

**SRI VENKATESWARA UNIVERSITY::TIRUPATI**  
**S.V.U.COLLEGE OF SCIENCES**  
**DEPARTMENT OF ZOOLOGY**

(Revised syllabus for regular students those who study in S.V.U. College (Campus),  
Tirupati)

(with effect from the batch of students who admitted during the academic year 2015-16)

**M.Sc. ANIMAL BIOTECHNOLOGY**

(CHOICE BASED CREDIT SYSTEM)

**SCHEME OF INSTRUCTION AND EXAMINATION**

Semes-ter	Code	Title of the Course	Credi-t Hrs/week	No. of Credits	Core/Elective	Uni.Exams (Hours)	IA	Semes-ter end exams	Total Marks
<b>I</b>		<b>Theory:</b>							
	ABT-101	Structure and Functions of Biomolecules	4	4	Core	3	30	70	100
	ABT-102	Analytical tools and Techniques	4	4	Core	3	30	70	100
	ABT-103	Cell Biology and Genetics	4	4	Core	3	30	70	100
	ABT-104	Microbiology and diseases	4	4	Core	3	30	70	100
<b>II</b>		<b>Theory:</b>							
	ABT-201	Enzymes and Intermediary metabolism	4	4	Core	3	30	70	100
	ABT-202	Molecular biology	4	4	Core	3	30	70	100
	ABT-203	Immunology	4	4	Core	3	30	70	100
	ABT-204	Biostatistics and Bioinformatics A)BIOSTATISTICS B)Bioinformatics (Genomics and Proteomics)	4	4	elective	3	30	70	100
	205	Human Values and Professional Ethics-I	--	04	--	3	30	70	100
<b>III</b>		<b>Theory:</b>							
	ABT-301	Animal Reproduction, Breeding and Transgenic Technology	4	4	Core	3	30	70	100
	ABT-302	Animal Cell Culture & Stem Cell Biology	4	4	Core	3	30	70	100
	ABT-303(a)	Genetic Engineering	4	4	IE	3	30	70	100
	ABT-303(b)	Environmental Biotechnology	4	4	IE	3	30	70	100
ABT-304	Animal Biotechnology and Industrial Applications	4	4	IE	3	30	70	100	

IV		<b>Theory:</b>							
	ABT - 401		4	4	Core	3	30	70	100
	ABT - 402	Medical Biotechnology	4	4	Core	3	30	70	100
	ABT-403	Cancer Biology	4	4	Core	3	30	70	100
	ABT-404	Heterologous expression and downstream processing	4	4	Core	3	30	70	100
	405	<b>Human Values and Professional Ethics – II</b>	4	4	Core	3	30	70	100

**Note: ABT: Animal Bio-technology; EE: External Elective; IE: Internal Elective**

## **SEMESTER –I ( w.e.f. 2015-16)**

### **ABT- 101: STRUCTURE AND FUNCTIONS OF BIOMOLECULES**

#### **UNIT - I: Carbohydrates**

- 1.1 Chemistry of carbohydrates - Definition and classification of carbohydrates.
- 1.2 Outlines of structures and properties of important mono- (Glucose & Fructose), di- (Lactose, Sucrose, Maltose) and polysaccharides (Glycogen, Cellulose, Chitin).
- 1.3 Physical and Chemical reactions of carbohydrates
- 1.4 Analysis of carbohydrates- Qualitative and Quantitative

#### **UNIT - II: Amino acids and Proteins**

- 2.1. Chemistry of amino acids and proteins - Classification of amino acids, Structures of amino acids, Chemical reactions of amino acids.
- 2.2. Peptide bond - Nature of peptide bond,  $\pi/\phi$  rotation. Ramachandran plot, Secondary structure predictions, helices and beta-sheets, Determination of primary structure.
- 2.3. Proteins and their classification, properties of proteins, determination of amino acid sequences (N and C terminus) Tertiary/quaternary structure of proteins (myoglobin/hemoglobin model).
- 2.4. Structural organization of proteins - Outline structures and biological functions. Protein folding and significance.

#### **UNIT - III: Lipids**

- 3.1. Chemistry of lipids - Classification of lipids, Properties of lipids,
- 3.2. Outline structures of saturated and unsaturated fatty acids, fats and waxes,
- 3.3. Phospholipids, glycolipids, cholesterol, prostaglandins, leukotrienes. Lipids as signaling molecules.
- 3.4. Structure and functions of, heterocyclic molecules, porphyrins and vitamins.

#### **UNIT - IV: Nucleic acids**

- 4.1. Chemistry of nucleic acids - Structure of purines and pyrimidines, modified bases nucleosides and nucleotides;
- 4.2. Properties of nitrogen bases and nucleotides
- 4.3. Structure, variation and properties of DNA and RNA.
- 4.4. DNA denaturation and renaturation kinetics, Determination of DNA complexity, Hyperchromacity,  $T_m$ , cot curves and their significance.

## ABT- 102: ANALYTICAL TOOLS AND TECHNIQUES

### UNIT - I: Cell and its components analysis

- 1.1 Isolation techniques - Cell disruption techniques - sonication, french press, enzymatic, non-enzymatic techniques.
- 1.2 Isolation of proteins - salting in/out, ammonium sulphate fractionation. Nucleic acids - polar solvents precipitation. Lipids - extraction by differential solubility.
- 1.3 Concentration of macromolecules flash evaporation, lyophilization, pressure dialysis, reverse dialysis, hollow fiber membrane filters and reverse osmosis.
- 1.4 Microscopic studies (principles and applications): Light, compound, phase contrast, confocal and SEM

### UNIT -II: Separation techniques

- 2.1 Adsorption chromatography - principles, counter current distribution and its significance, Adsorption materials - paper, silica gel, cellulose acetate, affinity chromatography, merits and demerits –Instrumentation -TLC, GLC, HPLC.
- 2.2 Size- Filtration, Dialysis, principles and applications-molecular sieve chromatography - principle. Determination of void volume, extension co-efficient and molecular mass of native molecules. Density- Centrifugation technique - density gradient - sucrose, cesium chloride, Determination of sedimentation co-efficient, Molecular mass.
- 2.3 Charge- Ion exchange chromatography – Matrices - Principles of separation of charged molecules. Chromatography separations
- 2.4 Electrophoresis - principles governing the movement of charged molecules in the electric field. Relationship of voltage, current and the mobility of biomolecules. Matrices used in electrophoresis - starch, cellulose acetate, agarose, polyacrylamide. Use of PAGE for separation of proteins, molecular mass determination. Immunoelctrophoresis, Separation of nucleic acids using agarose gel electrophoresis. Blotting techniques - western, southern and northern blotting techniques.

