

Annexure No.	27 I
SCAA Dated	29.02.2008

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

**M. TECH., MOLECULAR BIOLOGY AND HUMAN GENETICS (CBCS PATTERN)
WITH COMPULSORY DIPLOMA IN BIOMEDICAL INSTRUMENTATION
(for the students admitted during the academic year 2008-2009 batch and onwards)**

Eligibility Condition:

B.Sc. Zoology
B.Sc. Advanced Zoology
B.Sc. Applied Zoology
B.Sc. Life Sciences
B.Sc. Animal Science and Biotechnology
B.Sc. Advanced Zoology and Biotechnology

Scheme of Examination

SEM	Paper Core / Elective / Supportive	SUB. CODE 08ZOO	SUBJECT	Instru- ctional Hrs / Week		Internal		External	Total	Credits		
				L	P	Theory	Practical			Theory	Practical	Total
I	Core -I	13A	Cellular and Molecular Biology	3	1	15	25	60	100	3	1	4
	Core – II	13B	Human Genetics	3	1	15	25	60	100	3	1	4
	Core – III	13C	Bioinformatics and Genomics	3	1	15	25	60	100	3	1	4
	Elective – I	1EA	Immuno Technology	4	--	40	--	60	100	4	-	4
	Supportive - I	From other departments		2	--	20	--	30	50	2	-	2
	Diploma - I	1LA	Biomedical Instrumentation – Paper I	4	--	40	--	60	100	4	-	4
II	Core – IV	23A	Biochemical Genetics	3	1	15	25	60	100	3	1	4
	Core – V	23B	Proteomics	3	1	15	25	60	100	3	1	4
	Core – VI	23C	Animal Cell Culture and Techniques	3	1	15	25	60	100	3	1	4
	Elective – II	2EA	Introduction to Human Cytogenetic Techniques	4	--	40	--	60	100	4	-	4
	Supportive – II	From other departments		2	--	20	--	30	50	2	-	2
	Diploma	2LA	Biomedical Instrumentation – Paper II-Medical Imaging Systems	4	--	40	--	60	100	4	-	4

III	Core – VII	33A	Toxicology and Environmental Genetics	3	1	15	25	60	100	3	1	4	
	Core – VIII	33B	Population Genetics	3	1	15	25	60	100	3	1	4	
	Core – IX	33C	Recombinant DNA Technology	3	1	15	25	60	100	3	1	4	
	Elective – III	3EA	Gene Therapy	4	--	40	--	60	100	4	-	4	
	Supportive – III	From other departments			2	--	20	--	30	50	2	-	2
	Diploma - III	3LA	Biomedical Instrumentation – Paper III	4	--	40	--	60	100	4	-	4	
IV	Core - X	43A	Biosafety and Bioethics	3	1	15	25	60	100	3	1	4	
	Diploma - IV	4LA	Practical (Biomedical Instrumentation)	--	4	40	--	60	100	-	4	4	
	Project Work - Report				--	--	--	--	200	8			
	Viva-voce Examination				--	--	--	--	50	2			
	Field Trip (Visiting Educational Institution, Research Laboratories,)				--	--	--	--	50	2			
	Skill Development (Communication skills, Personality development, Summer training programme, Hands on training, On the job training programme etc.,)				--	--	--	--	50	2			
	Total								1800 + 400	72 + 16			

L-Lecture hours per week, P-Practical hours per week.

**SUPPORTIVE COURSES
(OFFERED TO THE STUDENTS OF OTHER DEPARTMENTS)**

Supportive I	C1GS	Entomo Biotechnology	2	--	20	-	30	50	2	-	2
Supportive II	C2GS	Stress and Biomarkers	2	--	20	-	30	50	2	-	2
Supportive III	C3GS	Conservation Biology	2	--	20	-	30	50	2	-	2

CORE PAPER –I

08ZOO13A

CELLULAR AND MOLECULAR BIOLOGY

Unit – I

Structure and organization of cell – Bacteria and Virus – Differences between Prokaryotic and Eukaryotic cells, Structure, Composition and Function of Plasma membrane, Mitochondria, Endoplasmic reticulum, Golgi complex, Vacuoles, Ribosomes, Mircosomes, Cytoskeleton and Peroxisomes, Chemical composition and function of Nucleus, Nucleolus and Chromosomes.

Unit – II

Overview of Cell cycle – mitosis – meiosis – Factors modifying the cell cycle – genes regulating the cell cycle - microtubules – motile functions of microtubules – microfilaments – microfilament based cell motility – nucleus and its molecular constituents – organization of chromatin and cell nucleus

Unit III

Membrane Biogenesis – Lipid biogenesis and membrane asymmetry – membrane models – active transport – passive transport – cell signaling – cell adhesion – cell junctions – cellular oxidations and mitochondria – photosynthesis and chloroplast – chloroplast transport

Unit IV

Development of motile male gametes – development of female gametes – fertilization in animals – gametogenesis and gertilization in higher plants

Unit V

Characteristics of Cancer – establishing the genetic basis of cancer – viruses and cancer – multistep progression from initiation to malignancy – the role of chemicals and radiation in multistep progression

Reference:

1. G. Karp. 1979. Cell Biology, Mc Gra Hill Kogatusha Ltd. Japan.
2. De Robertis E.D.D and De Robertis E.M.F. 1980. Cell and Molecular Biology. Holt – Sanders international (Edn.)
3. C.J. Avers. 1976. Cell Biology. D. Van Nostrand Co., New York.
4. J.D. Watson. 1977. Molecular Biology of the gene 3rd (Edn.) W.A.Benjamin Inc. London.
5. A.L. Lehninger. 1984. Principles of Biochemistry. CBS Publishers and Distributors, New Delhi.

