Annexure No.	22 D
SCAA Dated	01.07.2008

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046
M.Sc., ANIMAL BIOTECHNOLOGY (CBCS Pattern)
With Compulsory Diploma in Animal Biodiversity and Conservation

(FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2008-2009 BATCH AND ONWARDS)

Admission of Candidates

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

B.Sc. Biotechnology

B.Sc. Biochemistry

B.Sc. Microbiology

B.Sc. Genetics

B.Sc. Bioinformatics

B.Sc. Environmental Sciences

B.Sc. Environmental Zoology

B.V.Sc.

Scheme of Examination

Sem.	Paper Core/ Elective/ Supportive	Sub. Code: 08ZOOB	Subject	Instructional Hrs/Week	University Examinations			
					Internal	External	Total	Total Credits
I	Core -I	**13A**	Biochemistry and Biophysics	4	25	75	100	4
	Core – II	**13B**	Molecular Cell Biology	4	25	75	100	4
	Core – III	**13C**	Microbiology	4	25	75	100	4
	Core - IV	**13D**	Practical (Biochemistry and Biophysics, Molecular Cell Biology and Microbiology)	6	25	75	100	4
	Elective - I	**1EA**	An Introduction to Human Cytogenetics	4	25	75	100	4
	Supportive - I	**1GS**	Entomo Biotechnology	2	12	38	50	2
	Diploma - I	**1LA**	Evolution and Biogeography	4	25	75	100	4
II	Core –V	**23A**	Proteomics	4	25	75	100	4
	Core – VI	**23B**	Receptor Biology	4	25	75	100	4
	Core – VII	**23C**	Stem Cell Technology	4	25	75	100	4
	Core - VIII	**23D**	Practical (Proteomics, Receptor Biology and Stem Cell Technology)	6	25	75	100	4
	Elective - II	**2EA**	Molecular Entomology	4	25	75	100	4
	Supportive - II	**2GS**	Crustacean Aquaculture and Technology	2	12	38	50	2
	Diploma - II	**2LA**	Wildlife Biology and Conservation	4	25	75	100	4
III	Core – IX	**33A**	Nanobiotechnology	4	25	75	100	4
	Core – X	**33B**	Immunotechnology	4	25	75	100	4
	Core – XI	**33C**	Genetic Engineering	4	25	75	100	4
	Core – XII	**33D**	Practical (Nanobiotechnology, Immunotechnology and Genetic Engineering)	6	25	75	100	4
	Elective – III	**3EA**	Ecobiotechnology	4	25	75	100	4
	Supportive – III	**3GS**	Marine Biotechnology	2	12	38	50	2
	Diploma – III	**3LA**	Animal Biodiversity	4	40	60	100	4
	Diploma - IV	**3LB**	Practical (Evolution and Biogeography, Wildlife Biology and Conservation and Animal Biodiversity)	4	25	75	100	4
IV	Project, Viva, Field Trip and Skill Development	**4P**	Project Work	----	----	----	100	4
			Viva – voce Examination	----	----	----	50	2
			Field Trip* (Visiting Educational Institution, Research labs. And Industries etc.	----	----	----	50	2
			Skill Development* (Communication skills, Personality development, Summer training programme, Hands on training, On-the-job training programme etc.					
Total				----	----	----	2250	90

* To be submitted along with Project Work

Question Paper Pattern

Practical Components:

The M.Sc. Animal Biotechnology Core and Diploma Practical Examination having the following Marks:

Time: 3 hrs. **Maximum Marks – 100**

Internal: 25 Marks Time: 1 .50 minutes

Major Practical			10 Marks
Minor Practical			5 Marks
Spotters (A & B)	$2x2_{1/2}$	=	5 Marks
Record			5 Marks
		Total	25 Marks

External: 75 Marks

Major Practical			20 Marks
Minor Practical			15 Marks
Minor Practical			15 Marks
Spotters	3x5	=	15 Marks
Record			10 Marks
		Total	75 Marks

Theory Components:

The M.Sc. Animal Biotechnology Core, Elective, Supportive and Diploma Theory Examination having the following Marks.

Core, Elective and Diploma Papers : **Maximum Marks – 100**

Internal: 25 Marks

Test - 10 Marks
Assignment - 10 Marks
Seminar - 5 Marks

External: 75 Marks

Part A - 10x1=10 Marks (Question No. 1 to 10)
Answer all questions. All questions carry equal marks.

Part B – 5x5 = 25 Marks (Either or type – Question No. 11 to 15)
Answer all questions. All Question carry equal marks. Each answer should not exceed 2 pages.

Part C – 5x8 = 40 Marks (Either or type – Question No. 16 to 20)
Answer all questions. All Question carry equal marks. Each answer should not exceed 4 pages.

Supportive Papers: **Maximum Marks - 50**

Internal: 12 Marks

Test - 5 Marks
Assignment - 4 Marks
Seminar - 3 Marks

External: 38 Marks

Part A – 5x1=5 Marks (Question No. 1 to 6)
Answer all questions. All questions carry equal marks.

Part B – 3x4 = 12 Marks (Either or type – Question No. 7 to 9)
Answer all questions. All Question carry equal marks. Each answer should not exceed 2 pages.

Part C – 3x7 = 21 Marks (Either or type – Question No. 10 to 12)
Answer all questions. All Question carry equal marks. Each answer should not exceed 4 pages

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CORE PAPER –I **08ZOOB13A**

Biochemistry and Biophysics

The objective of the course is to provide a concise and unifying approach to physical chemistry, biochemistry and biophysics. It also provides the structure, function and interactions of bio molecules, how biological processes occur at the molecular level and to understand these processes with strong backgrounds in chemistry, biology, and physics.

Unit – I

Structure of atom, molecules, ionic bonds, covalent bonds, hydrogen bond, Vander Vaal's forces, Intermolecular forces, electrolytes, pH and buffer capacity in the cell environment.

Unit – II

Amino acids: Structure, classification, properties, isoelectric point and zwitter ions. **Proteins**: Classification based on chemical structure, function and solubility; properties, primary, secondary and tertiary, Helix, principles of isolation and purification, Synthesis of polypeptides.
Enzymes: Classification, Kinetics, Co-factors, Enzyme inhibition, Enzyme substrate compounds.