### UNIT - III: Spectroscopy

- 3.1. Characterization of biomolecules by Spectroscopy - Electromagnetic spectrum of light, simple theory of absorption of light by molecules, Beer-Lambert law, Types of detectors.
- 3.2. UV-visible spectrophotometry, infrared Spectroscopy, Raman Spectroscopy, fluorescence Spectroscopy, flame photometry, atomic absorption, plasma emission, mass, ESR and NMR spectrophotometry.
- 3.3. Optical rotatory dispersion (ORD) and Circular Dichroism (CD)
- 3.4. X-ray diffraction and X-ray crystallography.

### UNIT - IV: Radiobiology

- 4.1. Radioisotope tracer techniques - Nature and types of radioactivity, half life, decay units, Preparation of labeled biological compounds,
- 4.2. Detection and measurement of radioactivity (GM counter, scintillation counter), quench correction, Autoradiography.
- 4.3. Labeling of carbohydrates ( $C^{14}$  acetate), proteins ( $S^{35}$  methionine,  $I^{125}$  aminoacid) and nucleic acids ( $P^{32}$  dATP).
- 4.4. Biological uses of radioisotopes, Isotope dilution techniques, Safety measures in handling radio-isotopes.

## **ABT- 103: CELL BIOLOGY AND GENETICS**

### **UNIT -1: Cell and Cell membrane composition**

- 1.1. Organization of prokaryotic and eukaryotic cell. Plasma membrane - Molecular organization, current model and function, Cytoskeleton - microtubules, cilia and flagella, Structure and function of cytoskeleton.
- 1.2. Structure and function of endoplasmic reticulum, golgi apparatus,
- 1.3. Structure and function of lysosomes, peroxisomes,
- 1.4. Structure and function of mitochondria and chloroplast.

### **UNIT - II: Nucleus and Chromosome organization**

- 2.1. Nucleus - structure and function of nuclear membrane, nucleolus.
- 2.2. Eukaryotic chromosome and its high resolution organization,
- 2.3. DNA-histone interactions - formation of chromatin fibers - Hetero/Eu chromatin - structural transition - Histone-H1-significance in regulation of expression.
- 2.4. Polytene and lamp brush chromosomes.

### **UNIT - III: Cell division and chromosomal variations**

- 3.1. Mechanism of cell division - mitotic apparatus, cytokinesis, chromosome movement - present concept –
- 3.2. Regulation of eukaryotic cell cycle - Over view of cell cycle. Mutation causing cell cycle control. Meiotic process - stages, chromosome pairing, chiasma formation Molecular mechanisms of recombination, synaptonemal complex. Nondysjunction,
- 3.3. Chromosomal abnormalities - euploidy, haploidy - their fundamental and practical significance. Polyploidy - induction - Aneuploidy - type and genetic significance.
- 3.4. Tumor biology - cell to cell interaction, cell adhesion, cell transformation mechanism and oncogenesis.

### **UNIT IV: Principles of genetics**

- 4.1. Mendelian genetics, Linkage and gene mapping,
- 4.2. Quantitative genetics and problems, Hardy Weinberg Law, Sex chromosomes and sex determination. Inbreeding,
- 4.3. Mutagenesis - Types of mutations, mutagens, Molecular mechanisms of mutations, Spontaneous, induced mutations, reversion, suppression, and analysis of mutants
- 4.4. Role of mutagenesis in evolution, chromosomal deletions, duplications, inversions.

## **ABT- 104: MICROBIOLOGY AND DISEASES**

### **UNIT -1: Introduction to Microbiology**

- 1.1 Discovering the microbial world. Classification of micro organisms up to order level - bacteria, algae, fungi, protozoa.
- 1.2 Structure of prokaryotic and eukaryotic microorganisms. General and distinctive characteristics of the major groups of microorganism bacteria, mycoplasma, chlamydiae, rickettsias, actinomycetes, fungi, algae, protozoa Prions and viruses.
- 1.3 Isolation, cultivation and enumeration of microorganisms - direct and indirect methods, Maintenance of culture.
- 1.4 Outlines of characterization and identification of common bacteria, fungi, algae and protozoa.

## **UNIT - II: Microbial nutrition, growth and regulation**

- 2.1. Nutritional requirements to microorganisms - Mode of nutrition - phototrophy, chemotrophy - methylotrophy organotrophy, mixotrophy, saprophytic, symbiotic and parasitic, Interaction of microbes.
- 2.2. Growth of microorganism (bacteria) - normal and biphasic growth curve, batch and continuous cultures, chemostats, shift up and shift down. Growth determination, Microbial metabolism - energy yielding and energy requiring processes.
- 2.3. Control of microorganisms - principles, physical and chemical agents, Assay of antimicrobial action. Batch and continuous sterilization of media and air. Viruses - nature, cultivation and assay methods, structure, physico-chemical properties, classification, pathogenicity, Replication of viruses.
- 2.4. Microbes of biotechnological importance - examples of bacteria, yeast, algae and viruses.

## **UNIT-III:Microbial Genetics**

- 3.1. Chemical nature of gene, Concept of gene, operon, mosaic genes/split genes.
- 3.2. Plasmids incompatibility. Classification: copy number, control and its significance. Structure and functions of insertion elements (IS) - transposable elements. Mechanism of transposition. Catabolic transposons and their significance.
- 3.3. Horizontal transfer of genome among the microbial community - transformation, conjugation transduction - generalized transduction, specialized transduction – cotransduction.
- 3.4. Benzer's classical studies on II locus. Cistron complementation - Elucidation of co-linearity between DNA and protein sequence. Genetics of viruses – bacteriophage, lambda, SV 40, retroviral genome (HIV), replication, lytic and lysogenic cascades.