Practical:

1. Mendelian genetics calculations
2. Identification of different stages of meiosis and mitosis (slides).
3. Identification of sex chromatin in buccal smear test.
4. Preparation of mitosis in Onion root tip.
5. Squash preparation in Grasshopper testis.

CORE PAPER –II

08ZOOC13B

HUMAN GENETICS

UNIT-I

History of Human Chromosome Research - Denver Conference (1940) - Chicago Conference (1966) - Paris Conference (1971) - Nomenclature of Human Chromosome.

UNIT-II

Identification of Human diploid chromosome - peripheral blood cultures - banding techniques - G-band; Q-band; C-band; R-band - Identification of 23 pairs of Human chromosomes by band position.

UNIT-III

Chromosomal syndromes: Autosomal syndromes - Sex chromosomal syndromes - Structural chromosomal syndromes.

UNIT-IV

Prenatal diagnosis: Chorionic villi sampling - Foetoscopy, Ultrascopy - Amniocentesis. b) Postnatal diagnosis: Peripheral blood leucocyte culture - Sister Chromatid Exchange - Fragile site - Mitotic index. c) Genetic Counseling.

UNIT-V

Hereditary forms of Cancer - Oncogenes and Cancer - Chromosomes and Cancer - Cancer and the environment.

Reference Books:

1. Human Heredity Principles and issues -- by Michael R. Cumming's. 3rd Edition.
2. Genetics Medicine - by Karl. H. Muench Elsevier Pb. London
3. Human Genetics by Elof Axel Carlson, TATA Mc Graw-Hill Pb. New Delhi.

Practicals:

1. Problems related to Mendelian laws.
2. Pedigree analysis
3. Peripheral blood leukocyte culture for chromosomal studies
4. Mitotic indices
5. Sister chromatid exchange -determination
6. Micronucleus test
7. Chromosomal disorders-Numerical, Structural

CORE PAPER –III

08ZOOC13C

BIOINFORMATICS AND GENOMICS

Unit I

Biology of cells-Biology of Environment-Cell Energetics and Respiration- Calculus-Integration.

Unit II

Internet and Intranet-Application of IT-Database Management Systems and telecommunications.-Searches on MEDLINE, CD-ROM

Unit III

Chemical Bonding and Atomic and Molecular Orbital-X-ray crystallography of bio molecules – Molecular mechanics and molecular dynamics of Protein, Pesticides, Nucleotides.

Unit IV

Concept of molecular modeling-Genome data bank-microbial and cellular data banks
Analysis tools for sequence data banks.

Unit V

Introduction to Genomics- biological data modeling-Genomic mapping and single nucleotide polymorphisms-Micro array gene expression analysis –Genomics databases.

References

- 1.Jurnak, F.A. and Mc Pherson, A. 1985. Biological Macromolecules and Assemblies., New Delhi
- 2.T.K. Manicavachagom Pillai – Calculas
- 3.Powell, HTML, The complete reference , Tata Mac – Graw Hill, 1988.
- 4.Winter, M. J. 1996. Chemical Bonding , Oxford University Press, Inc., New York, 91 pp.
- 5.Setubal J., Meidanis J. Introduction to computational molecular biology. PWS Publishing Co., Boston (1996)
- 6.Matthew F. Schlecht. Molecular modeling on the PC &. Introduction to Database systems, J.M. Martin , Princeton – Hall.

Practical

- 1.Bioinformatics and the Internet
- 2.Protein Sequence Analysis
- 3.Molecular Graphics and Evaluating Protein Structure
- 4.Small Molecule Generation and assessment
- 5.Free energy calculations

ELECTIVE PAPER –I

08ZOOC1EA

IMMUNOTECHNOLOGY

Unit-I.

Introduction to Immune system; cellular and humoral immunity; complement; molecular basis of Immune diversity. Host-parasite interaction; Immunity and infection: immunity to bacteria, virus, protozoa, fungi and tumor.

Unit-II.

Antigens and antigenicity. Polyclonal and monoclonal antibody production and purification. Conjugation of antibody with enzymes, fluorochrome and toxin. Humoral immune response and cell mediated immune response.

Unit-III.

Immunity to infections. Immunological techniques: RIA, ELISA, Immunocytochemistry, immunofluorescence, Immunoblotting,

Unit-IV.

Fluorescence antibody techniques, flow cytometry, Fluorescence in situ hybridization. Immunopathology and immunological disorders.

Unit-V.

Principles and methods of vaccine preparation – Edible vaccines. Antibody engineering and structure. Cytokines and immunotherapy.

References

1. Immuno-Biotechnology by Surendra Naha and Ravidra Narain, Dominant distributors and Publishers, New Delhi, 2006.
2. Immunology by Ivan Roitt, Brostoff and Male. 5th Edition. Mosby publications, London.
3. Kuby Immunology by Richard A. Goldsby (Editor), Barbara A. Osborne, Thomas J. Kindt, Janis Kuby, Janis Kuby, Richard A. Goldsby. Richard A. Goldsby (Editor), Barbara A. Osborne, Thomas J. Kindt, Janis Kuby, Janis Kuby, Richard A. Goldsby. W H Freeman & Co. 2006
4. Cellular and Molecular Immunology by Abul K. Abbas, Andrew H. Lichtman. Elsevier Science Health Science. 2005.