Unit – III

Nucleic acids: DNA structure and properties, DNA as a genetic material, DNA synthesis – mechanism of replication (semi conservative and reverse transcription), nucleotides. **Different types of RNA**: mRNA and rRNA.
Lipids: Classification, properties – saturated and unsaturated fatty acids – plant waxes, steroids, cholesterol and lecithin.
Carbohydrates: Classification, structure and properties of functional groups.

Unit – IV

Bioenergetics: Laws of thermodynamics, concept of free energy, oxidation reduction (redox) reactions. Energy coupling reactions, energy rich compounds, ATP cycle, standard free energy, membrane potentials, and negative entropy changes in living systems, enzyme catalysis.

Unit – V

Analytical techniques: Principle and application of Chromatography (Paper, thin-layer, column and GLC), Centrifugation (RPM and G, Ultra centrifugation), Spectroscopic techniques (UV, visible spectroscopy, X-ray crystallography, NMR, IR, fluorescence & atomic absorption), Isotopes and their importance (GM counters & Scintillation counting).

Reference Books:

1. Biochemistry, by D.Voet and J.G. Voet, 2004. *John Wiley & Sons*, USA
2. Biochemistry, by R.H. Garrett and C.M. Grisham, (3rd Edition) 2007. *Saunders College Publishers.*
3. Principles of Biochemistry by A.L. Lehninger. 1984. *CBS Publishers and Distributors*, New Delhi.
4. Physical Biochemistry by D. Friefelder, (2nd edition) 1982. *W.H. Freeman & Company*.
5. The Physical Basis of Biochemistry, by Peter R. Bergethon, *Springer-Verlag*, 1998.
6. Biophysics-An Introduction, by C. Sybesma, 1989, *Kluwer Academic Publisher*.
7. Cellular Biophysics I and II, by Thomas F. Weiss, 1995, *MIT Press.*
8. Basic Biophysics for Biology, by E. K. Yeargers, 1992, *CRC press.*
9. Principles of Biochemistry by Albert L. Lehninger (4th edition) 2004. *CBS Publishers & Distributors,* New Delhi.
10. Biochemistry by Lubert stryer (4th edition) 2000. *Freeman International Edition.*
11. Biochemistry by Keshav Trehan, 1990. *Wiley Eastern Publications.*
12. Fundamentals of Biochemistry by J.L.Jain *et. al.* (4th edition) 1994. *S.Chand and Company.*
13. Textbook of Organic Chemistry (A Modern Approach) Ist edition) 2002. *McGraw Hill.*
14. *The Biochemistry* of Nucleic acid – Tenth Edition-Roger L.P.Adams, John T. Knowler and David P.Leader, 1992. *Chapman and Hall Publications.*
15. Essentials of Biophysics by Narayanan, P (2000), New Age Int. Pub. New Delhi.
16. A Text Book of Biophysics by Roy R.N. (1999), *New Central Book Agency*.
17. Biochemistry. S. C. Rastogi, 2nd edition. 2003. *Tata McGraw Hill Publishing Company Ltd.,* N. Delhi.

CORE PAPER –II **08ZOOB13B**

Molecular Cell Biology

Unit – I

Cell organization, Sub-cellular structures of prokaryotic and eukaryotic cells. Synthesis and sorting of plasma membrane. Chromatin structure and nucleosome concept, Organization and function of genetic material, Gene paradox, Repetitive DNA, Satellite DNA, Overlapping genes, Split genes, Pseudogenes. Chromatin, nuclear and mitochondrial genome organization, Structures of DNA and RNA, Stereochemistry of bases and secondary structures. Genetic structure analyses of eukaryotic genomes.

Unit-II

Evidence of basic targets, Enzymes, Mechanisms of DNA replication in eukaryotes. t-RNA, m-RNA, r-RNA and hn-RNA structures and folding, Mechanisms in eukaryotes RNA splicing. Ribosomes, Genetic code, General control of DNA, RNA and protein synthesis, Post-translational modifications, Protein targeting.

Unit-III

Gene regulation in eukaryotes, Gene clustering**,** Mechanism of positive and negative control of gene expression. Translational and transcriptional control of regulatory mechanism of gene expression, Environmental effects on gene regulation.

Unit-IV

Signaling at the cell surface, Types of signaling pathways that control gene activity, Integration of signals and gene controls. Moving proteins into membranes and organelles, Vascular traffic, secretion and endocytosis, Metabolism and movement of lipids.

Unit-V

Regulation of the Eukaryotic cell cycle, Cell birth, Lineage and cell death. Cancer/ oncogenes, Cell markers, Cellular morphology, Primary and established cell lines, Kinetics of cell growth, Genetics of cultured cells. Stem cell culture, embryonic stem cells and their applications. Cell culture based vaccines. Somatic cell genetics.

List of Suggested Reference Books:

1. Cell and Molecular Biology, (8th edn)., De Robertis, E.D.P. and De Robertis, E. M.F. 1995, *B.I.Waverly Pvt. Ltd*., New Delhi.
2. Essential Cell Biology, B. Albert et al., 1998. *Garland Publishing*, Inc. New York.
3. Principles of Cell and Molecular Biology. (2nd edn.)., Kleinsmith, L. J. & Kish, V.M. 1995.
4. Molecular Biology of the Cell. (3rd edn.)., Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. (eds.) 1994. *Garland Publishing*, Inc., New York.
5. Molecular Cell Biology (5^{th} Edn.), H. Lodish et al., 2004. *W.H. Freeman and Company*, New York.
6. Molecular Biology of the gene, J.D. Watson. 1977. (3^{rd} Edn.) *W.A. Benjamin Inc*. London.
7. An Introduction to Genetic Analysis (7^{th} Edn.)., A.J.F. Griffths et al., 2000. *W.H. Freeman & Co.*
8. Principles of Biochemistry, A.L. Lehninger. 1984. *CBS Publishers*, New Delhi.
9. Principles of Genetics (6^{th} Edn.)., R.H. Tamarin, 1996. *McGraw-Hill*, New Delhi.
10. Genes VIII, Lewin, B., 1987. ***Oxford University Press***, Oxford, New York, Tokyo.