## **Unit IV: Diseases caused by microorganisms**

- 4.1. Viral diseases: Flu, Dengue fever, Hepatitis,
- 4.2. Bacterial diseases: Cholera, tuberculosis, anthrax,
- 4.3. Fungal diseases: Athlets foot, Dutch Elm disease, ergotism
- 4.4. Protozoa diseases (Protista): Malaria, Sleeping sickness, dysentery  
And Plant Pathogens: TMV, Rust

## **SECOND SEMESTER (w.e.f. 2015-2016)**

### **ABT- 201: ENZYMES AND INTERMEDIARY METABOLISM**

#### **UNIT - I: Enzymes**

- 1.1. Classification of enzymes and their significance - Isolation and purification of enzymes - assay of enzyme activity
- 1.2. Determination of  $K_M$ ,  $V_{max}$  and  $K_{cat}$ . Enzyme inhibition - competitive, non-competitive, uncompetitive, allosteric regulation and irreversible enzyme inhibition.
- 1.3. Enzyme action, Active site determination
- 1.4. Isoenzymes - detection, characterization and significance. Ribozymes, Abzymes, multicomplex and multifunctional enzymes.

## **Unit-II: Metabolism of carbohydrates**

- 2.1. Bioenergetics - Free energy change in biological transformations, thermodynamic principles in biology, Redox potential, high energy compounds
- 2.2. Glycolysis - Biochemical steps involved in glycolytic pathway, TCA cycle and their Regulatory mechanisms.
- 2.3. Glyoxalate cycle, gluconeogenesis, HMP shunt, interconversion of hexoses and pentoses, amylogenesis, glycogen metabolism.
- 2.4. Brief account of enzymes and co-enzymes involved in biological oxidations, Organization of respiratory electron transport system, Mechanism of oxidative phosphorylation. Biological energy transducers, Chemiosmotic regeneration of ATP.

## **Unit III: Lipid metabolism**

- 3.1. Biosynthesis, degradation and regulation of saturated fatty acids.
- 3.2. Degradation of lipids from membranes, Oxidation of unsaturated fatty acids and synthesis of UFA by enzymatic (synthesis of prostaglandin and leukotrienes) and non-enzymatic (free radicals and lipid peroxidations) mechanisms.
- 3.3. Cholesterol and ketone bodies Metabolism and regulation
- 3.4. Metabolism of triglycerides, phospholipids, glycolipids.

## **UNIT - IV: Proteins, nucleic acids and heterocyclic compounds metabolism**

- 4.1. Metabolism of amino acids and proteins - Hydrolysis of proteins, proteases, Biosynthesis of essential amino acids and their catabolism (deamination, decarboxylation, and transamination), Coordinated control of metabolism, Formation of ammonia and urea. Nitrogen fixation by bacteria,
- 4.2. Metabolism of purines and pyrimidines, Biosynthesis and catabolism of Nucleosides and nucleotides, role of DNases and RNases on nucleic acids.
- 4.3. Outlines of biosynthesis of porphyrins (Chlorophyll and Haeme)
- 4.4. Inborn errors in metabolism - Phenylketonuria, Alkaptonuria, Sickle cell anaemia, Fructosaemia, galactosuria, Gaucher's and Krabbe's disease.

## **ABT- 202: MOLECULAR BIOLOGY**

### **UNIT - I: Replication**

- 1.1. DNA replication - Enzymes involved in DNA replication. Accessory proteins. Structures of oriC. Replisome – oriC - accessory protein interactions - Mechanism of formation of oriC open complex.
- 1.2. Replication initiation – elongation - okazaki fragments synthesis and processing – Direction of replication fork movement. Termination - Nature of termination sequences - Interactions between polymerase III and *ter* sequences
- 1.3. Mode of DNA replication Messelson and Stahl experiments. Replication of single stranded DNA -  $\phi$ X174. Replication of bacteriophage lambda DNA (rolling circle). Replication of closed covalent circular DNA ( $\theta$  model of DNA replication).
- 1.4. Problems associated with replication of linear DNA molecules - Structure and synthesis of telomere sequences. Cell cycle and its regulation - Interphasing of cell cycle and DNA replication.

## **UNIT - II: Transcription**

- 2.1. Prokaryotic RNA polymerase -  $\sigma$  factors:  $-\sigma^{70}$ ,  $\sigma^{32}$ ,  $\sigma^{54}$ ,  $\sigma^{28}$  promoter elements-Structural differences between  $\sigma^{70}$ ,  $\sigma^{54}$  dependent promoters - Promoter polymerase interaction - Foot printing assays - Mapping of transcription start point (TSP).
- 2.2. Gene structure, Upstream activating sequences and their role in regulation of transcription. Transcription, elongation and termination.
- 2.3. Eukaryotic RNA polymerases - Transcription factors – transcription. Structure and functions of RNA pol I, II and III dependent promoters. Enhancer sequences.
- 2.4. Post transcriptional modification of RNA and its regulation, Mechanism of tissue specific transcription.

## **UNIT - III: Translation**

- 3.1. Translation - Central dogma theory and flow of genetic information, Genetic code and its elucidation, Wobble hypothesis, Structure and composition of prokaryotic and eukaryotic ribosomes, Structures of mRNA and tRNA,
- 3.2. Events of protein synthesis (amino acid activation, initiation, elongation and termination) in prokaryotes and eukaryotes,
- 3.3. Post-translational modification of proteins, Inhibitors of translation.
- 3.4. Protein trafficking - Concept of signal peptide - transport and membrane targeting of proteins - Sec pathway - Alternative protein transport mechanisms.

## **Unit IV: Regulation of gene expression**

- 4.1. Regulation of gene expression. Constitutive and inducible gene expression, Use of mutants in gene expression. P and O site determination.
- 4.2. Regulation of catabolic gene expression Eg: lac operon, ara operon and gal operon.
- 4.3. Regulation of anabolic gene expression Eg: Trp and His operons
- 4.4. Hormonal regulation of genes.

## **ABT- 203: IMMUNOLOGY**

### **UNIT - I: Architecture and types of immune system:**

- 1.1 Immunity- innate and acquired, innate immune mechanisms, acute phase reactants, properties of acquired immunity, Toll-like receptors.
- 1.2 Immunogens and antigens – Properties, factors governing immunogenicity, haptens, epitopes-size and identification. Adjuvants-properties and mechanism of action.
- 1.3 Cells involved in the immune response- T cells, B cells, CD antigens, neutrophils, eosinophils and natural killer cells. Macrophages, dendrites, Phagocytosis
- 1.4 Lymphoid tissues- Primary and secondary lymphoid organs, structure and cellular organization. Lymphocyte traffic.