Practical

1. ELISA
2. Immuno electrophoresis

DIPLOMA IN BIOMEDICAL INSTRUMENTATION

DIPLOMA PAPER - I

08ZOOC1LA

Course Objective: To make an introduction to the modern Biomedical instruments and systems, their features and applications

Unit I: Basic concepts of electronics

Electronic components and circuit analysis – amplifiers – filters – analog to digital and digital to analog conversion – digital signal processing – microcomputers – display devices – recording devices – software and programming languages

Unit II: Analysis of molecules in clinical medicine

Spectrophotometry – amperometric biosensors for oxygen and glucose – ion selective electrodes for pH and CO₂ - flame photometry – mass spectrometry - carbon dioxide concentration measurement by Infrared transmission spectroscopy nitrogen by emission spectrometry – drugs by fluometry and chromatography – electrophoresis – DNA sequencing

Unit III: Cardiovascular measurement: the cardio vascular system

Measurement of blood pressure- sphygmomanometer – blood flow – cardiac output and cardiac rate – electrocardiography – echo cardiography – ballistocardiography – plethysmography – magnetic and ultrasonic measurement of blood flow

Unit IV: Introduction to the physiology of cardiac, nervous, muscular and respiratory systems - transducers and electrodes

Different types of transducers and their selection for biomedical applications – electrode theory different y types of electrodes –reference electrodes – hydrogen calomel – Ag-AgCl –pH electrode – selection criteria of electrodes

Unit V: measurement of electrical activities

Nervous system - electromyography – electroencephalograph and their interpretation – evoked potentials - eye, ERG, EOG

References:

1. Handbook of Biomedical Instrumentation – R.S.Khandpur, TMH Publishing company Ltd. New Delhi
2. Introduction to Biomedical Equipment Technology – Joseph J Carr, John M Brown, Pearson Education (Singapore) Pvt. Ltd
3. Biomedical Instrumentation and Measurements – Leslie Cromwell, Prentice Hall of India Pvt.Ltd, New Delhi
4. Bioinstrumentation – John G.Webster, John Wiley & sons, Inc.
5. Medical Instrumentation: application and design - John G.Webster, John Wiley & sons, Inc.
6. Biomedical Instrumentation and Measurements – Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer. Prentice Hall of India 2008.

CORE PAPER –IV

08ZOOC23A

BIOCHEMICAL GENETICS

UNIT-I

Introduction to Inborn errors of Metabolism-One gene One Enzyme hypothesis – Genes involved in metabolic disorders

UNIT-II

Carbohydrate metabolic disorders: Diabetes Mellitus - Clinical features and laboratory findings in insulin resistance - Ketosis and lactic acidosis - Galactosuria (G6PD)- Mucopolysaccharidosis

UNIT-III

Lipid metabolic disorders: Lipidosis – atherosclerosis - Cystic fibrosis - thalassemias, sickle cell anaemia – Hemophilia – hemoglobinopathies

UNIT-IV

Amino acid metabolism-Phenyl ketonuria- Homocystinuria – Alkaptonuria. Alpha-1-antitrypsin deficiency, obesity

UNIT-V

Nucleic acid and Protein metabolism - Gout Syndrome – Lesch Nyhans syndrome – Duchenne's muscular dystrophy (DMD)– Tay Sachs disease

References

1. Animal Genomics, Bhanu Chowdhary, S.Karger AG, P.O. box 4009 Switzerland
2. The Biology Chemistry Interface, Cooper and Raymond, Daya Publishing House, New Delhi
3. Genetics The Continuity of Life, D.J. Fairbanks, Daya publishing House, New Delhi
4. Concepts in Biochemistry, Boyer, R. Narendra book agency, Delhi
5. Textbook of Pediatrics, S.T. Achar and J. Vishvanathan, Orient Longman Limited, 1988.
6. Williams. Textbook of Endocrinology.

Practical

1. Quantitative analysis of Phenyl Ketonuria (PKU) by using urine samples.
2. Quantitative analysis of homocysteine by using urine samples.
3. Protein estimation from blood serum by Lowry et al method
4. Estimation of blood glucose level
5. Demonstration of Amniocentesis.

CORE PAPER –V

08ZOOC23B

PROTEOMICS

Unit-1.

Introduction to proteomics. Study of multiprotein systems. Proteome. Life and death of a protein. Proteins as modular structures. Functional protein families. Deducing proteome from the genome. Analytical proteomics. Significance for analytical proteomics. Peptide separations. Protein extracting from biological samples. Protein digestion techniques. Proteases, Cyanogen bromide and In-gel digestion.

Unit-2.

One dimensional SDS-PAGE. Two dimensional SDS-PAGE. Problems with 2D-SDS-PAGE. Ionization techniques for macromolecules. Preparative IEF. High-performance liquid chromatography. Capillary electrophoresis.

Unit-3.

Mass spectrometer analysis of proteins and peptides. MALDI-TOF MS instruments. MALDI. TOF Mass analyzer. ESI Tandem MS instruments. Tandem Mass analyzers. Triple Quadrupole Mass Analyzer. Ion-Trap Mass Analyzer. Q-TOF and Fourier Transform-Ion Cyclotron Resonance MS instruments.

Unit-4.

Protein identification by peptide Mass fingerprinting. Peptide sequence analysis and identification by Tandem Mass spectrometry. Mining proteomics. SALSA. Protein expression profiling. Identification of protein-protein interactions and protein complexes. Mapping protein modifications.

Unit-5.

Protein chips. SELDI. Microsequencing. Proteomics in cancer research. Proteomic analysis in pancreatic ductal adenocarcinoma and Human breast carcinoma. Profiling of chemoresistant cancer cells. Proteomics in disease understanding.

References

1. Protein Biochemistry and Proteomics by Hubert Rehm. Academic Press, Elsevier. USA. 2006.
2. Proteomics today by Mahmoud Hamdan and Pier Giorgio Righetti. John Wiley & sons. New Jersey. USA. 2005.
3. Introduction to Proteomics by Daniel C. Liebler. Humana Press, Totowa, NJ, USA. 2002.

Practicals

1. Purification of proteins
2. SDS PAGE
3. Softwares used in proteomics

CORE –VI

08ZOOC23C

ANIMAL CELL CULTURE AND TECHNIQUES

Unit – I. Introduction to animal cell culture techniques. Safety in cell culture laboratories. Detection of Contamination. Preservation and Storage. Equipments for routine cell maintenance.