CORE PAPER – III **08ZOOB13C**

Microbiology

Unit – I

Introduction to Microbiology – Scope of microbiology – History of microbiology – Classification of bacteria, fungi, yeast and virus. Structure and functions of bacteria and virus. Reproduction in bacteria – Transformation, conjugation, transduction. Mapping in bacterial genomes.

Unit – II

Cultivation and control of microorganism – Methods of collection of sample – methods of estimation of microorganism in soil, water and air – Isolation and identification of bacteria. Methods of sterilization and disinfection – Microbial control – Physical and chemical – techniques of pure culture – Method of cultivation of bacteria – Phases of growth – Influence of environment on bacteria – Nutritional requirements of heterotrophic bacteria.

Unit – III

Microbial Ecology: Distribution of microorganism in soil, water and air – Environmental factors influencing the distribution of microorganism – Role of microorganisms in the cycling of nutrients – Carbon, nitrogen, phosphorous and sulphur cycle – Bacterial photosynthesis – Microbial interactions – synergism, symbiosis, commensalism and parasitism.

Unit – IV

Food Microbiology: Sources, types incidence of microorganism in vegetables, meats, poultry, seafood, milk and diary products – spoilage of food, fruits, vegetables, cereals, meat, poultry egg, seafood, caned products – Factors influencing spoilage – Methods of detection of spoilage, physical, chemical, bioassay – principles of food preservation and prevention of food spoilage – Food poisoning organism.

Unit – V

Microbial Technology: Genetic engineering of food and additives – Single Cell Protein (SCP) production – Production of organic acids (acetic acid), ethanol – Antibiotics – Microbial toxins – bacterial – Vitamins – methanogenesis – hydrogen oxidizing bacteria – Fermentation products – Degradation of protein, cellulose, pectin and chitin – Oil degrading bacteria.

References:

1. Burden, K.L. and R.P. Williams (6th Ed.) 1968. Microbiology. The *Macmillan Co*., London P. 818.
2. Dawes, E.A. (Ed.) 1986. Energy conservation in bacterial photosynthesis. *In:* Microbial energetics. *Blackie & Son Ltd*., Glasgon, 133-144pp.
3. Doelle, H.W. (Ed.) 1969. Fermentation acetic acid bacteria and lactic acid bacteria. In: Bacterial metabolism. *Academic Press*. New York, London. 256 – 351 pp.
4. Hay, J.M. (Ed.) 1986. Modern Food Microbiology. *CBS publishers*, Delhi. 622 pp.
5. Reed, G. (4th Ed.) 1983. Prescott & Dunn's Industrial Microbiology. AVI Publishing Co., Inc. Connecticut, 883. pp.
6. Roberts, T.A. and F.A. Skinner (Eds.) 1983. Food Microbiology: Advances and Prospects, *Academic Press*, Inc. London, 393 pp.
7. Selle, A.J. (Ed.) 1967. Fundamental Principles of Bacteriology. *Tata McGra – Hill Publishing Company Ltd*., New Delhi, 822 pp.

CORE PAPER – IV **08ZOOB13D**

Practical: (Biochemistry and Biophysics, Cell and Molecular Biology and Microbiology)

Biochemistry and Biophysics:

1. pH: Structure and operation of pH meter
2. To measure the pH of human blood.
3. Preparation of buffers: Phosphate buffer and citrate buffer.
4. Chromatographic techniques:
   a. Paper chromatographic techniques to separate amino acids.
   b. Thin layer chromatographic technique to separate lipids.
   c. Column chromatographic techniques to separate urinary pigments.
5. Colorimetric/Spectrophotometric estimation of the following biomolecules.
   a. Total free amino acids (Ninhydrin reagent method)
   b. Protein (Biuret and Lowry *et al*., 1951 method)
   c. Total soluble carbohydrates (Anthrone reagent method)
   d. Total cholesterol (Zlatkis *et. al.* method)
6. Electrophoresis (PAGE) – Demonstration.

Cell and Molecular Biology:

1. Principles of microscopy and optics*.
2. Cell size determination
3. Microtomy and photography*.
4. Mounting of polytene chromosomes.
5. Preparation of mitosis in Onion root tip.
6. Cell division in Grasshopper testis*.
7. Preparation of animal tissue culture medium using membrane filtration*.
8. Cell counting and cell viability using trypan blue dye exclusion assay
9. SDS - PAGE of protein from animals*.

* Practical by demonstration only.

Microbiology:

1. Preparation and requirements of microbiology laboratory.
2. Microscopy the operational uses of light microscope, preparation, use and care.
3. Preparation of Non-selective selective culture media.
4. Estimation of bacterial from soil and water using plate count or serial dilution.
5. Isolation of bacteria.
6. Observation of morphological characters of bacterial and protozoan temporary wet mount technique.
7. Staining methods: Preparation of smears for staining, simple staining, negative staining, gram staining.
8. Control of microorganism – physical methods (moist and dry heat) – mechanical removal methods (sterilization and filtration).

ELECTIVE PAPER – I **08ZOOA1EA**

An Introduction to Human Cytogenetics

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

a) **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. Study guide for Cumming's human heredity principles and issues by Shontz, Nancy N. ; Cummings, Michael R. (3rd Edition), 2000. *Pacific Grove, CA : Brooks/Cole Thomson Learning*
2. Genetics Medicine (1994) - by Karl. H. Muench. *Elsevier pb*. London
3. Human Genetics by Elof Axel Carlson, 1984. *Tata McGraw-Hill pb*. New Delhi.

SUPPORTIVE PAPER – I **08ZOO1GS**

Entomobiotechnology

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, 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.

DIPLOMA PAPER - I **08ZOOA1LA**

Evolution and Biogeography

Unit – I:

Geological time scales, fossils and fossilization, fossil histories of Invertebrates and Vertebrates, origin of protozoa, metazoa, bilateria, metamerism, symmetry, skeleton and coelom.

Unit – II:

Origin of life; theories of evolution; Neo-Lamarckism; Neo-Darwinism, micro, macro and mega evolution; morphological, taxonomical rates of evolution.

Unit – III:

Zoogeographical animal distribution, barriers, significance of island fauna, isolation and isolating mechanisms – race formation; selection natural, artificial and sexual.