### **Unit II Humoral Immunity**

- 2.1. Functions of antibody in relation to structure. Antigen-antibody interactions- affinity of antibody, avidity, bonus effect, classical precipitin reaction, antigen-binding site of antibody, forces involved in antigen-antibody complex formation
- 2.2. Generation of antibodies, Theories of antibody formation. Monoclonal and polyclonal antibodies.

- 2.3. Complement - nature, physicochemical properties, complement cascade pathway, complement fixation.
- 2.4. Antibody response-primary and secondary antibody response, antibody response to haptens, enumeration of antibody-forming cells, T-dependent and T-independent antigens, MHC, Interleukins, cytokines

### **UNIT - III: *In vitro* serological tests**

- 3.1. Principles and applications of serological tests used in identification of pathogenic agents and initial sources of inoculum-precipitation tests in liquid media, single and double diffusion tests using agar gel media,
- 3.2. Immuno-electrophoresis, rocket immuno-electrophoresis, hemagglutination, bentonite and later flocculation tests, complement fixation test, labeled antibody techniques (tests with fluorescent antibody, test with radioisotope-labeled antibody and enzyme-labeled immunoassays ELISA)
- 3.3. Immunosorbent electron-microscopy, infectivity neutralization test, and western blotting  
and immunodetection of viral antigens, relative merits and demerits of the above tests.
- 3.4. Blood groups and isohaemagglutination.

### **UNIT - IV:**

- 4.1. Antigen Presentation- pathways of antigen processing and presentation of intracellular and extracellular antigens. Cell mediated immunity (CMI): Induction and mechanism
- 4.2. Hypersensitivity reactions – Classification, Type I – IV reactions. Immunity to bacterial, fungal, viral and parasitic diseases. Allergy: classification and details.
- 4.3. Immune tolerance, immune suppression. Transplantation and G.V.H. reactions.
- 4.4. Immunopathology-Autoimmune diseases; immune complex diseases; immunodeficiency diseases; immunity to infection. Production of vaccines and sera - conventional and biotechnological.

## **ABT- 204: Biostatistics and Bioinformatics**

### **A. BIOSTATISTICS**

#### **UNIT – I :**

- 1.1. Definition to Biostatistics: classification, variables, attributes and distribution of data
- 1.2. Measures of location and dispersion: Arithmetic mean, median and mode. Mean deviation, quartiles, standard deviation, coefficient variation.
- 1.3. Curve fitting: Fitting straight line, parabola exponential curve and geometric curve to the data, fitting of straight line using MS-Excel – work book
- 1.4. Correlation and regression: Scatter diagrams, types of relationships, positive and Negative correlation, computation of correlation coefficient, interpretation of correlation coefficient. Simple and multiple Regression lines and its interpretation.

#### **Unit II:**

- 2.1. Normal probability distribution and its application
- 2.2. Tests of significance: level of significance, testing of hypothesis – null and alternative Hypotheses, level of significance and p-value of a test.
- 2.3. student t test for one and two samples, mean paired tests
- 2.4. F and  $\chi^2$  distributions and their implementation using Excel/SPSS. Analysis of variance with one and two factors and Multiple comparison tests



## **B. BIOINFORMATICS (GENOMICS AND PROTEOMICS)**

### **UNIT III: Basics of Personal computer and its components**

- 3.1. Concept of programming languages, hardware and software. The basics of operating system. Windows operating systems commands to create and handle directory and files, creation of biological data bases and MS access.
- 3.2. MS office: introduction and facilities available, shortcut bar, customizing tool bars, starting an office file, MS word, Excel, Power point
- 3.3. Introduction to internet and biologists: Basics on internet, getting into the internet, email, file transfer protocols, gopher, www, browsing and downloading from the sites
- 3.4. Networking of computers and overview of networks: Virtual library I, II, III and information networks: www, http, html, URLs, EMB net, NCBI net, Virtual tourism.

### **UNIT IV: Databases and predictive tools**

- 4.1. Primary information resources for proteins and genes, biological databases for protein and DNA sequences, Specialized genomic resources, DDBJ, Gen Bank, and EMBL public DNA sequence databases, SWISSPORT data base, information retrieval from biological data bases, the NCBI data model, submitting the DNA sequence to the database and updating.
- 4.2. Sequence Analysis: Wisconsin GCG, DNASIS, DNASTAR, CLONE Manager, packages for nucleotide sequence analysis, sequence alignment and database searching, practical aspects of multiple sequence alignment.
- 4.3. Phylogenetic analysis: phylogenetic models, multiple alignment procedures, (CLUSTAL, ALIGN, PHYLIP), tree building methods, trees evaluation, rooting trees, phylogenetic software.
- 4.4. Predictive methods: Detecting regulatory elements in the DNA, Physical properties of proteins based on proteins based on sequences, differential protein structural motifs, RNA binding domains and folding classes, transcription factors and their DNA binding, protein structure predictions.

## **HUMAN VALUES AND PROFESSIONAL ETHICS – I**

- I. Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics- Goals – Ethical Values in various Professions.
- II. Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation, justice, responsibility and freedom, Good behavior and respect for elders, Character and Conduct.
- III. Individual and society:  
Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues)- Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).
- IV. Bhagavad Gita – (a) Niskama karma. (b) Buddhism – The Four Noble Truths – Arya astanga marga, (c) Jainism – mahavrata and anuvratas. Values Embedded in Various Religions, Religious Tolerance, Gandhian Ethics.

- V. Crime and Theories of punishment – (a) Reformatory, Retributive and Deterrent. (b) Views on Manu and Yajñavalkya.

**Books for study:**

1. John S Mackenzie: A manual of ethics.
2. “The Ethics of Management” by Larue Tone Hosmer, Richard D. Irwin Inc.
3. “Management Ethics – integrity at work” by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. “Ethics in Management” by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varanasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkamba Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

### III SEMESTER

#### ABT-301: ANIMAL REPRODUCTION, BREEDING AND TRANSGENIC TECHNOLOGY

##### UNIT- I:

- 1.1. Structure and function of male reproductive system- hormonal regulation of spermatogenesis and spermiogenesis; inhibin and androgen binding proteins; capacitation of spermatozoa.
- 1.2. Structure and function of female reproductive system- influence of hormones on development of ovarian follicles and oogenesis;
- 1.3. Reproductive cycles: estrous and menstrual cycle; ovulation, atresia and corpus luteum formation; pregnancy and lactation; implantation and placentation.
- 1.4. Contraception in males and females: Hormonal and chemical; recent advances in contraception research.