Unit II. Types of cultured cells and culture systems. Cell growth requirements. Various types of media. Dispersion and disruption of tissues. Steps in managing cell cultures. Determination of cell yield and viability.

Unit III. Monolayer culture techniques. Various methods to measure the growth. Cell identification. Microcarrier culture.

Unit IV. Mass culture of mammalian cells. Primary cells. Suspension culture. Biological techniques for virus preparation.

Unit V. Flow cytometer. Cell synchronization. Autoradiography. Mutant isolation. Karyotyping. Cell fusion. Cell transformation. Applications of animal cell culture. Evaluation of chemical carcinogenicity.

Reference

1. Methods in Enzymology, CELL CULTURE, by William B Jakoby and Ira H Paston. Academic press. California.
2. Animal cell culture by Freshnay.

Practicals

1. Sterilization
2. Preparation of Media and other reagents
3. Dispersion and disruption of tissues
4. Establishment of primary cell culture
5. Maintenance of cell lines

ELECTIVE PAPER –II

08ZOOC2EA

INTRODUCTION TO HUMAN CYTOGENETIC TECHNIQUES

UNIT- I

History of Human chromosome research- Terminology

UNIT- II

Study of Human Chromosomes by using Banding techniques – G banding – Q banding – C banding techniques.

UNIT - III

Prenatal diagnosis, Amniocentesis, choridri villi sampling, ultra sonography, foetal tissue sampling, foetal blood sampling.

UNIT- IV

Postnatal diagnosis, peripheral blood leukocyte culture for chromosomal analysis – Sister Chromatid exchange analysis-mitotic index-micronucleus tests.

UNIT - V

Cancer genetics- human genome projects.

References

1. Human heredity Principles and Issues – Michael, R. Cumming's 3rd Edition
2. Genetics Medicine – Karl. H. Muench, Elsevier Pub, London
3. Human genetics – Elof Axel carison, TATA Mc grow Hill Pub, New Delhi

Practicals

RPMI 1640, Mc coy's 5A Medium preparation
Human leukocyte culture from peripheral blood
Giemsa staining of chromosomes
Karyotypic analysis by manual and karyotypic software
Chromosomes preparation from onion root tip
Drumstick chromosome preparation from buccal smear
Flourescent insitu hybridisation

DIPLOMA PAPER –II

08ZOOC2LA

MEDICAL IMAGING SYSTEMS

Unit I: Medical x-ray equipment

Introduction – properties of x-rays – photoelectric effect – Compton effect – Bremsstrahlung – x-ray tube – x-ray equipment block diagram – fluoroscopic system

Unit II: X-ray computed Tomography

Introduction- Ct scanners and detectors – image processing for computed tomography – spiral/helical computed tomography – multislice spiral computed tomography – radiation dose – clinical applications of computed tomography

Unit III: Nuclear Medical Imaging systems

Introduction – Instrumentation: The gamma camera – image characteristics – clinical applications of nuclear medicine – positron emission tomography – radioisotopes and radiopharmaceuticals – radiation dose

Unit IV: Magnetic Resonance Imaging

Introduction – nuclear magnetism – vector description of magnetic resonance – signal excitation and detection – NMR spectrum – factors affecting image appearance – pulse sequences and image contrast – effect of flow magnetic resonance images

Unit V: Ultrasonic Imaging systems

Introduction – Therapeutic and diagnostic equipment – therapeutic ultrasonic equipment – piezoelectric transducers – ultrasonic imaging equipment – ultrasonic waves – ultrasonic blood flow equipment – safety and bioeffects in ultrasonic imaging – clinical applications of ultrasound – obstetrics and gynecology breast imaging – cardiac disease

References

1. Handbook of Biomedical Instrumentation – R.S.Khandpur, TMH Publishing company Ltd. New Delhi
2. Introduction to Biomedical Equipment Technology – Joseph J Carr, John M Brown, Pearson Education (Singapore) Pvt. Ltd
3. Biomedical Instrumentation and Measurements – Leslie Cromwell, Prentice Hall of India Pvt. Ltd, New Delhi
4. Bio instrumentation – John G.Webster, John Wiley & sons, Inc.
5. Medical Instrumentation: application and design - John G.Webster, John Wiley & sons, Inc.
6. Biomedical Instrumentation and Measurements – Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer. Prentice Hall of India 2008.

CORE- VII

08ZOOC33A

TOXICOLOGY AND ENVIRONMENTAL GENETICS

Unit I

Toxicology – Introduction- Types of toxicology- Classification- Dose response- Selective toxicity – descriptive animal toxicity tests- predictive toxicology-characteristics of exposure.

Unit II

General Principles of Toxicology – Toxicological evaluation - Factors influencing toxicity- Factors related to the toxic effect-exposure situation-internal environment-subject- External environmental factors.

Unit III

Ecogenetics – Introduction-Toxicity and Carcinogenicity of Foreign chemicals – Heavy metal toxicity-Drug metabolism- Genetic epidemiology. Human Populations – Introduction – Genetic Diseases- Genetic and Environmental risk factors-Children's environmental health- Lead toxicity.

Unit IV

Genetic Toxicology- Introduction – Cellular responses to genotoxic agents – DNA damage and replication interference- Biomonitoring methodologies. Respiratory Toxicology – Introduction – Pathophysiological effects of gaseous and particulate air pollutants-Pulmonary Biology genetics of Asthma-Oxidative stress in Lung.

Unit V

Signal Transduction – Introduction – Genetic polymorphisms-Gene expression- Effects of Environmental estrogens – Cell responses to physiological, pathological and environmental stimuli .

