SHIVAJI UNIVERSITY, KOLHAPUR.

B

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(2009)

Syllabus For

B. Sc. Part-II Biotechnology (Entire)

Sem.-III & IV

Syllabus to be implemented from June 2011 onwards.

B.Sc. Semester- III

BIOTECHNOLOGY (ENTIRE)

Course Code	Title of the Course	Theory	Internal
BTE-301	Genetics	40	10
BTE-302	Fundamentals of Biophysics	40	10
BTE-303	Metabolic Pathways	40	10
BTE-304	Ecology	40	10
BTE-305	Molecular Biology- I	40	10
BTE-306	Plant Tissue Culture	40	10
BTE-307	Techniques in Genetics and Immunology	*Practical	-------
BTE-308	Techniques in Molecular Biology	*Practical	-------
BTE-309	Techniques in Plant Tissue Culture	*Practical	-------

(Note :- Practical Examination will be Annual)

BTE 301 - Genetics

Topic		Lectures

No.		45
	Unit I	
1.	1.1Mendels law of Inheritance – principal of segregation ,independent assortment ,Dominance, Mendelian genetics in humans 1.2 Varity of gene expression –modifiers, suppressors, plueiotropic gene, multiple allele 1.3 interaction of gene Epstasis, complimentary gene, duplicate gene	**10**
	Unit II	
2.	2.1 Linkage –definition, coupling and repulsion hypothesis, linkage groups 2.2 Crossing over –Mechanism and theory 2.3 Structural and numerical changes in chromosomes 2.4 Extra chromosomal inheritance-mitochondrial and plastids	**12**
	Unit III	
3.	3.1 Definition of mutation 3.2 Mutation- a. Basic Concept, b. Types –Spontaneous, Induced c. Mechanism of mutagenesis – Base analogues, Nitrous acid hydroxyl amine, alkyl ting agent, Acridine dyes, U. V. light	**11**
	Unit IV	
4.	4.1 Plasmid- Structure properties and applications 4.2 genetic recombination in bacteria – definition, fate of exogenote in recipient cell, transformation, Conjugation, transduction, mechanism of recombination	**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 :** **Introduction** of spectroscopy, properties of electromagnetic radiation, Electromagnetic spectrum, Lambert law and Beer's law. **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. **U. V. visible spectroscopy and Fluorescence spectroscopy**- Principle, Instrumentation and Applications.	**13**
	Unit III	
3.	**Spectrophotometry II :** **Nuclear Magnetic Resonance Spectroscopy**: Introduction, Quantum Description of NMR, number, 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. **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 45
	Unit I	
1.	**Metabolism:-** Introduction to metabolism, anabolism & catabolism ,catabolism & its three stages, types of metabolic reactions, Methods employed to study metabolism, High energy compounds	**12**
	Unit II	
2.	**Carbohydrates Metabolism:-**Glycolysis, TCA cycle and Energetics , Glyoxylate cycle, Gluconeogenesis, Glycogenesis, Glycogenolysis, HMP and its significance, regulations of carbohydrate metabolism	**12**
	Unit III	
3.	**Lipid Metabolism:-** Biosynthesis of fatty acids, degradation of fatty acids (L-oxidation)	**11**
	Unit IV	
4.	**Nitrogen Metabolism:** - Role of nitrogen in plants, source of nitrogen, nitrate reduction and ammonia assimilation, biological nitrogen fixation, nif gene- concept and significance. **Nitrogen excretion, Urea cycle and its significance**	**10**

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 3.2water 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, ,lindmans tropical dynamic concept, ecological efficiency	**11**
	Unit IV	
4.	**Evolution :-** 4.1 Lamarkism,darwinism,Modren synthetic theory & mutational theory 4.2 Gene pool, Gene frequency 4.3 Hardy-Weinberg law 4.4 Adaptive radiation & macroevolutions	**10**

Reference:

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.	**Experimental Evidences for DNA as a genetic material:-** 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.	
2.	**Properties and Function of DNA:-** 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	**12**
	Unit II	
3.	**Nucleic Acid biosynthesis:-** 3.1 De novo synthesis of Purine and Pyrimidine ring 3.2 Salvage Pathway 3.3 Synthesis of Deoxyribonucleotide 3.4 Feedback inhibition.	
4.	**Organization of genome:-** 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 (Nuclesome, Solenoid Model)Radioisotope. 4.6 Karyotype study	**12**
	Unit III	
5.	**DNA Replication-** 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	**11**

	Unit IV	
6.	**DNA damage & Repair** 6.1.1 DNA damage 6.1.2 Chemical damage 6.1.3 UV radiation 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	**10**

References:

1) Molecular biology by Watson
2) Genetics by Strickberger
3) Molecular Biology by Glickpastornack
4) Molecular biolage Geralad Carph
5) Gene By Levin
6) Genome by T.A. Brown

BTE 306 - Plant Tissue Culture

Topic No.		Lectures 45
	Unit I	
1.	**Introductory History** - Cellular totipotency, techniques in plant tissue culture. **Infrastructure & Organization Of Plant Tissue Culture Laboratory- General and aseptic laboratory-** different work areas, equipments and instruments required, other requirements. **Aseptic Techniques-** Washing and preparation of glassware's, packing and sterilization, media sterilization, surface sterilization, aseptic workstation, precautions to maintain aseptic conditions. **Culture Medium-** Nutritional requirements of explant, PGR and their invitro roles, basal MS medium composition and media preparation.	**10**
	Unit II	
2.	**Callus Culture Techniques-** Introduction, principle, protocol, factors affecting, morphology and internal structure, genetic variations, applications, limitation. **Somatic Embryogenesis-** Introduction, principle, protocol, factors affecting, applications, limitations. **Organogenesis-** Introduction, principle, protocol, factors affecting, applications, limitations. **Organ Culture Technique-** Introduction, principle, protocol, factors affecting, applications, limitations, w.r.t root tip culture, leaf culture, ovary and ovule culture	**11**
	Unit III	
3.	**Anther & Pollen Culture Technique-** Introduction, principle, protocol, factors affecting, applications, limitations **Micropropogation-** Introduction, stages of Micropropogation, factors affecting, applications, problems & limitations. **Different Pathways of Micropropogation**- Axillary bud proliferation, somatic embryogenesis, organogenesis, meristem culture. **Somaclonal Variation-** Introduction, terminology, origin, selection at plant level, selection at cell level, mechanism, assessment, applications and limitations.	**11**
	Unit IV	
4.	**Suspension Culture Technique**- Introduction, principle, protocol, types, growth and growth measurement,syncronization,applications, limitations. **Production of Secondary Metabolites**- Introduction, principle, optimization of yield, commercial aspects, applications, limitations. **Plant Protoplast Culture:-** History, Principle, protocol for isolation- Mechanical and Enzymatic, protoplast culture, importance. **Commercial Aspects of Plant Tissue Culture**- Location, Design & requirements of commercial labs, selection of plants, reduction in production costs, production management.	**13**

References:-

1] Introduction to plant tissue culture- M.K. Razdan

2] Plant tissue culture-Theory & practice-S.S.Bhojwani & M.K. Razdan
3] Micropropgation- 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

BTE 307 - Techniques in Genetics and Immunology

Sr. No.	Name of the Practical	Practicals 15
1	Isolation of Lac negative mutants of E.coli by visual detection	**2**
2	Isolation of Streptomycin resistant mutants by gradient plate technique	**2**
3	Transformation in E.coli	**2**
4	U.V survival curve	**2**
5	Widal test –Quantitative	**1**
6	Radial immunodiffusion Assay	**1**
7	ELISA-dot ELISA	**1**
8	RPR card test	**1**
9	Problems based on Mendelian Inheritance, linkage and crossing over	**1**
10	Study of meiotic abnormality in Rhoeo	**1**
11	Study of karyotype by using photograph	**1**