##### UNIT- II:

- 2.1. Introduction - Sex determination; principles of animal breeding; structure of the livestock breeding industry: dairy cattle, beef cattle, swine, sheep and poultry
- 2.2. Selection for qualitatively inherited characters -gene frequency and selecting against recessive genes; detecting heterozygotes for recessives.
- 2.3. Parental determination and verification; the use of markers and/or molecular probes, selection criteria: multiple records, pedigree selection, family selection.

- 2.4. Progeny testing: breeding value, transmitting ability and heritability; correlated characters; selection for maternal ability; factors affecting selection response; genotype-environment interactions

#### **UNIT- III:**

- 3.1. Artificial insemination (AI) techniques and their development: estrus synchronization; semen collection, evaluation, storage.
- 3.2. *In vitro* fertilization, ICSI and preservation of endangered species.
- 3.3. Embryo transfer technology, Super ovulation, cryo preservation of embryos, Hormones involved in embryo transfer technology.
- 3.4. Microinjection and Macroinjection – introduction – procedure – applications advantages and limitations.

#### **UNIT- IV:**

- 4.1. An overview of transgenic technology Development of transgenic mice and other animal models: by injection of foreign DNA/gene into zygote; optimization of construct for *in vivo* expression
- 4.2. Generation of chimeric, transgenic and knockout mice and other animals and their characterization.
- 4.3. Transgenic fishes, transgenic poultry and transgenic insects as bioreactors.
- 4.4. Potential application of transgenic animals: models for various diseases/disorders, production of peptides and proteins of biopharmaceutical interest (molecular farming).

#### **Reference Books:**

1. Comparative Reproductive Biology. Edited by H. Schatten and G.M. Constantinuescu. Blackwell Publishers, UK.
2. Comparative Endocrinology and Reproduction. Edited by K. P. Joy, A. Krishna, C. Haldar, Narosa Publishers, Delhi.
3. Daltons Introduction to Practical Animal Breeding. Edited by Malcolm B. Willis, Blackwell Science, UK..
4. Williams Text Book of Endocrinology, Edited by J. D. Wilson and others, Saunders, USA.
5. Animal Transgenesis and Cloning. Edited by L. M. Houdebine, Wiley, USA.

### **ABT-302: ANIMAL CELL CULTURE & STEM CELL BIOLOGY**

#### **UNIT- I:**

- 1.1. Introduction to animal cell and tissue culture: Components of cell culture, cell types and cell lines, different substrates, types of culture.
- 1.2. Animal cell culture: experimental works – Technological uses of Animal cell cultures - Prospects.
- 1.3. The biology of stem cells: Overview; different types of stem cells- embryonic Stem cells, fetal tissue stem cells, adult stem cells; nuclear transfer of stem cells; human & animal cloning. Animal stem cell protocols & research.
- 1.4. Embryonic stem cells: the blastocyst and inner cell mass cells primitive endoderm implantation; blastocyst development in vitro.

## **UNIT- II:**

- 2.1. Isolation and propagation of embryonic stem cells; chimeras; generation of knockout mice.
- 2.2. Nuclear transfer technology: Transfer of nuclei into eggs; development potential of transplanted nuclei; reprogramming a nucleus.
- 2.3. Animal cloning: Overview; challenges in human therapeutic cloning; somatic cell nuclear transfer in humans: pronuclear early embryonic development.
- 2.4. Stem cell differentiation: Overview; adult stem cells; fetal stem cells; human embryonic stem cells; human parthenote stem cells.

## **UNIT- III:**

- 3.1. Stem cell plasticity: Overview; self renewal potential; differentiation versus stem cell renewal; transdifferentiation; cell cycle dynamics of different stem cells.
- 3.2. Stem cell assays and protocols: Isolation of defined stem cell populations; progenitor cell assays, sources of progenitor cells, cytokine and chemotherapy approaches to mobilization of progenitor cells; flow cytometric techniques; methods of cell selection using monoclonal antibodies.
- 3.3. Magnetic approaches to cell separation, Dyna beads, nano particle preparations; growth factors and ex-vivo expansion of hematopoietic stem / progenitor cells bioreactors for expansion.
- 3.4. Stem cell therapies: Clinical applications of stem cell therapy; neurodegenerative diseases- Parkinson's disease, Alzheimers, spinal cord injury, other brain syndromes; tissue systems failures- diabetes, cardiomyopathy, kidney failure, liver failure hemophilia, lymphoma and leukemic malignancies requiring stem cell therapy.

## **UNIT- IV:**

- 4.1. Stem cells & tissue engineering: Role of nanoparticles; organ development; nanoparticles as scaffolds.
- 4.2. Human Embryonic Stem Cells and Society: The religious, legal, ethical and scientific debate; the future of the debate; the regulatory aspects of therapeutical use of stem cells.
- 4.3. Bioethical, Environmental and Health issues related to Biotechnology.
- 4.4. Intellectual property results – patents and protection of ideas – Risk and Reward.

## **Reference Books:**

1. Handbook of Stem Cells Volume 1 and 2 Eds Robert Lanza and others Elsevier Academic Press.
2. Austen C.R. and Short. R.V. Reproduction in animals.
3. Schatten and Schatten. Molecular Biology of Fertilization.
4. R.G. Edwards. Human Reproduction.
5. S.F. Gillbert. Developmental Biology. Sinauer Association Inc., Massachusetts.

## **ABT 303(a): GENETIC ENGINEERING**

### **UNIT-I**

- 1.1. Isolation and purification of genes/DNA fragments. Mechanical shearing – Scope, merits and demerits.
- 1.2. Restriction endonuclease digestion- Outlines of microbial restriction and modification systems – Classification of restriction endonucleases,

- 1.3. Type II – restriction endonucleases – Nomenclature – Mode of action and use molecular cloning – RFLP – Applications in forensic medicine, Wild life biology, agriculture etc.
- 1.4. PCR Technology: Introduction to the technique – designing primers – General principles, degenerative primers, Random primers – Inverse PCR, Multiplex PCR – Real time PCR and its significance-RAPD.

#### **UNIT II**

- 2.1. cDNA synthesis –Principles – Strategies used for synthesis of full length cDNA.
- 2.2. Strategies for synthesis of full length cDNA – RACE.
- 2.3. Chemical synthesis of gene – Solid phase synthesis of oligos – designing gene from amino acid sequence – Strategies.
- 2.4. Synthesis of full length gene.