Unit – IV:

Trends in Evolution channelisation of selection – mechanism of evolution. Adaptations and Co-adaptations; adaptive radiations and non-adaptive characters in biology.

Unit – V:

Genetic variations - classification and origin; genetic drift mutation; Genetic assimilation and homeostasis; non-genetic variation – age, seasonal, cast density, dependent, ecological polymorphism, mimicry and animal colorations.

Recommended Readings:

1. Glaessner, M.F: Pre Cambrian fossils, 1965. *Biol. Rev.* 37: 467-494.
2. Stahl, V: Vertebrate History: Problems in Evolution, 1985. ***McGraw - Hill***, New Delhi.
3. Stokes, W.L: Essentials of Earth History: An Introduction to Historical Geology, 1960. *Prentice Hall* Ltd.
4. Colbert, E.H: Evolution of Vertebrates, 1970. *John Willey and Sons*, Inc. New York.
5. Levtrup: Phylogeny of Vertebrate, 1984. *John Willey and Sons*, Inc. New York.
6. Smith: Evolution of Vertebrate structure, 1953. *John Willey and Sons*, Inc. New York.
7. Carter, G.S: Animal Evolution, 1951. *Sedgwick and Jackson*, London, England
8. Mayer, S: Systematic and origin of species, 1942. *University Press*, Columbia.
9. Sobrig and Sobrig: Population Biology and Evolution, 1981. *Addison Wiley.*

CORE PAPER –V **08ZOOB23A**

Proteomics

Unit –I

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 –II

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 –III

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

Unit –IV

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 –V

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:

Protein biochemistry and proteomics by Hubert Rehm. Academic Press, Elsevier. USA, 2006.
Proteomics today by Mahmoud Hamdan and Pier Giorgio Righetti. John Wiley & Sons, New Jersey, USA, 2005.
Introduction to proteomics by Daniel C. Liebler. Humana Press, Totowas, NJ, USA, 2002.

CORE PAPER –VI **08ZOOB23B**

Receptor Biology

Receptors are nature's transducers—they detect circulating hormones or substances released by nerve activity and elicit a biological response. Receptors serve fundamental roles in recognition and communication; they pervade endocrinology, enzymology and sensory physiology. Thus they provide the basic mechanism by which living things gain information about their environment and integrate the functioning of their own systems.

Unit –I

Introduction to receptor – Regulation of receptors - application of receptors in biology- Examples of receptors, Autocrine, Paracrine and Endocrine models - Action- Characterization of receptors.

Unit –II

Signal transduction mechanisms for plasma – membrane receptors- Introduction – classification – Adenylyl cyclase and cyclic AMP- Guanylyl cyclase and cyclic GMP- Ion channels controlled by G proteins - Calcium as a second messenger.

Unit -III

Receptors for Immunoglobulin- Introduction - Receptors for Immunoglobulin IgE - Nature of the IgE receptor – Function of the IgE receptor.

Unit –IV

Hormone receptors – Introduction – Mechanism of hormone action -Thyroid hormone receptors- Events elicited by hormone – receptor binding.

Unit -V

Vertebrate visual photoreceptors - Rhodopsin – Photo transduction - Nicotinic acetylcholine receptor - Structure and function - Receptor phosphorylation - Steroid receptors and membrane receptors.

Books Recommended

1. Fundamentals of Receptor Molecular Biology By Donald Francis Hoelzl Wallach.
2. Molecular Biology of the Cell (4th Ed.), Albert *et al.:* Garland Publishing Inc., 2002
3. Molecular Cell Biology (5th Ed.), Lodish *et al*.: Freeman and Company, 2004
4. Biochemistry (5th Ed.), Berg *et al.:* Freeman and Company, 2002
5. Harper's Biochemistry (26th Ed.), Murray *et al.* Appleton & Lange, 2003.
6. Molecular Biology of Receptors: Techniques and Applications of Receptor Research by A.D. Strosberg
7. The Receptors by P. Michael Conn, Volume 1 Academic press, Inc.,
8. Molecular Cell Biology by Darnell J., Lodish H., Baltimore D., Freeman W.H., 1990.
9. Cell Biology by Kimball T.W., Wesley Publishers, 1989.

CORE PAPER –VII **08ZOOB23C**

Stem Cell Technology

Unit-I

Stem cell concept – Properties of stem cell – Types of stem cell embryonic stem cell – Adult stem cells – Problem of differentiation.

Unit-II

Differentiation status of cells – Primordial germ cell -Skin cell - Gastrointestinal cells – Embryonic stem cell differentiation as a model to study haematopoetic and endothelial cell development.

Unit-III

Stem cell location and Classification – Neural stem cells – Stem cell niches – Germ line Epithelial and Epidermal and neural niches.

Unit-IV

Uses of Stem cells - Human stem cells – Renewal of stem cells- Stem cells and Tissue engineering –Embryonic stem cells and Gene therapy - Therapeutic cloning.

Unit-V

Single-Cell PCR methods for studying stem cells – Ethical and Social consideration of Stem cell research

REFERENCE BOOKS

1. **Embryonic Stem Cells** Method and Protocols Edited by **Kursad Turksen,** Humana press, 2002**.**
2. **Stem Cell Century**, Law and Policy for a Breakthrough Technology **Russell Korobkin** and **Stephen R. Munzer,** Yale University Press (2007).
3. **Essential of Stem cell Biology, Robert Lanza** (Eds.) **Elsevier press**, (2005).
4. **Hand Book of Stem Cells** Volume 1&2, **Robert Lanza** (Eds.), **Elsevier press**,(2004).
5. **Stem Cells and the Future of Regenerative Medicine** by Committee on the Biological and Biomedical Application of Stem Cell Research, (2004).
6. **Stem cells**, scientific progress and Future Research Direction by National Institutes of Health, (2000).

CORE PAPER –VIII **08ZOOB23D**

Practical: (Proteomics, Receptor Biology and Stem Cell Technology)

Proteomics:

1. Protein extraction and digestion from biological samples.
2. Liquid chromatography.
3. SDS-PAGE and silver staining of gels.
4. Blotting procedures.
5. 2D SDS-PAGE
6. Spot matching in 2D gels using software.
7. Protein analysis by HPLC.
8. Protein modification and analysis.