BTE 308 - Techniques in Molecular Biology

Sr. No.	Name of the Practical	Practicals 15
1	Eukaryotic DNA Isolation from - 1. Plant Material / Animal Material	**2**
2	Genomic DNA isolation from bacteria	**2**
3	Plasmid isolation from *E.coli.*	**2**
4	Agarose gel electrophoresis to separate DNA	**1**
5	Restriction digestion of DNA and Plasmid	**3**
6	Isolation of RNA	**2**
7	Agarose gel electrophoresis to separate RNA	**1**
8	SDS-PAGE for separation of protein	**1**
9	UV spectroscopy of DNA, RNA and Protein	**1**

BTE 309 - Techniques in Plant Tissue Culture

Sr. No.	Name of the Practical	Practicals 15
1	Laboratory Organizations & general techniques.	**1**
2	Stock solutions & media preparations.	**1**
3	Aseptic seed germination	**1**
4	Embryo culture	**1**
5	Micropropogation stage I-Initiation of micropropagation -Shoot tip & axillary bud culture technique	**1**
6	Micropropagation stage II-Subculture & multiplication of culture.	**1**
7	Micropropogation stage III-Rooting- invitro & ex vitro Protoplast isolation.	**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.	**2**
11	Anther Culture	**1**
12	Protoplast Isolation	**1**
13	Visit to commercial plant tissue culture laboratory.	**1**

B.Sc. Semester- IV

BIOTECHNOLOGY (ENTIRE)

Course Code	Title of the Course	Theory	Internal
BTE-401	**Immunology**	**40**	**10**
BTE-402	**Instrumentation in Biophysics**	**40**	**10**
BTE-403	**Plant Biochemistry**	**40**	**10**
BTE-404	**Environmental Biotechnology**	**40**	**10**
BTE-405	**Molecular Biology- II**	**40**	**10**
BTE-406	**Animal Tissue Culture**	**40**	**10**
BTE-407	**Techniques in Biophysics**	***Practical**	**-------**
BTE-408	**Techniques in Metabolic Pathways**	***Practical**	**-------**
BTE-409	**Techniques in 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 (APC, Null, NK) 2.2 organs of immune system-primary and secondary lymphoid organs- structure and their role	**10**
	Unit III	
3.	**Antigen and Antibody** 3.1 Antigen- defination , nature,types of antigen,factors affecting antigenicity 3.2 Antibody-defination, nature,basic structure of immunoglobulin molecule,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 applicationsof- a) agglutination b) precipitation c) complement fixation d) ELISA e) neutralization	**12**

References:

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

BTE 402 - Instrumentation in Biophysics

Topic No.		Lectures 45
	Unit I	
1.	**Chromatography :** Introduction, column chromatography, size exclusion chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, GLC. **Electrophoresis-** Introduction, Principle, supporting media in electrophoresis, Agarose gel Electrophoresis, PAGE.	**13**
	Unit II	
2.	**Radioactivity :** **Introduction**, properties of alpha, beta and gamma radiation, Neutron-proton ratio and nuclear Stability, Process of radioactive decay, radioactive decay energy, rate of radioactive decay, units of radioactivity, Dosimeter: Absorbed dose(D), Dose equivalent(H) and effective dose equivalent **Radioactivity detecting techniques**: Ionization chamber, Geiger Muller counter, Scintillation counter, Hazards biological effect of radiation, Biological Applications of Radioisotope.	**12**
	Unit III	
3.	**Instrumentation I:** Principle, construction ,working and application of the following instruments : Colorimeter, Spectrophotometer, Flame photometer, Polarimeter, Refractometer.	**10**
	Unit IV	
4.	**Instrumentation II:** Principle, construction ,working and application of the following instruments :Centrifuge, pH meter, Conductometer, Scanning Electron Microscope, Transmission Electron Microscope.	**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 & Instrumentation – Dr. Mrs. Anita Pande