#### **UNIT III**

- 3.1. Vectors for constructing genomic libraries – Cosmids, BACs, YACs and vectors for constructing cDNA libraries.
- 3.2. Multiple vectors - PUC18/19, Blue script vector/multiple cloning site – Unidirectional deletion of genes – DNA sequencing.
- 3.3. Cloning strategies and introduction of rDNA in to host – t4DNA ligases, Terminal transferases – Homopolymeer tailing, Linkers, adaptors and blunt end ligation. Transformation, Transduction, Transfection, Electroporation.
- 3.4. Bacterial and yeast expression vectors. Construction of expression vectors – promoter types, merits and demerits. Yeast expression vectors – ppic9k/ppic3k-integration vectors.

#### **UNIT IV**

- 4.1. Mammalian expression vectors – structure, strategies for expression of cloned gene.
- 4.2. Purification recombinant proteins. Expression of recombinant proteins with this tag, GST tag.
- 4.3. Strategies for large scale purification of proteins. Recombinant vaccines.
- 4.4. Strategies for expression and purification of therapeutic proteins – Insulin , Interferon, streptokinase, epidermal growth factor.

#### **References**

1. Old and Primrose Principles of Gene Manipulation: An introduction to genetic engineering. 6<sup>th</sup> ed. Blackwell Scientific Publ. 2001.
2. SB. Primrose and R.W. Twyman. Principles of genome analysis and genomics. 3 rd edition. Blackwell Science. 2003.
3. D S T Nicholl. An introduction to genetic engineering. 2 nd edition. Cambridge University Press. 2004.
4. Glick and Pasternak, Molecular Biotechnology, Panima Publ.2003
5. J. Sambrook, E.F. Fritsch and T. Maniatis. Molecular Cloning: a Laboratory Manual, Cold Spring Harbor Laboratory Press, New York, 2000.
6. M.R. Walker and R. Rapley. Route Maps in Gene Technology, Blackwell Science Ltd., Oxford, 1997.
7. M. Kingsman and A.J. Kingsman Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes, S, Balckwell Scientific Publications, Oxford, 1998.
8. S.P Hunt and R. Liveey. Functional Genomics:A practical Approach. Oxford University Press, 2000.

9. H. Kreuzer and A. Massey. Recombinant DNA and Biotechnology: A guide for Teachers: 2 nd ed. ASM Press. 2001.
10. H. Kreuzer and A. Massey. Recombinant DNA and Biotechnology: A guide for students: 2 nd ed. ASM Press. 2001.
11. Benjamin Lewin, Gene IX, 9th Edition, Jones and Barlett Publishers, 2007.

### **ABT-303(b): ENVIRONMENTAL BIOTECHNOLOGY**

#### **UNIT I**

- 1.1 Introduction,
- 2.1 Waste and Pollutants: Manufacturing, energy production, agriculture and dairy, transport, House Building and Domestic activities.
- 3.1 Hazards from wastes and pollutants; biological agents present in wastes.
- 4.1 Hazards from chemicals in wastes, Hazards from physical pollutants.

#### **UNIT II**

- 2.1. Waste treatment: Biofilters.
- 2.2. Treatment of Liquid wastes
- 2.3. Treatment of solid waste.
- 2.4. Contributions of Biotechnology to waste treatment.

#### **UNIT III**

- 3.1. Aerobic waste water treatment
- 3.2. Measurements of the level of pollution.
- 3.3. The process of waste water treatment. Aerobic reactors or digesters, Microorganisms.
- 3.4. Anaerobic treatment of waste water: Microorganisms, Sludge Treatment

#### **UNIT-IV**

- 4.1. Biodegradation of Xenobiotic compounds: Types of Recalcitrant Xenobiotic compounds.
- 4.2. Hazards from Xenobiotics, General features of Biodegradation of Xenobiotics.
- 4.3. Biodegradation of halogenated compounds. The origin of capacity to degrade Xenobiotics.
- 4.4. Bioremediation: Microbial Bioremediation.

#### **Reference**

1. A Text Book of Biotechnology, HD Kumar (WE Pub.)
2. Biodegradation and Detoxification of Environmental Pollutants – Chakrabarthy
3. Biotechnology by B. D. Singh. Kalyani Publishers, 2007.
4. Concepts in Biotechnology – Balasubramanian, Bryce, Dharmalingam, Green and Jayaraman.
5. Environmental Biotechnology by Alan Scragg. Pearson Education Limited, England.
6. Environmental biotechnology by S.N. Jogdand. Himalaya Publishing House. Bombay.
7. Environmental chemistry by A.K. De Wiley Eastern Ltd. NewDelhi.
8. Environmental Microbiology – Grant and Long.
9. Environmental Microbiology – Mitchall.
10. Introduction to Biodeterioration by D. Allsopp and k.J. Seal, ELBS/Edward Arnold.
11. Microbial Ecology – Fundamentals and Applications – Atlas and Bartha.

12. Microbial Technology. Vol. I and II, - Pepler and Perlman (Eds).
13. PK Gupta: Elements of Biotechnology. Rastogi and Co. Meerut 1996
14. Prescott and Dcenn, S Industrial Microbiology – Reed (Ed).
15. Principles of Fermentation Technology – Stanbury, Whitaker and Hall 1997.
16. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf and Eddy, Inc. Tata Mc Graw Hill, New Delhi

## **ABT- 304 (a): ANIMAL BIOTECHNOLOGY AND INDUSTRIAL APPLICATIONS**

### **UNIT-I**

- 1.1. Preservation animal engineered bacteria/ yeast/ cell lines – reversal strategies – optimizes of expression of restriction primer – mechanism of restriction, isolation digestion.
- 1.2. Metabolic engineering: enzymatic cultivation of domestic and agricultural wastes – saccharification – large scale purification of cellulases – and their use in conservation of agriculture waste in to sugars.
- 1.3. Fermentative production of bio Ethanol, Propanol and Butanol.
- 1.4. Glycolytic pathway, manipulating increased flux towards alcohols.

