. Applied and environmental Microbiology- Amann, R.I Stromely, J. Stahl.
2. Environmental Biotechnology- Chattergy.
3. Environmental Biology- Verma Agerwal
4. Environmental Chemistry- B.K Sharma.
5. Environmental Pollution- Peavy and Rowe.
6. Environmental problems and solution- Asthana and Asthana.
7. Environmental Chemistry- Manahan.
8. Environmental Science- Saigo, Canninham
9. Environmental Chemistry- A.K. Bagi and G.R. Chatwal
10. A textbook of Biotechnology- R.C. Dudey

BTE 405 - Molecular Biology- II

Topic No.		Lectures 45
Unit I		
1.	1. Transcription in prokaryote and Eukaryote 1.1 Mechanism of transcription in detail 1.2 Inhibition of transcription 1.3 Post transcriptional modification 1.4 Transcriptional control by hormones	12
Unit II		
2.	2. Genetic Code:- 2.1 Properties of genetic code. 2.2. Assignment of codons with Unknown sequences a) Polyuridylic b) Acid Method Copolymers method 2.3 Assignment of codons with known sequences a) Binding technique b) Repetitive seq. technique 2.4 Variation in genetic code	10
Unit III		
3.	3. Translation in prokaryote and Eukaryote 3.1 Structure and role of ribosome in translation 3.2 Amino acid t-RNA complex formation 3.4 Initiation, Elongation, termination of translation 3.5 Inhibition of translation 3.6 Post- translation modifications(Protein folding, Removal of Leader sequences, Phosphorylation, glycosylation, acetylation)	11
Unit IV		
4.	4. Regulation of gene expression in prokaryote and eukaryote. 4.1 Regulation of gene expression in prokaryote a) Lac operon b) Tryptophan operon c) Arabinose operon 4.2 Regulation of gene expression in eukaryote a) Promoter b) Enhancers c) Activators d) Repressor e) Co-Repressors 4.3 Regulation of gene expression at transcriptional and translation level 4.4 Biopatent, Biopiracy, and Bioethics.	12

References:

- 1) Molecular biology- Watson
- 2) Genetics- Strickberger
- 3) Molecular Biology- Glickpastornack
- 4) Molecular biology- Gerald Carp
- 5) Gene- Levin
- 6) Genome- T.A. Brown

BTE 406 - Animal Tissue Culture

Topic No.		Lectures 45
	Unit I	
1.	<p>History and Introduction of Animal Cell culture.</p> <p>Requirements of Animal cell culture- substrate for cell growth, Equipments required for animal cell culture (Laminar air flow, CO₂ incubator, Centrifuge, Inverted microscope).</p> <p>Sterilization of Glassware's, Equipments & culture media- Glassware sterilization, reagent and media sterilization, sterility testing.</p> <p>Culture media- Natural media, synthetic media (serum containing media, serum free media, balanced salt solution, media constituent, complete culture media, physicochemical properties of media).</p>	12
	Unit II	
2.	<p>2. Cultured cells- Biology and Characterization- Characteristics of cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines.</p> <p>Characterization of cultured cells- Morphology of cells, species of origin of cells, Identification of tissue of origin, transformed cells, Identification of specific cell lines.</p> <p>Measurement of growth parameters of cultured cells- Growth cycle of cultured cells, plating efficiency of cultured cells</p> <p>Cell synchronization- Cell separation by physical means, cell separation by chemical blockade</p> <p>Senescence and apoptosis- Cellular senescence, Measurement of senescence. Apoptosis, Measurement of apoptosis</p>	11
	Unit III	
3.	<p>Basic technique of mammalian cell culture- Isolation of tissue, disaggregation of tissue, measurement of viability, primary cell culture, Cell lines, Maintenance of cell culture, Subculture, Stem cell cultures.</p> <p>Scale up of Animal cell culture-Scale up in suspension-stirrer culture, continuous flow culture, Airlift fermenter culture</p> <p>Scale up in monolayer- Roller bottle culture, multisurface culture, multiarray disks, and tubes, Microcarrier culture, Perfused monolayer culture</p> <p>Immobilized cell culture.</p>	12
	Unit IV	
4.	<p>Organ and Histotypic culture-Types and maintenance of organ culture, Histotypic culture</p> <p>Applications of cell culture-In transplantation, and tissue engineering, monoclonal antibodies production, culture based vaccine, valuable recombinant product, cloning, ethics and morality.</p>	11

References:-

- 1] Animal tissue culture- Paul
- 2] Culture of animal cell 3rd edition- R Ian Freshney
- 3] Animal cell culture- R.W.Masters
- 4] Animal biotechnology- M.M.Ranga
- 5] Animal biotechnology- R.Sasidhara
- 6] Animal cell culture technique- Martin Clynes Springer
- 7] Cell growth & division a practical approach- Ed. R. B. Segal & R.L.Press