Receptor Biology:

1. Mouse Leptin Receptor assay by ELISA
2. Progesterone receptor assay
3. Estrogen receptor assay

Stem Cell Technology:

1. Preparation and requirements of Stem cell Technology laboratory.
2. Culture of stem cell – Differentiation experiments.
3. Techniques on protein – Nucleic acid interaction : Gel retardation assay, DNAase foot printing modification production ,Modification interference – Demonstration
4. Single cell PCR methods for studying Stem cells –Demonstration

ELECTIVE PAPER –II **08ZOOB2EA**

Molecular Entomology

UNIT – I

Genetic engineering with baculo-viruses *Bacillus thuringiensis* and entomopathogenic fungi. Recombinant DNA technology and pest control - cloning of *B.t.* into other organisms.

UNIT – II

Transgenic plants for pest resistance - *B.t.* toxin gene - Trypsin inhibitor and other genes, peptides and nueropeptides in pest management - Resistant management strategies in transgenic crops.

UNIT - III

Molecular genetics of insect behavior: Insect central nervous system - Analysis of behavior by traditional methods and molecular methods - Role of genetics in vector control

UNIT - IV

Role of biotechnology in pest management - Biological control and biotechnology - genetic improvement of natural enemies - Mass production techniques - *in vitro* production of entomopathogens in cell lines.

UNIT - V

Mosquito vector biology – Genome of malarial, filarial and dengue/chikungunya parasites - Transgenic mosquitoes – SIT (sterile insect technique).

REFERENCE:

1. Comprehensive molecular insect science by Gilberts, L. I., Iatrou, Gill.
2. Insect molecular genetics by David Haymer.
3. Dimensions of molecular entomology by T. N. Anandha Krishnan.
4. Molecular biology of Insect Disease Vectors by Canpton.
5. Insect molecular genetics by Maregoies Hoy.
6. Insect molecular biology by Inada, M., Field and David, A.O. Brochta.

SUPPORTIVE PAPER –II **8ZOO2GS**

Crustacean Aquaculture and Technology

Learning objectives:

- To develop skills and acquire knowledge to be able to understand different aquaculture systems consisting of common and high demanded crustacean species and their culturing techniques, the relationship between successful aquaculture and environmental stewardship.
- To provide an opportunity for underpinning of sustainability (the environment, culture ability and economic viability of culture operations).
- Specifically, this paper will help to learn how aquaculture supports production of representative species on socio-economic perspectives, conservation, and for various other purposes.
- To learn about the interrelationship between culture operations and the natural environment, specifics on culture of selected species.

Unit-I

Importance of fisheries and aquaculture - Current issues regarding sustainability of aquaculture - Ecological and social aspects of aquaculture development - Nutritional value of crustaceans as food.

Unit-II

Taxonomy of crustaceans – Live feeds (Algae and algal culture, Micro-invertebrate culture (Rotifers, *Artemia*, Copepod etc.) - Artificial feeds - Aquaculture and Techniques (semi-intensive, intensive, hyper-intensive).

Unit-III

Brooding (selective breeding, “specific pathogen free”) - The hatchery technology and prawn seed production.

Unit-IV

Culture and Grow-out technology for commercially important crustaceans: freshwater prawns, marine shrimps, freshwater crayfish, lobsters, and crabs.

Unit-V

Nutritional requirement and feeding strategies - Water quality management and maintenance of sanitation - Pathology and quarantine - Post-harvest handling and marketing.

List of Suggested Reference Books:

1. Palaemonid Prawns, K.V. Jayachanadran, 2001, *Science Publishers, Inc*., USA, UK.

2. A Text Book of Fish, Fisheries and Technology, K.P. Biswas. M.Sc., Ph.D. F.Sc. (Bombay) E.F. (West Germany), 1992 published by *Smt. Manju Biswas*, Neral Main Road Goria, Calcutta.

3. Fish & Fisheries of India, V.G. Jhingran, Director, Central Inland Fisheries Research - institute, Barrackpore (W.B.), 1982 published by *Hindustan Publishing Corporation* (India) 6 UB, Jawahar Nagar, Delhi.

4. Biotechnology and Genetics in Fisheries and Aquaculture by A.R. Beaumont and K. Hoare, Blackwell Science (2003).

5. Production of Meal, Oil and Protein-Vitamin Preparation in Fishing Industries, Kuli Kev, *Oxford & IBH*. (2000)

6. Prawn Culture by C.V. Kurian and M.J. Sebastian, 1976.

7. Limnological Methods by Adoni *et. al.,* 1985. *McGraw Hill Book Co.,. Inc, New York.*

8. Freshwater Aquaculture in India – Srivastava *et. al*., 1993. *Oxford and IBH Publishing, New Delhi.*

9. A Manual of Freshwater Aquaculture - Santhanam *et. al.*, 1996.

10. Marine Fishes in India - D. V. Bal & K. Birabhadra Rao, 1968. Tata McGraw Hill Publishing Company Ltd. New Delhi.

11. The Marine and Freshwater Plankton - Charles, C. David, 2001. *Michigan State University Press.*

DIPLOMA PAPER – II **08ZOOB2LA**

Wildlife Biology and Conservation

Unit – I

Biogeography of India and patterns and distribution of ecosystems, ecological succession, biotic and abiotic factors of an ecosystem with special reference to tropical rain forests. Taxonomy of common Indian wild animals of reptilia, aves and mammalia. Geography of India and the pattern of distribution of fauna and flora.

Unit – II

Natural history of wild life; population patterns, habits, habitats, habitat selection, resting behaviour; nutritional and reproductive strategies of common wild animals such as the calotes, poisonous and non-poisonous land and water snakes; crocodiles, birds of prey and other insectivorous, frugivorous, nectivorous and seed feeding birds, wild mammals of the Indian region.

Unit – III

Social behaviour such as aggregation, sexual behaviour, migration and territorial behaviour in birds and mammals; means of dispersal and barriers of dispersal, group size and spacing carrying capacity.

Unit – IV

Wildlife conservation: Extermination and extinction, endangered species; effects of environmental degradation on wildlife and its conservation; administrative regulations, laws and their applications in Zoological parks, wild life sanctuaries and Biosphere reserves.

Unit – V

Wild life management; Tropic structure of wildlife, common diseases of wildlife; Wild life sanitation, management of wildlife, Zoo planning and management and tourism development in wild life sanctuaries.