### **UNIT-II**

- 2.1. Products from animal and plant cells, monoclonal antibodies, hormones etc. Genetically engineered products, DNA biotechnology, Modern methods for the detection of pathogens.
- 2.2. Bioinformatics and Biotechnology, Disease Processes, Extremophiles and the search for new biocatalysts.
- 2.3. Transgenics: Transgenic animal: production and application; transgenic animals as models for human diseases.
- 2.4. Transgenic animals in live-stock improvement; expression of the bovine growth hormone; transgenics in industry; chimera production; Ethical issues in animal biotechnology.

### **UNIT-III**

- 3.1. Poultry
- 3.2. Piggery.
- 3.3. Dairy Sciences.
- 3.4. Aquaculture applications.

### **UNIT- IV**

- 4.1. Safety in the contained use and release of transgenic animals-Mechanism of implementation of biosafety guidelines-at Institutional, national and International level.
- 4.2. DBT Guidelines- Actus and treaties related to biosafety of GMM and GMP's-Public awareness perception and acceptance of products of biotechnology.
- 4.3. Global scenario of transgenic micro organisms and plants-Intellectual property rights-Patent laws at national and international level.
- 4.4. Ethical issues related to biotechnology products-Ecological risks of engineered microorganisms remedies.

## References

1. Tzotzos, G.T. 1995. Genetically modified organisms-A guide to biosafety, CAB International, Wallingford, U.K. 213p.
2. DBT 1998 Background document for workshop on biosafety issues emanating from use of genetically modified organisms (GMOs). Bangalore. September 1998. 289p.
3. Subbaram, N.R. 1998. Hand book of Indian patent law and practice. S.Viswanathan (Printers & Publishers) Pvt. Ltd. Chennai 628p.

## ABT 304(b): PHARMACOLOGY AND MOLECULAR THERAPEUTICS

### UNIT -I

- 1.1. Gene therapy; Intracellular barriers to gene delivery.
- 1.2. Overview of inherited and acquired diseases for gene therapy.
- 1.3. Retro and adeno virus mediated gene transfer; Liposome and nanoparticles mediated gene delivery, Cellular therapy.
- 1.4. Stem cells: definition, properties and potency of stem cells; Sources: embryonic and adult stem cells; Concept of tissue engineering.

### UNIT-II

- 2.1. Introduction, Disease prevention (Vaccines), An ideal vaccines.
- 2.2. Disease diagnosis: Probes.
- 2.3. Monoclonal antibodies.
- 2.4. Detection of Genetic Disease.

### UNIT-III

- 3.1. Nature of drug targets- interactions of drugs with target molecules- action of antibiotics- peptide antibiotics- Lox, Cox<sub>2</sub> inhibitors- Cox, Lox as drug targets.
- 3.2. Definition of Drug Discovery, Stages of drug discovery, Strategic Issues in drug discovery.
- 3.3. Drug Development- Chemistry, Preclinical Studies, Transition from Preclinical to Clinical, Source of Drugs, Drugs from Natural Sources (Natural Products) - Plants, Animals, Microorganisms (Fungi, Bacteria)- High throughput screening.
- 3.4. Drugs from Organic Synthesis. Formulation development: Stabilization of drug, localization of drug at specific sites, drug delivery strategies, application of nanotechnology.
- 3.5. Drug administration: routes, targets of localization, metabolism, non-specific localization. Target validation: Validation of targets using siRNA based and recombinant methods.

### UNIT -IV

- 4.1. Forensic medicine.
- 4.2. Preparation of the DNA Sample.
- 4.3. Approaches for DNA Analysis.
- 4.4. Applications of Forensic medicine.

## Reference

1. Bernhard Palsson and Sangeeta N Bhatia, Tissue Engineering, 2<sup>nd</sup> Edition, Prentice Hall, 2004.
2. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21<sup>st</sup> century medicine, 1st Edition, Springer, 2008.



3. Burger's Medicinal Chemistry and Drug Discovery, 5th Edition, Vol. 1. Principles and Practice, edited by M. E. Wolff, John Wiley & Sons: New York, 1995.
4. Principles of Medicinal Chemistry, 4th Edition, edited by W.O. Foye, T.L. Lemke, and D. A. Williams, Williams and Wilkins: Philadelphia, 1995.
5. Medicinal Chemistry: Principles and Practice, edited by F.D. King, Royal Society of Chemistry: Cambridge, 1994.
6. A Practical Guide to Combinatorial Chemistry, edited by A. W. Czarnik and S. H. DeWitt, American Chemical Society: Washington DC, 1997.

## **IV SEMESTER**

### **ABT 402: MEDICAL BIOTECHNOLOGY**

#### **UNIT I**

- 1.1. Introduction, Disease prevention (Vaccines), An ideal vaccines.
- 1.2. Disease diagnosis: Probes.
- 1.3. Monoclonal antibodies.
- 1.4. Detection of Genetic Disease.

#### **UNIT II**

- 2.1. Disease treatment.
- 2.2. Interferons.
- 2.3. Growth factor.
- 2.4. Antisense nucleotide as therapeutic agent.

#### **UNIT III**

- 3.1. Gene Therapy.
- 3.2. Types of gene therapy.
- 3.3. Augmentation therapy.
- 3.4. Targeted transfer.

#### **UNIT-IV**

- 4.1. Forensic medicine.
- 4.2. Preparation of the DNA Sample.
- 4.3. Approaches for DNA Analysis.
- 4.4. Applications of Forensic medicine.

#### **REFERENCE**

1. Biotechnology by B. D. Singh. Kalyani Publishers, 2007.
2. Text Book of Biotechnology By H.K. Das (Wiley Publications).
3. Strategies in Transgenic Animal Sciences - By Glemn M.M. and James M. Robl ASM. 2000.
4. Essentials of Biotechnology for Students By Satya N. Das. 2001.
5. Gene series By Benjamin Lewin, Oxford University Press
6. Molecular Biology of Cell By Bruce Alberts
7. Molecular Biology David Freifelder, Narosa Publishing House
8. E. coli and Salmonella typhimurium- Cellular and Molecular Biology By Neidhardt, American Society for Microbiology, USA.
9. Molecular Biology of the Gene by Watson.

## ABT-403: CANCER BIOLOGY

### UNIT I

- 1.1. Introduction:** Cancer types, Characteristics of cancer cells.
- 1.2.** Carcinogenesis: cancer initiation, promotion and progression, termination.
- 1.3.** Factors responsible for carcinogenesis: Physical, chemical and biological.
- 1.4. Tumor Development:** Models, Tumor angiogenesis. Overview of invasion and metastasis. Cell-cell interactions in cancer. Invasion and the extracellular matrix. Specific cases of Prostate, Breast, Intestinal cancers.