BTE 407 - Techniques in Genetics, Immunology and Cell Biology

Sr. No.	Name of the Practical	Practicals 30
Techniques in Immunology and Genetics		
1	Isolation of Lac negative mutants of <i>E. coli</i> by visual detection	1
2	Isolation of Streptomycin resistant mutants by gradient plate technique	1
3	Transformation in <i>E. coli</i>	1
4	Conjugation in <i>E. coli</i>	1
5	U.V survival curve	2
6	Widal test –Quantitative	1
7	Radial immunodiffusion Assay	1
8	Immuno-electrophoresis-Qualitative	1
9	Double Immunodiffusion Technique	1
10	ELISA-dot ELISA	1
11	RPR card test	1
12	Problems based on Mendelian Inheritance, linkage and crossing over	1
13	Study of meiotic abnormality in <i>Rhoeo</i>	1
14	Study of karyotype by using photograph	1
Techniques in Cell Biology		
1	Measurement of size of cell structure/cell organelle/spore by micrometry.	1
2	Isolation of nucleus.	1
3	Isolation of chloroplast.	1
5	Isolation of giant chromosomes using <i>Drosophila</i> / Chironomous larvae.	1
6	Study of separation of chromosome by paradichlorobenzene (PDB).	1
7	Study of methodology of cell lyses.	1
8	Use of dialysis to separate smaller molecules than larger molecules.	2
9	Effect of temperature and organic solvent on membrane permeability of cells	2
10	Study of Mitosis.	1
11	Study of Meiosis	2
12	Study of plasmolysis.	1

BTE 408 - Techniques in Molecular Biology and Metabolic Pathways

Sr. No.	Name of the Practical	Practicals 30
Techniques in Molecular Biology		
1	Eukaryotic DNA Isolation from - Plant Material / Animal Material.	2
2	Genomic DNA isolation from bacteria.	2
3	Purification of DNA by silica membrane.	1
4	Plasmid isolation from <i>E.coli</i> .	1
5	Agarose gel electrophoresis to separate DNA.	1
6	Determination of T _m of DNA.	1
7	Restriction digestion of DNA.	1
8	Isolation of RNA.	2
9	Agarose gel electrophoresis to separate RNA.	1
10	SDS-PAGE for separation of protein CCB and Silver staining.	2
11	Separation of Lactate dehydrogenase by electrophoresis.	1
Techniques in Metabolic Pathways		
1	Estimation of fructose by Resorcinol method.	1
2	Estimation of DNA by Diphenylamine method.	1
3	Estimation of RNA by Orcinol Method.	1
4	Separation of Amino acids by TLC.	1
5	Paper electrophoresis of Amino Acid	2
6	Isolation of Amylase from germinating seed and determination of its activity.	2
7	Separation of biomolecules by Gel Filtration Chromatography	2
8	Purification of proteins /enzymes by Ion exchange chromatography using DEAE Cellulose	2
9	Study of lipase activity	1
10	Study of nitrate reductase activity	1
11	Estimation of Indole-3 Acetic Acid by (Salkowski reagent) Colorimetric method.	1

BTE 409 - Techniques in Plant Tissue Culture and Environmental Biotechnology

Sr. No.	Name of the Practical	Practicals 30
Techniques in Plant Tissue Culture		
1	Laboratory Organizations & general techniques.	1
2	Preparation of M.S. stock solutions & medium	2
3	Aseptic seed germination	1
4	Embryo culture technique.	1
5	Micropropagation stage I-Initiation of micropropagation -Shoot tip or axillary bud culture technique tissue culture	2
6	Micropropagation stage II-Subculture & multiplication of culture.	1
7	Micropropagation stage III-Rooting- <i>in vitro</i> & <i>ex vitro</i>	1
8	Micropropagation stage IV-Acclimatization & hardening	1
9	Callus culture technique- Initiation of culture, callus morphology	2
10	Suspension culture technique-Initiation of culture, growth measurement.	1
11	Anther Culture technique.	1
12	Isolation of Protoplast	1
Techniques in Environmental Biotechnology		
1	Determination of total and permanent hardness of water sample.	1
2	Estimation of COD of water sample.	1
3	Estimation of BOD of water sample.	1
4	Determination of TDS of water	1
5	Routine bacteriological analysis of water Presumptive, Confirmatory, Completed, MPN.	2
6	IMVIC Test	1
7	Study of degradation of pesticides using microbes	2
8	Study of effect of pesticide on <i>Azotobacter</i> population by viable count method.	1
9	Isolation of microorganism from air by solid impaction technique.	1
10	Development of activated sludge by using sewage.	2
11	Study of effect of heavy metal on growth of organisms.	1
12	Determination of phenol coefficient of phenol derivative.	1