Recommended Readings:

Dasmann, R.F. 1982. : **WildLife Biology,** Wiley eastern Ltd. New Delhi.
Krishnan, M: **India's WildLife,** 1972. *Bombay Natural His. Soc.*
Mani, M.S. : **Ecology and Biogeography of India,** 1974. *Junk. Publ.* The Hague.
Giler, R.F. : **WildLife Management and Techniques**, 1971. *WildLife Soc*.
Stracey, P.D. : **WildLife in India – Conservation and Control,** 1963. Ministry of Agriculture Govt. India.
Hind, R.A.: **Animal Behaviour,** *1966*. McGraw Hill, New York.
Stillwell, F.: **The wards of WildLife,** 2004. *W.W.F*.
Seber, G.A.F.: **The estimation of animal abundance and related parameters, 1973**. *Chapman and Hall.*
Gee, E.P. : **The WildLife of India,** 1964. *Colling London.*
Puri, G.S.: **Indian Forestry Ecology**, 1984. *Oxford Book House*. Calcutta.
Leopold, A. : **Game Management,** 1933. *Charles Scribers Press*, New York.
Keith, Lloyd, B.: **Wildlife's ten years cycle,** 1979. *Univ. of Wisconsin Press*, Madison.
David, L. : **The natural regulation of animal numbers,** 1979. Oxford, *Clarendon Press.*
Leopold, A.: **A Sand country Almanac, 1987**. *Oxford University Press*, N.Y.

CORE PAPER - IX **08ZOOB33A**

Nanobiotechnology

Unit- I

Introduction to Nanobiotechnology - Biominaralised inorganic Nanomaterial- Biocompatible devices - Implant coating – stents and seeds –Structure and process of biomolecules for functional materials- Bioelectronics in Medical applications.

Unit- II

Introduction to protein based Nano structure- Protein pattering and application in bio materials and Bio devices DNA based Nano structures - fabrication properties and application.

Unit- III

Nanoanalysis - Nano particle molecular labels - Polymers nanofibres and their applications in bioengineering – Functional polymers for bone tissue engineering applications-Applications of nanotechnology in tissue engineering

Unit- IV

Microfluidics - Devices and their importance for Nanobiotechnology- Advantages of Microfluidics Devices – Concepts for Microfluidics Devices - Materials for Microfluidics components – Fluidic Structures.

Unit- V

Bio medical applications - Bio active Nano material in bone crafting and tissue engineering – Inorganic / polymers Nanocomposites for dental restoration and bone replacement application- Biosensors – Drug delivery –Neuro electronic interfaces – Protein engineering – Nanoluminescent tags.

REFERENCES

1. **K.K.JAIN 2006**, **Nanobiotechnology in Molecular Diagnostics**: Current Techniques and Applications Horizon Biosciences.
2. **MARK RATNER and DANIEL RATNER** 2005**,** Nanobiotechnology a Gentle Introduction to the Next Big Idea, Pearson Education.
3. **CHALLA S.S.R. KUMAR (Ed). 2006.** Biological pharmaceutical Nanomaterial. Wiley-VCH Verlag Gmbh & Co, KgaA.
4. **NIEMEYER, C.M., MIRKIN, C.A. (Eds.).2004.** Nanobiotechnology Concepts, Applications and Perspectives, Wiley-VCH, Weinheim.

CORE PAPER - X **08ZOOB33B**

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 and 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.

REFERENCE:

1. Immunology, S.K. Gupta (1999). *Narosa Publishing House*, New Delhi.
2. Essential Immunology (8th Edition), Ivan Roitt, 1994. *Blackwell Scientific Publication*. Immunology W.H. Freemen and Company.
3. Abdul .K. Abbas. Andrew .K. Litchmen and Jordan, 1997, Cellular and Molecular Immunology, 3rd Edn. *W.B. Saunder Company*.
4. Weir, D.M. and Stewart, J., 1997, Immunology, 8th Edn., *Churchill Livingston*, New York.
5. Eryl Liddell and Ian Weeks., 1995, Antibody Technology, *BIOS Scientific Publishers*.
6. Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts and James D. Watson.(Eds.), 1994, Molecular Biology of the cell, 3rd Edn., *Garland Publishing Inc*., New York.
7. Immunology, George Pinchuk (2004). *Tata McGraw-Hill Publishing Company Limited*, New Delhi.

CORE PAPER - XI **08ZOOB33C**

Genetic Engineering

Unit-I

Outline process of genetic engineering and recombinant DNA technology, Isolation of genes, Concept of restriction and modification - Restriction endonucleases, DNA modifying enzymes, Ligases. Host-vector system - Cloning vectors for *E. coli*., Cloning vectors for Eukaryotes. Different Kinds of Vectors - Plasmids, Phage vectors, Cosmids, Phagemids, Virus vectors, Shuttle vectors and expression vectors.

Unit-II

Isolation and purification of DNA from animal cells, DNA sequencing and sequence analysis, Synthesis of gene, DNA finger printing, Different strategies of cloning**,** Direct and vector mediated gene transfer, Ligation strategies, Genomic libraries, cDNA libraries, Gene tagging, Expression of cloned genes, Isolation and purification of the expressed product. Site-directed mutagenesis. PCR technology, its principles and application. Molecular marker technology, Promoters and Operon systems. DNA forensics, DNA finger printing and paternity decisions.

Unit-III

Micro manipulation and cloning, Somatic cell cloning, Identification and isolation of genes of economic importance, Gene mapping, Transgenesis for animal improvement and production of animals as bioreactors for proteins of pharmaceuticals value, Gene transfer in fish, Expression of animal genes in bacteria, Biohazards and safeguards of genetic engineering.

Unit-IV

Conventional methods of animal improvement, predominantly selective breeding and cross-breeding. Embryo biotechniques for augmentation of reproductive efficiency and faster multiplication of superior germ plasm. Super ovulation. Oestrus synchronization. Embryo collection, evaluation and transfer. *In vitro* maturation of oocytes. *In vitro* fertilization and embryo culture. Embryo preservation, Embryo sexing.