References

1. Frant C.L.V., 1991. Basic Toxicology II (Eds), Hemisphere Publishing Corporation., Washington, London
2. Casarett and Doulls 1980. Toxicology : The basic Science of Poisons, II (Eds), Macmillan publishing Co., inc., New York.
3. Butler, G.C. 1978, Principles of Ecotoxicology, John Wiley & Sons, Chichester.
4. Gupta, P.K. 1985, Modern Toxicology, Vol II, metropolitan Book co., (P) ltd., New Delhi.
5. Thomas, J. Haley and William O. Berndt, 1987. Hand book of toxicology. Hemisphere Publishing corporation, Washington.

Practicals

1. Determination of LC 50
2. Acute toxicity of pesticides and metals
3. Sub Lethal toxicity of pesticides and metals
4. Histopathology of organs
5. Micronucleus Assay.

CORE –VIII

08ZOOC33B

POPULATION GENETICS

Unit I

The basics of population genetics – an over view-hardy Weinberg Law-Natural selection and mutation at one locus with two alleles-Fundamental theorem of natural selection, genetic drift.

Unit II

Complex genetic systems – Natural selection with multiple alleles at one locus, population genetics with multiple loci-natural selection and quantitative inheritance, nonrandom mating.

Unit III

Inbreeding-genotype frequencies with inbreeding, inbreeding coefficient, inbreeding depression-calculation of inbreeding-coefficient pedigrees..

Unit IV

Heterosis –manifestations of heterosis-example of heterosis-genetic basis of heterosis-dominance hypothesis-over dominance hypothesis-application of heterosis.

Unit V

Genetic basis of evolution and speciation- Lamarckism and Neo-Lamarckism – Darwinism and Neo Darwinism – mutation theory-synthetic theory-evolution at molecular level, evolution of proteins, nucleotide sequences-speciation-races, species, modes of speciation.

References.

1. Daniel L. Hartl – A primer of population genetics, Sinauer associates, Inc., pb. Sunderland Massachusetts, USA
2. Jonathan Rougharden- Theory of population genetics, and evolutionary ecology: An Introduction – Prentice Hall, Uper Saddle, and River, NJ 07458
3. Wilkie, A.O.M. the molecular basis of genetic dominance. J.Med .Genet..31 : 89-98.1995.
4. Wright. S. 1977. Evolution and the genetics of Populations : Experimental results and Evolutionary Deductions. University of Chicago Press, Chicago.

Practical

1. Hardey – Weinberg equilibrium and Allele frequency estimation
2. Genetic distance analysis
3. The measurement of Inbreeding and of its effects
4. Analysis of genetic diversity in subdivided population.
5. Quantitative Inheritance

CORE-IX

08ZOOC33C

RECOMBINANT DNA TECHNOLOGY

UNIT-I

Introduction - Historical developments, scope, terminology and perspectives, gene manipulation through protoplast culture. Gene transformation - Agrobacterium - Mediated gene transfer - Electroporation -Short gun methods of DNA introduction into cells.

UNIT-II

Cloning vehicles - plasmids, bacteriophages and cosmid vectors; cloning strategies, genomic DNA libraries, c - DNA libraries, transgenic animals.

UNIT-III

Isolation and purification of DNA from animal cells, DNA sequencing, DNA engineering through cutting and joining DNA molecules; Restriction Endonucleases and ligases.

UNIT-IV

Application of gene transfer technology; Transfer of novel genes including NIF genes, expression of Animal genes in bacteria. Application in Animal Biohazard and Biosecurity in animal Biotechnology. Ethical aspects in Animal Biotechnology.

UNIT-V

Application of Biotechnology in Human welfare and medicine (production of effective vaccines, Human insulin, Human growth hormone).

Reference Books:

1. Genetic Engineering -- by Boyer.H.W and Nicosia.S. (1978 Elsevier/North Holl and Biomedical press, Amsterdam
2. Genetics of Industrial Microorganism -- by Seberk.O.K and Laskin.A.I. (1979) American Society of Microbiology, Washington. D.C.
3. Genetic Engineering Vo.1 -- by Setlow.J.K and Hollanddev (1978) Plenum press. Newyork.
4. Microbial technology Vol.1 and 2 -- by Pepler.H.J and Eriman.P.(1979). Academic press. New york.
5. Biotechnology-A textbook of Industrial Microbiology -- by Crueger.W. and Cuger.A. (1984) Science tech. Inc. USA.

Practicals

1. Isolation of genomic DNA from human blood
2. Restriction digestion of genomic DNA
3. Amplification of DNA using PCR.
4. Restriction fragment length polymorphism
5. Single strand confirmation polymorphism
6. Isolation of a gene and cloning in plasmids
7. Transformation of recombinant plasmids

ELECTIVE- III

O8ZOOC3EA

GENE THERAPY

Unit-I

History and scope of gene therapy. Advantages and disadvantages of Gene therapy. Genes and disease. Hereditary disorders. Trends in gene therapy.

Unit-II

Gene therapy used in biochemical disorders. ADA gene therapy – bubble babies. Gene therapy used to treat Sickle cell anaemia. DMD mini gene therapy.

Unit - III

Gene therapy for cancers. Steriotoxy method. Hammer headed RNA. Triple helix. Targeted cell killing. HSV TK – By stander effect and other gene therapy techniques

Unit-IV

Molecular medicine – DNA as vaccines – Treatment for CFTR – AAV in gene therapy – Gemini virus – TMV – vectors used in gene therapy

Unit-V

Techniques used in gene therapy. Gene gun or biolystic process – electroporator and other techniques– ethics of gene therapy – future aspects of gene therapy

References

1. Tom Stratchan – Human Molecular Genetics
2. J.D. Watson – Molecular genetics
3. Lemoine – Gene therapy
4. Old and Primrose – Principles of gene manipulation

Practical

1. Total RNA isolation from human blood
2. Genomic DNA isolation from human tissues
3. DNA isolation from viruses
4. Transduction
5. CaCl₂ mediated transformation

DIPLOMA PAPER – III

08ZOOC3LA

THERAPEUTIC EQUIPMENT

Unit I: Cardiac defibrillators and pacemakers

Introduction – paddles – defibrillator energy delivery - external defibrillators – implantable defibrillators – pulse generators – arrhythmia therapy – implantable monitoring – troubleshooting defibrillators – external and implantable pacemakers – programmable pacemakers – power sources – design of encapsulation and leads – pacing system analyzer

Electro surgical devices: Introduction – basic ESU – ESU power amplifier – active electrodes – dispersive electrodes – sinusoidal oscillators.