### UNIT II

- 2.1. Oncogenes and their role in Cancer:** Introduction to oncogenes.
- 2.2.** Mechanisms of oncogene activation (gene amplification).
- 2.3.** Mechanisms of oncogene activation (chromosomal translocations).
- 2.4.** Chromosomal translocations with dominant negative effects. Introduction to tumor suppressor genes.

### UNIT III

- 3.1. Cell-Cycle Regulation and Cancer:** Mutations affecting mitogenic signal transduction pathways. Cell Cycle Regulation - Mutations affecting the cell cycle. Loss of checkpoint control and genetic instability. Replicative senescence
- 3.2. DNA Damage, Repair failure and Carcinogen Mechanisms:** Carcinogens, DNA damage and repair.
- 3.3.** Carcinogenesis: Chemical and physical agents.
- 3.4.** Carcinogenesis: Repair mechanisms. Aberrant repair and genetic instability. Genetic predisposition to cancer.

### UNIT IV

- 4.1. Tumor Immunology:** Tumor immunology [tumor antigens, cytokines,
- 4.2.** Vaccine development, Immunotherapy and its limitations.
- 4.3.** Tumor cell evasion of immune defenses.
- 4.4.** Principles of chemotherapy and chemoprevention. Drug screens: High throughput Screening (HTS) approaches

### Reference:

1. "Oxidative Stress and Inflammatory Mechanisms in Obesity, Diabetes, and the Metabolic Syndrome" Edited by Lester Packer and Helmut Sies, CRC Press LLC (2007).
2. "Oxidative stress and neurodegenerative disorders" G. Ali Qureshi and S. Hasan Parvez, Elsevier, St. Louis, MO 63146 USA (2007).
3. "Oxidative Stress Disease and Cancer" Edited by Singh, World Scientific Publishing (2006).
4. "Fatty Acids and Oxidative Stress in Neuropsychiatric Disorders" Edited by Ravinder, M.D. Reddy and Jeffrey K. Yao, Nova Science Pub Inc (2007).
5. "Oxidative Stress, Inflammation, and Health" Edited by Young-Joon Surh and Lester Packer, CRC Press LLC (2005).
6. "Critical Reviews of Oxidative Stress & Aging" Edited by Cutler, World Scientific Publishing (2002).
7. Free Radicals, Oxidative Stress, and Antioxidants: Pathological and Physiological Significance" Edited by Tomris Özbenm, Springer (1998).

8. "Oxidative Stress and the Molecular Biology of Antioxidant Defenses" Edited by Scandalios Spring Harbor Lab Press (1997).
9. "Biochemical Society Symposia Volume 61, Free Radicals and Oxidative Stress" Edited By C Rice-Evans and B Halliwell, Portland Press Ltd. London (1995).
10. "Biological Consequences of Oxidative Stress: Implications for Cardiovascular Disease and Carcinogenesis" Edited by Lawrence Spatz and Arthur D. Bloom, Oxford University Press (1992).

## **ABT-404: HETEROLOGOUS EXPRESSION AND DOWNSTREAM PROCESSING**

### **UNIT I**

- 1.1. Cell distribution methods: Sonicatron – crush press – freeze than methods. Cell distribution for intracellular products, removal of insolubles, biomass (and particulate debris).
- 1.2. Separation techniques, flocculation and sedimentation, centrifugation and filtration methods.
- 1.3. Purification by chromatographic techniques; Reverse osmosis and ultra filtration; Drying; Crystallization; Storage and packaging; Treatment of effluent and its disposal.
- 1.4. Isolation, screening and maintenance of industrially important microbes; Microbial growth and death kinetics (an example from each group, particularly with reference to industrially useful microorganisms).

### **UNIT II**

- 2.1. Bioreactor designs; Types of fermentation and fermenters; Concepts of basic modes of fermentation - Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Solid substrate, surface and submerged fermentation.
- 2.2. Fermentation economics; Fermentation media; Fermenter design-mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization.
- 2.3. Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.
- 2.4. Membrane-based separations(micro and ultrafiltration theory, design and configuration of membrane separation equipment, applications, precipitation methods(with salts, organic solvents, and polymers, extractive separations, aqueous two phase extraction, supercritical extraction) insitu product removal, integrated bioprocessing.

### **UNIT III**

- 3.1. Role and Importance of downstream processing in biotechnological processes.
- 3.2. Problems and requirements of bioproduct purification.
- 3.3. Economics of downstream processing in Biotechnology, cost -cutting strategies.
- 3.4. Characteristics of biological mixtures, process design criteria for various classes of bioproducts(high volume, low value products and low volume, high value products), physico-chemical basis of bioseparation processes.

### **UNIT IV**

- 4.1. Adsorptive chromatographic separations processes.
- 4.2. Electrophoretic processes (all electrophoresis techniques including capillary electrophoresis)

- 4.3. Hybrid separation technologies (membrane chromatography, electrochromatography etc).
- 4.4. Gel Permeation Chromatography, dialysis, Crystallisation.

## References

1. Wankat P.C, "Rate Controlled Separations ", Elsevier, 1990.
2. Belter PA and Cussler E, "Bioseparations ", Wiley, 1985.
3. "Product Recovery in Bioprocess Technology ", BIOTOL Series, VCH, 1990.
4. Asenjo J.M, "Separation processes in Biotechnology", 1993, Marcel Dekker Inc.

## **HUMAN VALUES AND PROFESSIONAL ETHICS – II** **COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)**

### Syllabus

(With effect from 2015-16)

(effective from the batch of students admitted from the academic year 2014-15)

- I. Value Education- Definition – relevance to present day - Concept of Human Values – Self introspection – Self esteem. Family values - Components, structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.
- II. Medical ethics- Views of Charaka, Sushruta and Hippocrates on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.
- III. Business ethics- Ethical standards of business-Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.
- IV. Environmental ethics- Ethical theory, man and nature – Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.
- V. Social ethics- Organ trade, Human trafficking, Human rights violation and social disparities Feminist ethics, surrogacy/pregnancy. Ethics of media- Impact of Newspapers, Television Movies and Internet.

## Books for study:

1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics – integrity at work" by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. "Ethics in management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.

11. Caraka Samhita: Tr. Dr. Ram Kraran Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.