Unit-V

Genetic diversity, Molecular taxonomy, Species and population biodiversity, Biodiversity and centers of origins of animals, Conservation of animal genetic resources, Morphological and molecular characterization of biodiversity. Bio-safety in relation to transgenic research and applications.

List of Suggested Reference Books:

1. Genetics (3rd Edition), Strickberger, M.W. 1996, *Printice Hall*, India Ltd., New Delhi.
2. Molecular Biology of the Cell (3rd Edition), Alberts, B. et. al., 1994, *Garland Publishing Inc*., New York.
3. Genes VIII. Levine, B., 2004, *Oxford University Press.*
4. Genetics: Analysis of Genes and Genomes (5th Edn.), Hartl, D.L. & Jones, E.W., 2001, *Jones and Bartlett Publishers*, Sadbury, Massachusetts.
5. Gene Cloning and DNA Analysis, (5th Edn.)., T.A. Brown, 2001, *Blackwell Science Ltd.*,
6. Genetics. The Continuity of Life, D.J. Fairbanks & W.R. Andersen, 1999. *Books/ Cole Pub. Company*.
7. An Introduction to Genetic Analysis (7th Edn.)., A.J.F. Griffths et al., 2000. *W.H. Freeman & Co.*
8. Principles of Genetics (6th Edn.)., R.H. Tamarin, 1996. *WCB/ McGraw-Hill*, New Delhi.
9. Genetic Engineering, Boyer.H.W and Nicosia. S. 1978. *Elsevier/North Holl and Biomedical Press*, Amsterdam
10. Genetics of Industrial Microorganism, Seberk, O.K and Laskin, A.I., 1979. *American Society of Microbiology*, Washington.
11. Principles of gene manipulation, 3rd Edn., Old & Primrose, 1989, *Publishers Business Service.*
12. Recombinant DNA Technology, (2nd Edn.), J.D. Watson, M. Gilman, J. Witkowski & M. Zoller, 1992. *Scientific Americans Books*, New York.
13. Molecular Biotechnology, S. Maulik and S.D. Patel, 1997, *Wiley. Liss*
14. r - DNA technology and Biotechnology, K. Kreuzer & A. Massey, 1996, *ASM Press*, Washington. D.C
15. Dealing with genes, D. Berg & M. Singer, 1992, *Blackwell Scientific Publication.*
16. Molecular Biotechnology, B.R. Glick & J.J.Pasternak, 1994, *ASM Press*, Washington
17. Techniques for Engineering Genes, Butterworth. Heinemann, 1993, Open Universities Nederland.
18. Methods in Gene Biotechnology, W. Wu, M.J. Welsh, P.B. Kaufman & H.H. Zhang, 1997, *CRC Press*, New York.

CORE PAPER - XII **08ZOOB33D**

Practical: (Nanobiotechnology, Immunotechnology and Genetic Engineering)

Nanobiotechnology

1. Protein Micro array –Demonstration
2. Quantum dots-Demonstration
3. DNA micro array- Demonstration.
4. Materials for the manufacture of Micro fluidics components-silicon-glass- polymers-Fluidic structure and fabrication methods –Demonstration.

Immunotechnology

1. Media preparation and animal cell culture.
2. Primary cell culture establishment from tissue.
3. Antibody development and purification.
4. ELISA
5. Western Blot.
6. Immunofluorescence.
7. RIA
8. Mounting of Spleen and Bone Marrow Cells
9. Lymphoid organs in Rat.
10. Differential counting of human WBC
11. Demonstration of Antigen – Antibody by interfacial ring test / blood grouping culture.

Genetic Engineering

1. Preparation of plasmid DNA and genomic DNA from *E.coli.*
2. Preparation of genomic DNA from animals/ human.
3. Agarose gel electrophoresis of plasmid and genomic DNA.
4. Restriction mapping of plasmid DNA.
5. PCR amplification, RFLP*.
6. Vector preparations*.
7. Insert preparations*.
8. Ligation*.
9. Transformation of *E. coli* with plasmid DNA using $CaCl_2$ *.
10. Isolation of the recombinant plasmid*.
11. Preparation of cDNA using RT-PCR*.

* Practical by demonstration only.

ELECTIVE PAPER - III **O8ZOOB3EA**

Ecobiotechnology

This course provides the application of biotechnology to solve environmental problems like pesticides, metals, industrial effluents, solid waste, acid rain, global warming, ground water contamination etc., by environmental quality evaluation, monitoring, and remediation of contaminated environments. This course also provides detailed knowledge of environmental biology and pollution.

Unit – 1

Introduction: Ecology and Ecosystem, Environmental bcotechnology, Scope and importance, Current status, Future. **Environmental pollution**: Origin, Types, Air, Water, Soil, Noise and Thermal, their sources and effects.

Unit – 11

Sewage and waste water treatment: Introduction, Aerobic and anaerobic treatment, Conventional and advanced treatment technology, Use of microorganisms, Bioreactors, Use of immobilized enzymes.

Unit – III

Solid waste management: Introduction, Impact on global climate change, E-waste, Landfills, Composting, Earthworm treatment.

Unit – IV

Hazardous waste management: Introduction, Xenobiotics compounds, Hazardous waste, Biodegradation of xenobiotics compounds, Organisms involved in degradation of xenobiotics.

Unit – V

Novel methods for pollution control: Introduction, Vermitechnology, Application of environmental genetics and Aiming for biodegradable and eco-friendly products.

Text Books:

1. Fundamentals of Ecology by Eugene P. Odum, 1972, *W.B. Saunders Company*, London
2. Environmental Pollution by Hodges, L., 1977. *Holt, Reinhart Publishers*, USA. Environmental Pollution and Control by Jeffrey Peirce, J., Aarne Vesilind, P. and Ruth Weiner, 1997, *Elsevier*, The Netherlands.
3. APHA Standard Methods for the Examination of Water and Waste Water, 14th Education, 1985. American Public Health Association., Washington, USA.
4. Environmental Biotechnology by C. F. Forster and D. A. J. Wase, 1987. *Ellis Horwood Limited*, England
5. Environmental Microbiology by W.D. Grant and P.E. Long, 1985. *Blakie Glasgow*, London.
6. Industrial Microbiology by Casida, 1994, *Wiley Eastern Publishers.*
7. Microbial Gene Technology by H. Polasa, 1991. *South Asian Publishers*, New Delhi.