Unit II: Biomedical Lasers

Introduction- CO₂ laser – argon laser surgical unit – interaction and effects of UV – IR laser radiation on biological tissues – penetration and effects of UV-IR laser radiation into biological tissues – effects of Mid – IR laser radiation – effects of near IR laser radiation – effects of visible-range laser radiation – effects of UV laser radiation – general description and operation of lasers – biomedical laser beam delivery systems

Unit III: Ventilators and Humidifiers

Introduction – negative-pressure ventilators - positive-pressure ventilators – ventilation modes – breath delivery control

Implantable insulin delivery systems: Introduction – drug delivery devices – new techniques of insulin administration – ambulatory and implantable infusion systems- alternate routes – subcutaneous route – peritoneal route for insulin infusion.

Unit VI: Essentials of anesthesia delivery

Introduction – anesthesia machines – gases used during anesthesia and their sources – oxygen – nitrous oxide – carbon dioxide – helium – gas blending and vaporization system –breathing circuits – gas scavenging systems – monitoring the function of the anesthesia delivery system – monitoring the patient

Lung, Blood gas and Dialysis machines: Introduction – spirometers – gas measurements – kidney dialysis machines – hemodialysis

Unit V: Clinical laboratory: separation, spectral and non-spectral methods

Introduction – separation methods – chromatographic separations – gas chromatography – high performance liquid chromatography – fluorometry – flame photometry – atomic absorption spectroscopy – turbidimetry and nephelometry – clinical laboratory: Non-spectral methods and automation –particle counting and identification-electrochemical methods – ion specific electrodes – radioactive methods – automation – trends in laboratory instrumentation

Hospital equipment safety: Introduction – Electrical hazards of medical instruments – devices to protect against electrical hazards – equipment safety programme – preventive maintenance – logical approach to troubleshooting

References:

1. Handbook of Biomedical Instrumentation – R.S.Khandpur, TMH Publishing company Ltd. New Delhi
2. Introduction to Biomedical Equipment Technology – Joseph J Carr, John M Brown, Pearson Education (Singapore) Pvt. Ltd
3. Biomedical Instrumentation and Measurements – Leslie Cromwell, Prentice Hall of India Pvt.Ltd, New Delhi
4. Bio instrumentation – John G.Webster,John Wiley & sons, Inc.
5. Medical Instrumentation: application and design - John G.Webster, John Wiley & sons, Inc.
6. Biomedical Instrumentation and Measurements – Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer. Prentice Hall of India 2008.

COREPAPER –X

08ZOOC43A

BIOETHICS AND BIOSAFETY

UNIT-I

Introduction to Bioethics in Biotechnology- Ethics – Bioethics- Biotechnology – Positive effects – Negative effects- Ethics in biotechnology- Biotechnology examples – Rice with Vitamin A- No-till agriculture- Witchweed Control – Cheese chymosin from yeasts- Cotton without Insecticides- Slow Ripening Fruits-Controlled Ripening – Saving the Banana- Virus Resistant Crops- The Potato Famine- Building with Silk- Reduced Need for Fertilizers- More from the Sun- Toxic Soils- Biological Pest Controls – Fast Growing Trees- Fast Growing fish- A ban on Glyphosate- The Monarch Butterfly Story- Consumer traits – food safety- Environmental concerns- Economic and Social Concerns.

UNIT –II

Biosafety Regulations- National and International Guidelines.

Introduction – Regulation framework in various countries – USA- European Union- Canada- Australia- South Africa- Asian Region- International Guidelines.

Awareness Education on Genetically Engineered Organisms. Introduction on genetic engineering- Interaction with non target organisms Unpredictable gene expression or transgene instability- Gne glow- Resistance/tolerance of target organisms- Increased weedings- Loss of biodiversity / reduction of cultivars- Changes in the soil ecology- Generation of new live viruses- Risks and uncertainty associated with biotechnology.

UNIT III

CPCSEA Guidelines for Laboratory Animal Facility

Goal- Veterinary care- Animal procurement- Quarantine, Sterilization and separation – Surveillance, diagnosis, treatment and control of disease- Animal care and technical personnel- Personal hygiene- Animal experimentation involving hazardous agent- Multiple surgical procedures on single animal- Duration of experiments- Physical restraint- Physical plant- Physical relationships of animal facilities to laboratories – Functional areas- Physical relationship of animal facilities to laboratories- Functional area- Physical facilities- Environment- Animal husbandry- Activity – Food- Bedding- Water- Sanitation and cleanliness- Assessing the effectiveness of sanitation – Waste disposal- Pest control- Emergency , weekend and holiday care.

GLP and Bioethics- Introduction – National Good Laboratory Practice (GLP) Programme- The GLP authority functions- Why follow Good Laboratory Practices?- The Aspiration – Who is responsible? – The IT Way- Role of a Sponsor- What are the quality standards for Clinical Trials?- Why is India a favorite destination for Clinical Trials worldwide?