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, ATP synthase complex b) Anaerobic-Alcoholic fermentation and lactic acid fermentation	**11**
	Unit IV	
4.	**Biosynthesis of amino acids-** Transamination, Deamination with respect to one amino acid example. **Biosynthesis of plant hormones**- Auxin, Cytokinin, Gibberellin.	**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	**12**
1.	**Water Pollution** -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 Methos-UV Treatment, Distillation. Chemical Methods-Chlorination, Ozonization]	
2.	**Air Pollution** -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 SO_2,NO_x	
3.	**Soil Pollution** -Definition, Sources, Role of pesticide in soil pollution, control measures.	
	UNIT II	**11**
3.	**Environmental Toxicology** Definition, classification and concept. -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	
	UNIT III	**11**
4.	**Energy** - 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]	
	UNIT IV	**11**
5.	**Bioremediation Techniques** -Definition, Principle -*Insitu and Exsiu* Bioremediation -Bioremediation of waste waters [MSW,BSW and ISW] -Activated Sludge Process -Solid Waste Treatment [Plastics and Aromatics], Slurry Phase Treatment -Agricultural Bioremediation- Microbial Composting, Biogas, Land Farming and paste Control -Bioremediation of Industrial wastes, Xenobiotics -Bioaugmentation and Biofiltration.	

Reference:

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

BTE 405 - Molecular Biology- II

Topic No.		Lectures 45
	Unit I	
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.	**Genetic Code:-** 2.1 Triplet nature 2.2 Salient feature of genetic code 2.3 Decipheration of genetic code 2.4. Assignment of codons with Unknown sequences- a) Polyuridylic b) Acid MethodCopolymers method 2.5 Assignment of codons with known sequences a) Binding technique b) Repetitive seq. technique 2.6 Wobble Hypothesis 2.7 Variation in genetic code	**10**
	Unit III	
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, acelylation)	**11**
	Unit IV	
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.	**10**

References:

1) Molecular biology by Watson
2) Genetics by Strickberger
3) Molecular Biology by Glickpastornack
4) Molecular biolage Geralad Carph
5) Gene By Levin
6) Genome by T.A. Brown

BTE 406 - Animal Tissue Culture

Topic No.		Lectures 45
	Unit I	
1.	**History and Introduction of Animal Cell culture**- History of animal cell culture **Requirements of Animal cell culture-** Characteristics of animal cell in culture, substrate for cell growth, Equipments required for animal cell culture (Laminar air flow, Co_2 incubator, Centrifuge, Invertedmicroscope) **Sterilization of Glassware's, Equipments & culture media-** Glassware sterilization, reagent and media sterilization, sterility testing. **Culture media-** Natural media, synthetic media (serum containing media, serum free media, balanced salt solution, media constituent,complete culture media, physicochemical properties of media)	**13**
	Unit II	
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. **Characterization of cultured cells-** Morphology of cells, species of origin of cells, Identification of tissue of origin, transformed cells, Identification of specific cell lines. **Measurment of growth parameters of cultured cells-** Growth cycle of cultured cells, plating efficiency of cultured cells **Cell synchronization-** Cell separation by physical means, cell separation by chemical blockade **Senescence and apoptosis-** Cellular senescence, Measurement of senescence. Apoptosis, Measurement of apoptosis	**11**
	Unit III	
3.	**Basic technique of mammalian cell culture-** Isolation of tissue, disaggregation of tissue, measurement of viability, primary cell culture, Cell lines, Maintainance of cell culture, Subculture, Stem cell cultures **Scale up of Animal cell culture-**Scale up in suspension-stirrer culture, continuous flow culture, Airlift fermenter culture Scale up in monolayer- Roller bottle culture, multisurface culture, multiarray disks, and tubes, Microcarrier culture, Perfused monolayer culture **Immobilized cell culture, Insect culture**	**10**
	Unit IV	

4.	**Organ and Histotypic culture-**Types and maintenance of organ culture, Histotypic culture **Applications of cell culture-**In transplantation, and tissue engineering, monoclonal antibodies production, culture based vaccine, valuable recombinant product, cloning, ethics and morality.	**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-Ed. Martin Clynes Springer
7] Cell growth & division a practical approach-Ed. R. B. Sega& R.L.Press