Compulsory Visit to commercial Plant Tissue Culture Laboratory and ETP plant

Equivalence of the Pre-revised and revised course

Pre-revised Course		Revised Course	
Semester III		Semester III	
BTE-301	Genetics	BTE-301	Genetics
BTE-302	Fundamentals of Biophysics	BTE-302	Fundamentals of Biophysics
BTE-303	Metabolic Pathways	BTE-303	Metabolic Pathways
BTE-304	Ecology	BTE-304	Ecology
BTE-305	Molecular Biology- I	BTE-305	Molecular Biology- I
BTE-306	Plant Tissue Culture	BTE-306	Plant Tissue Culture
Semester IV		Semester IV	
BTE-401	Immunology	BTE-401	Immunology
BTE-402	Instrumentation in Biophysics	BTE-402	Advances in Cell Biology
BTE-403	Plant Biochemistry	BTE-403	Plant Biochemistry
BTE-404	Environmental Biotechnology	BTE-404	Environmental Biotechnology
BTE-405	Molecular Biology-II	BTE-405	Molecular Biology-II
BTE-406	Animal Tissue Culture	BTE-406	Animal Tissue Culture
Practicals (Annual practical examination)			
BTE 307 BTE 407	Techniques in Genetics and Immunology Techniques in Biophysics	BTE 407	Techniques in Genetics, Immunology and Cell Biology
BTE 308 BTE 408	Techniques in Molecular Biology Techniques in Metabolic Pathways	BTE 408	Techniques in Molecular Biology and Metabolic Pathways
BTE 309 BTE 409	Techniques in Plant Tissue Culture Techniques in Environmental Biotechnology	BTE 409	Techniques in Plant Tissue Culture and Environmental Biotechnology

Practical-

Annual Practical examination

A) Every candidate must produce a certificate from the Head of the Department in his college, stating that he has completed in a satisfactory manner a practical course on the lines laid down from time to time by the Academic Council on the recommendations of the Board of Studies and that the laboratory Journal has been properly maintained. Every candidate must have recorded his/her observations in the Laboratory journal and written a report on each exercise performed. Every journal is to be signed periodically by a member of the teaching staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journals at the practical examination and such journals will be taken into account by the examiners in assigning marks.

B) The practical examination will be conducted on two (2) consecutive days for each practical not less than 5 hours on each day of the practical examination.

BTE 407 - Techniques in Genetics, Immunology and Cell Biology

Practical I- Techniques in Immunology and Genetics

- Q.1 Major Experiment- 20 Marks**
- Q.2 Minor Experiment- 10 Marks**
- Q.3 Spotting- 10 Marks (5 spots- each carrying two marks)**
- Q.4 a) Journal- 05 Marks**
 - b) Viva-voce- 05 Marks**

Practical II- Techniques in Cell Biology

- Q.5 Major Experiment- 20 Marks**
- Q.6 Minor Experiment- 10 Marks**
- Q.7 Spotting- 10 Marks (5 spots- each carrying two marks)**
- Q.8 a) Journal- 05 Marks**
 - b) Viva-voce- 05 Marks**

BTE 408 - Techniques in Molecular Biology and Metabolic Pathways

Practical I- Techniques in Molecular Biology

- Q.1 Major Experiment- 20 Marks**
- Q.2 Minor Experiment- 10 Marks**
- Q.3 Spotting- 10 Marks (5 spots- each carrying two marks)**
- Q.4 a) Journal- 05 Marks**
 - b) Viva-voce- 05 Marks**

Practical II- Techniques in Metabolic Pathways

- Q.5 Major Experiment- 20 Marks**
- Q.6 Minor Experiment- 10 Marks**
- Q.7 Spotting- 10 Marks (5 spots- each carrying two marks)**
- Q.8 a) Journal- 05 Marks**
 - b) Viva-voce- 05 Marks**

BTE 409 - Techniques in Plant Tissue Culture and Environmental Biotechnology

Practical I- Techniques in Plant Tissue Culture

- Q.1 Major Experiment- 20 Marks**
- Q.2 Minor Experiment- 10 Marks**
- Q.3 Spotting- 05 Marks (5 spots- each carrying one mark)**
- Q.4 a) Journal- 05 Marks**
b) Viva-voce- 05 Marks

Practical II- Techniques in Environmental Biotechnology

- Q.5 Major Experiment- 20 Marks**
- Q.6 Minor Experiment- 10 Marks**
- Q.7 Spotting- 05 Marks (5 spots- each carrying one mark)**
- Q.8 a) Journal- 05 Marks**
b) Viva-voce- 05 Marks

TOUR REPORT- 10 Marks