UNIT IV

Intellectual Property Rights(IPR)

Intellectual Property Rights- An introduction- Origin of the Patent Regime- Early patterns Act & Indian Pharmaceutical Industry – History of Indian Patent System- The Present Scenario – Basis of Patentability – Novelty- Utility= Inventive Step and Non Obviousness- Case studies- Basis of Patentability – Non Patentable Inventions-

Renovation of Turmeric Patent- Revocation of W.R. Grace and U.S. department of Agriculture Neem Patent- Patent Application Procedure in India- Patent Granted Under Convention Agreement- Who can apply for a patent?- Patent Procedure – Opposition to Grant of Patent- Grant and Sealing- Exclusive Rights – Grant of Exclusive Rights- Special Provision for selling or distribution – Suits relating to infringements – Compulsory License- Termination of Compulsory License – Case study- Compulsory Licenses- Relief under TRIPS agreement.

UNIT V

ELSI and Human Genome Project (HGP)

Human Genome Project- Genome Mapping- Define the social questions raised by the Human Genome Project- What is genetic information?- Who should have access to genetic information? – How will this new genetic information be used by insurance companies? –Will genetic counseling be provided in the course of genetic testing? – If you have the gene do you always express the trait? – How does genetic information impact society? –What were some of the ethical, legal and social implications addressed by the human Genome Project?-societal Concerns- What are some of the pros and cons of gene testing? – For what diseases are gene testes available? – Is genetic testing regulated? – Does insurance cover genetic testing?

Reference Books:

1. Bioethics, by Shaleesha A. Stanley (2008). Published by Wisdom Educational Service, Chennai.

DIPLOMA PAPER - IV

PRACTICALS

08ZOOC4LA

1. Study of multimeter and using for measurement volt and resistance
2. Study of CRO
3. Study of waveforms and measurement of frequency and time
4. Measurement of skin contact impedance and technique to reduce it
5. Measurement of respiration rate using thermistor
6. pH measurement of given biological sample
7. Measurement of leakage currents with the help of the safety tester
8. Visit to hospital – operation and function of all the controls of hospital x-ray machine
9. Identification of different block/sub system of x-ray machine
10. Use of sphygmomanometer for measurement of blood pressure

SUPPORTIVE PAPER – I**08ZOOC1GS****ENTOMO-BIOTECHNOLOGY****Unit – I**

Critical examination and discussion of advances in the areas of insect biotechnology, including genetic engineering and genomics.

Unit – II

An in-depth analysis and role of insect as vectors of pathogens, or as parasites causing disease in humans (principally) and animals – mosquito transmitted diseases - The interaction of host and parasite and the dynamic nature of the epidemiological system

Unit – III

Biology of insect, viruses, bacteria, fungi and entomopathogenic nematodes and their use in insect pest/vector control.

Unit – IV

Genetic improvement of natural enemies, Insect cell line, Botanical insecticides and Neuro-endocrinology - bioactive peptides.

Unit – V

Transgenic plants- role in insect control, Genetic control - Sterile (transgenic) Insect Technology (SIT).

References:

1. Yoshinori N & Kaya H, (1993). Insect Pathology (*Academic Press*) Pp. 1 - 666
2. Ananthakrishnan, T.N (2007). Dimensions of Molecular Entomology (*University Press*). Pp. 1- 162
3. Blissard, G.W. and Rohrmann, G.F.1990. Baculovirus Diversity and Molecular Biology. *Ann. Rev. Entomol.* 35: 127-155.
4. Burges, H.D. 1981. Microbial Control of Pests and Plant Diseases. Pp.949. *Academic press*. New York.
5. Carter, J.B.1984. Viruses as pest control agents. *Biotechnol. and Genetic Engineering Reviews*, 1: 375 – 419.
6. Cho, T., Shular, M.L. and Granados, R.R. 1989. Current Developments in New Media and cell Culture System for the Large Scale Production of Insect Cells. *Advances in Cell Culture.* 7: 261-277.
7. Cockburn, A.F., Howels, A.J. and Whitten, M.J. 1984. Recombinant DNA Technology and Genetic Control of Pest Insects. *Biotechnology and Genetic Engineering Reviews*, 2: 69-99.
8. Day, P.R. 1986. Biotechnology and Crop Improvement and Protection. *BCRC Monograph No. 34*, Pp. 24.
9. Hedin, P.A., Men, P.A. and Hollingsworth, R.M. (eds.) 1988. Biotechnology for Crop Protection, 471 Pp. *American Chemical Society*, Washington, DC.

10. Herzog, D.C. and Hoy, M.A. 1985. Biological Control in Agrl. IPM system, Pp. 5889. *Academic Press, New York.*
11. Hoy, M.A. 1985. Recent Advances in Genetics and Genetic Improvement of Phytoseiidae. *Ann. Rev. Entomol.*, 30: 343-370.
12. Kirschbaum, J.B. 1985. Potential Implication of Genetic Engineering and other Biotechnologies to Insect Control. *Ann. Rev. Entomol.* 30: 51-70.
13. Maeda, S. 1989. Expression of Foreign Genes in Insects using Baculovirus Vectors. *Ann. Rev. Entomol.* 34.
14. Meeusen. L. and Warren, G. 1989. Insect Control with Genetically Engineered Crops. *Ann. Rev. Entomol.* 34: 373-381.
15. Miller, L.K. Lingg, A.J. and Bulla, L.A. Jr. 1983. Bacterial, Viral and Fungal Insecticides. *Sciences*, 219: 715-721.

SUPPORTIVE PAPER – II

08ZOOC2GS

STRESS AND BIOMARKERS

The aim of the subject Stress and Biomarkers is to provide students with the background and experimental evidences to study and to understand the nature and toxicity of xenobiotics and their impacts on animals. The primary objective of the course is to provide the basic principles of environmental toxicology, toxicological assessments, toxicological response, and the effects of toxicants that have been released into the environment (e.g., pesticides, metals, effluents etc.). Toxicity testing (acute and chronic) will be examined and toxicological endpoints (e.g. Behavioral Biochemical, Histopathological, Hematological, Physiological, Hormonal, etc.) will be presented.

UNIT –I

Introduction – definition – sub disciplines – environmental toxicants – routes of entry of xenobiotics.