BTE 407 - Techniques in Biophysics

Sr. No.	Name of the Practical	Practicals 15
1.	To determine the Young's Modulus of bar by bending.	**1**
2.	To determine the Young's Modulus and Modulus of rigidity for flat spiral spring.	**1**
3.	To determine the coefficient of viscosity of the given liquid using Searl's viscometer.	**1**
4.	To determine the coefficient of viscosity of the given liquid from its rate flow through capillary tube.	**1**
5.	To determine the surface tension of a liquid by Jeager's Method.	**1**
6.	To determine the surface tension of a liquid by using Quinke's Method.	**1**
7.	Study of temperature by using LM 35/ AD 590 Sensor.	**1**
8.	To determine the thermoelectric power at a given temperature using a thermocouple.	**1**
9.	To draw the calibration curve of a spectrometer with a given prism and hence to find the wavelength of some unknown lines.	**1**
10.	To determine the wavelengths of spectral by diffraction through a plane transmission grating.	**1**
11.	Study of absorption spectrum of $KMnO_4$ solution/ Biological sample using continuous source and to measure the wavelength	**1**
12.	To calibrate a polarimeter and hence to determine the concentration and specific rotation of sugar solution.	**1**
13.	To verify the truth tables of OR, AND, NOT, NOR and NAND Gates and verification of De Morgan's Theorem.	**1**
14.	Determination of interplaner distance using X-Ray Diffraction photograph.	**1**
15	Visit to research centre	**1**

BTE 408 - Techniques in Metabolic Pathways

Sr. No.	Name of the Practical	Practicals 15
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	TLC for separation of Amino acids.	**1**
5	Paper electrophoresis of Amino Acid	**2**
6	Isolation of Amylase from germinating seed	**2**
7	Gel Filtration Chromatography	**2**
8	Ion exchange chromatography using DEAE Cellulose	**2**
9	Study of lipase activity	**1**
10	Study of activity of nitrate reductase	**1**
11	Industrial visit to Demonstrate GLC, HPLC, LCMS,GCMS	**1**

BTE 409 - Techniques in Environmental Biotechnology

Sr. No.	Name of the Practical	Practicals 15
1.	To determine total and permanent hardness of water sample.	**1**
2.	To estimate COD of water sample.	**1**
3.	To estimate BOD of water sample.	**2**
4.	To estimate aspirin from aspirin tablet.	**1**
5.	Quality Control- To determine percentage purity of soda ash sample	**1**
6.	Determination of TDS of water	**1**
7	Routine bacteriological analysis of water and soft drinks- Presumptive, Confirmatory, Completed, MPN.	**3**
8	IMVIC Test	**2**
9	To study degradation of pesticides using microbes	**2**
10	Visit to biodiversity site and ETP site.	**1**

SYLLABUS EQUIVALANCE

B.Sc. II Entire Biotechnology

Sr. No.	Annual Paper Title	Semester III	Semester IV
1	General microbial genetics, Immunology	Genetics	Immunology
2	Biophysics and Instrumentation	Fundamentals of Biophysics	Instrumentation in Biophysics
3	Metabolic Pathways	Metabolic Pathways	Plant Biochemistry
4	Ecology and Environmental biotechnology	Ecology	Environmental Biotechnology
5	Molecular biology	Molecular Biology- I	Molecular Biology- II
6	Plant and Animal tissue culture	Plant Tissue Culture	Animal Tissue Culture
7	Techniques in Genetics, Immunology and Biophysics	Techniques in Genetics and Immunology	Techniques in Biophysics
8	Techniques in Molecular biology and Metabolic Pathways	Techniques in Molecular Biology	Techniques in Metabolic Pathways
9	Techniques in Plant Tissue culture and Environmental Biotechnology	Techniques in Plant Tissue Culture	Techniques in Environmental Biotechnology

	Nature of Question Paper	
Q.No.1	Multiple Choice based objective type (four options for each	8 Marks

	question be given)	
Q.No. 2	Attempt any two of the following out of three	16 Marks
Q.No. 3	Shot notes (4 out of 6)	16 Marks
	Total	40 marks