SUPPORTIVE PAPER –III **8ZOO3GS**

Marine Biotechnology

Unit-I

Basics of Aquaculture: Introduction to Biotechnology scope and its utility in Aquaculture - Indian and World Aquaculture-Role, Status and Importance of Aquaculture, Marine ornamental fishes of India.

Unit –II

Molecular Aspects of Growth and Reproduction in Aquatic Organisms: Gene sequence analysis and functions of Moult Inhibiting Hormone –Vitellogenesis Inhibiting Hormone - Mandibular Organ Inhibiting Hormone – Gonadotrophic Hormone I & II – Induced spawning – Ovaprim – Applications. GH Transgenic Fish - Embryonic Stem Cell Technology –Morpholino based gene knock down technology – Homologous Recombination and chimera formation – Nuclear Transfer Technology- Fish genetics and Bioinformatics

Unit-III

Marine Biodiversity: Marine Biodiversity - Defining and Measuring diversity, molecular methodologies - Maintenance of biodiversity and Conservation -Application-Marine food web dynamics - Primary, secondary and tertiary Production.

Unit – IV

Principles of Oceanography: Living resources of Indian sea - Application of ocean remote sensing, salinity and density-Horizontal, Vertical and temporal variations - Winds and general oceanic circulation - Marine food analysis - Spilage, quality control, ISO standard keeping export in consideration –Biodegradation.

Unit-V

Marine Biotechnology and its Potential: Probiotics bacteria and their importance in aquaculture – PCR and other techniques for identification of bacterial and viral pathogen in aquaculture- Vaccines for aquaculture – Marine virology - Cryopreservation technique-application of cryopreservation in aquaculture - Applied genetics of cultivated fishes – Commercial enzymes from marine microorganism – Marine organism as a source of polysaccharides - Marine food.

REFERENCES

1. Biological Oceanography, (1999) Lalli, C.M.
2. Textbook of Marine Ecology (1989) Nair, N.B and Thampis
3. An Introduction to Marine Sciences (1988). Medius, P.S & Campell, J. J.
4. General Oceanography- An introduction (1980) Sielder, G.
5. Drugs from Sea (2000). Fusetani, N.
6. Recent Advances in Marine Biotechnology.Vol.2 (1998) Nagabhushan.R
7. Biotechnology and Biodegradation (1990), D. Chakaraborthy.
8. Chemical Oceanography (1992). Millero & Saha, M.C.
9. Methods of Seawater Analysis (1995) . Grasshoff.K., Erhardt & Kremling

DIPLOMA PAPER – III **08ZOOB3LA**

Animal Biodiversity

UNIT I - BIODIVERSITY; SPECIES CONCEPTS; ANIMAL DIVERSITY

What is Biodiversity? - Components of Biodiversity (Ecosystem, Genetic and Species diversity) - Assigning values to biodiversity - Species concepts - **Animal diversity**: (Distribution, inventory, species richness) - Biodiversity Hotspots (Western Ghats, Indo-Burma region).

UNIT II - LOSS OF ANIMAL DIVERSITY, STATUS OF SPECIES

Extinctions: Past rates of Extinctions - Concepts of Island biogeography and extinction rates on Islands - Human induced, Modern and local extinctions - Population reduction-threats to wildlife (examples)- Habitat loss, degradation and fragmentation. Threats to animal diversity in India - **Status of species**: Rare, endemic and threatened species - Measuring status of species in the wild - IUCN Red list (Assessments and methodologies) - Status of Indian animals.

UNIT III - CONSERVATION: TOOLS IN ANIMAL CONSERVATION

What is conservation biology? - *In situ* and Ex *situ* conservation of Indian animals (Case studies) - Population management -Project Tiger and Elephant - Captive breeding programme - peoples participation in conservation - Successes and failures of conservation actions in India (Case study) -**Tools in Conservation**: Interpretation of various data on wildlife - GIS - remote sensing - Landscape model – PVA and CAMP processes.

UNIT IV - ANIMAL LAWS AND POLICIES IN INDIA; ECONOMICS OF BIODIVERSITY CONSERVATION

Wildlife (Protection) Act of India (1972) - Protected Area network - forest policy - Prevention of cruelty to Animal Act - Convention on Biological diversity, International Trade in endangered species - Zoo policy- Laws and their applications in Zoological parks, wildlife sanctuaries and biosphere reserves - Economics of biodiversity conservation.

UNIT V - CONSERVATION EDUCATION AND AWARENESS

Wildlife / Animal magazines, Journals- How to write popular and Scientific articles - Magazine and Journal information - Wildlife, nature, environment games (examples) – Role of NGO's and Government organizations in wildlife conservation - Wildlife celebration days in India - Biotechnology in conservation.

Selected 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.

DIPLOMA PAPER - IV **08ZOOB3LB**

Practical: (Evolution and Biogeography, Wildlife Biology and Conservation and Animal Biodiversity)

I. Evolution and Biogeography:

Fossils Characteristics and identification:

1. Coelenterate – Coral (Carboniferous)
2. Arthropoda – Trilobite (Silurian)
3. Mollusca – Lamellibranch (Recent)
4. Mollusca – Gastropod (Tertiary)
5. Mollusca – Ammonite (Jurassic)
6. Echinodermata – Crinoid (Carboniferous)
7. Echinodermata – Echinoid (Jurassic)
8. Vertebrata – Shark's tooth (Miocene)

Fossil specimens:

Fish vertebra, dextral snail, sea urchin fossil brachiopods fossil, animal tooth fossil, fossil of fish, fossil cast of archaeopteryx lithographica, fossil cast of trilobite and fossil of pecton.

II. Wildlife Biology and Conservation & Animal Biodiversity:

1. Inventories/Surveys.
2. Field Techniques.
3. Identification and use of keys – Reference specimen.
4. Collection and preservation.
5. Introduction to computerized techniques – Remote sensing CAMP and GIS and their modules for conservation.
6. IUCN Red List Exercise and PVA modeling.
7. Statistical analysis/interpretation.
8. Technical writing and reporting of field studies.
9. Public presentation.
10. Field Project/ Report – Visit to Zoological parks, wildlife sanctuaries and biosphere reserves.