UNIT –II

Toxicity tests – need for conduct of toxicity tests – bioassay – types of acute toxicity tests- terminologies in toxicity tests- chronic toxicity tests.

UNIT –III

Bioassay – basic requirements – test organisms – test solutions – test procedures – data analysis –joint toxicity.

UNIT –IV

Biomarkers – introduction – background – biomarker selection and development – methods – types – specific and non specific – organ and tissue specific.

UNIT –V

Physiological biomarkers – definition – direct enzyme inhibition – endocrine – blood chemistry – energetics –growth rate –histopathology.

References

1. Principles of Ecotoxicology, 3rd edition. C.H. Walker, S.P. Hopkin, R.M. Sibly & D.B. Peakall. Taylor & Francis, New York. 315 pp. 2006.
2. Principles of Biochemical Toxicology, 3rd ed. J.A. Timbrell. Taylor & Francis, New York. 394 pp. 2000.
3. Huggett, R.J., Kimerle, R.A., Mehrle, P.M., Jr., Bergman, H.L., eds.: Biomarkers: Biochemical, Physiological, and Histological Markers of Anthropogenic Stress. Lewis Publishers, Boca Ratan, FL, 1992.
4. McCarthy, J.F., Shugart, L.R., eds.: Biological Markers of Environmental Contaminants. Lewis Publishers, Boca Ratan, 1990.
5. Peakall, D.B.: Animal Biomarkers as Pollution Indicators, Ecotoxicological Series 1. Chapman and Hall, London, 1992.
6. Fossi, M.C., Leonzio, C., eds.: Nondestructive Biomarkers in Vertebrates. Lewis Publishers, Boca Ratan, FL, 1994.
7. Frant C.L.V. 1991, Basic Toxicology II (Eds.), Hemisphere publishing corporation, Washington, London
8. Casarett and Doull's 1980. Toxicology: The Basic Science of Poisons.. II (Eds.) Macmillan publishing co., Inc, New York.
9. Thomas J. Haley and William O. Berndt, 1987. Handbook of toxicology. Hemisphere Publishing Corporation, Washington.
10. Water Toxicology V.V. Metelev, Kanaev, N.G. Dzasokhova-Amerind Publishing Co., Pvt., Ltd., New Delhi

08ZOOC3GS

SUPPORTIVE PAPER –III

CONSERVATION BIOLOGY

Conservation biology is the science of preserving biodiversity and sustaining the earth. This course provides an introduction to conservation biology, and will focus on the earth's biological diversity, threats to its biological diversity, how threats influence populations and species, and solutions to dealing with those threats. The goal of conservation biology is the development strategies for preserving populations, species, biological communities, and entire ecosystems.

UNIT –I

Introduction to Conservation Biology- Concern for Biological Diversity- Current status of Conservation Biology- Origin of New Species – Genetic diversity – Communities and Ecosystems- Tropic levels- Measuring Biological Diversity.

UNIT – II

Threats to Biological Diversity- Rates of Extinction- Biogeography of Indian sub continent - Vulnerability to extinction- Endemic species of India - Species diversity in Western Ghats. Habitat loss- Global climate change- Modern Extinction rates.

UNIT –III

Population biology of endangered species – Monitoring populations- Population Viability Analysis- Long term Monitoring of species and ecosystems. Human population and the use of resources- Habitat destruction - fragmentation and Degradation. Habitat degradation and pollution. Man animal conflict. Exotic species introductions- Disease and overexploitation - invasive species.

UNIT – IV

The value of Biodiversity- Direct values- The economic value of Biodiversity- Conservation and Ecotourism- Traditional medicines and rainforest conservation- The Ethical value of Biodiversity.

UNIT – V

Protected areas – Conservation networks- Habitat conservation- Effective preservation of species- Linking nature reserves with habitat corridors- present and future human use of reserves. Habitat management- The key to success in the conservation of endangered species. Convention on Biological diversity- International agreements - International Trade in endangered species - Zoo policy- Laws and their applications in Zoological parks, Wildlife sanctuaries and Biosphere reserves

References

1. R. B. Primack 1993. Essentials of Conservation Biology, Sinauer Associates, USA
2. G. K. Meffe and C. R. Carroll 1994. Principles of Conservation Biology, Sinauer Associates, USA
3. B. Groom bridge 1992. Global Biodiversity. Status of the Earth's Living Resources. Chapman and Hall, London.
4. R. A. Mittermeier, N. Meyers, P.R. Gil and C. G. Mittermeier 2000. Hotspots: Earth's Biologically richest and most endangered Terrestrial Ecoregions. Cemex/Conservation International, USA
5. R. A. Mittermeier, P.R. Gil and C. G. Mittermeier 1997. Megadiversity: Earth's Biologicals Wealthiest Nations, Cemex, SA
6. M.E. Soule 1986. Conservation Biology: The Science of Scarcity and Diversity, Sinauer Associates Inc., USA.
7. M. L. Reaka - Kudla, D. E. Wilson and E. O. Wilson 1997. Biodiversity II: Understanding and Protecting our Biological Resources. Joseph Henry Press, Washington, DC.
8. T. W. Clark, R. P. Reading and A.L. Clarke 1994. Endangered Species Recovery: Finding the Lessons, Improving the process. Island Press, Washington, DC.
9. Anon. 1992. Convention on Biological Diversity - Text and annexes. World Wide Fund for Nature - India.
10. <http://www.redlist.org>
11. W. V. Reid and K.R. Miller 1989. Keeping options Alive. World Resources Institute.
12. Anon. 1997. Wildlife (Protection) Act of India, Nataraj Publishers, Dehradun
13. K. J. Gaston 1996. Biodiversity: Biology of numbers and Difference. Blackwell Science, Oxford.
14. E. O. Wilson, 1988. Biodiversity. National Academy Press, Washington, D.C.