

**MANONMANIAM SUNDARANAR UNIVERSITY  
TIRUNELVELI**

**PG - COURSES – AFFILIATED COLLEGES**

Course Structure for M.Sc. Zoology

( Choice Based Credit System)

( with effect from the academic year 2016- 2017 onwards )

(44<sup>th</sup> SCAA meeting held on 30.05.2016)

Sem	Sub 'Pr. No.	Subject status	Subject Title	Hrs/ week	Cre - dits	Marks				
						Maximum			Passing minimum	
						Int.	Ext	Tot.	Ext.	Tot
III	12	Core – 7	Animal physiology	6	5	25	75	100	38	50
	13	Core – 8	Biostatistics and bioinformatics	6	5	25	75	100	38	50
	14	Core – 9	Aquaculture	6	5	25	75	100	38	50
	15	Elective	a. Research methodology (or) b.Bioinstrumentation	6	5	25	75	100	38	50
	16	Practical – III	Animal physiology, Biostatistics and bioinformatics, Aquaculture	6	--	-	-	-	-	-
IV	17	Core – 10	Biotechnology	6	4	25	75	100	38	50
	18	Core – 11	Genetics	6	4	25	75	100	38	50
	19	Core - 12	Immunology	6	4	25	75	100	38	50
	20	Practical – III	Core Practical – 7,8 & 9	--	4	50	50	100	25	50
	21	Practical -- IV	Core Practical – 10,11& 12	6	4	50	50	100	25	50
	22	Project		6	5	20	50	100	25	50

### Animal Physiology

- Unit I : Nutrition and Digestion :** Importants of Carbohydrates, Protein, Lipids. Vitamins and Minerals with regard to human health. Balanced diet, Malnutrition and BMR. Human digestive tract and functions. Role of enzymes in digestion of carbohydrates, proteins and lipids. Gastrointestinal hormones .Intestinal villi and absorption.
- Unit II : Blood and Circulation :** Structure of arteries and Veins. Blood Corpuscles. Haemopoiesis and formed elements. Plasma functions. Blood volume regulation. Blood groups Coagulation of blood. Structure and function of the human heart. Structure function of coronary arteries and vein. ECG, Cardiac cycle, Heart rate, Blood pressure. Neural and chemical regulation of heart.
- Unit III : Respiration and Excretion :** Respiration in air and water. Structure and function of human lung and the respiratory tract. Respiratory pigments. Gas transport between the lungs and tissues. Neural and chemical regulation of respiration .Human: Structure of the Kidney –Nephron Renal circulation –Urine formation. Renal disorders – Micturition and dialysis. Regulation of water and electrolytes. Hormonal control of osmo –iono regulation.
- Unit IV : Nervous System and Sense Organs :** Neuron –Structure and function Neuro transmitters –Synapse, Conduction of nerve impulses. Structure and function of brain and Spinal cord, EEG. Muscles –Classification – Ultra structure of skeletal muscle -Mechanism of muscular contraction –Neural control of muscles tone and function. Sense organ of vision, hearing and tactile responses.
- Unit V : Endocrinology and Reproduction :** Structure and function of Endocrine glands. Hormones and diseases. Basics mechanism of hormone action. Estrus and endometrial reproductive cycle's. Neuro endocrine regulation of reproduction.

**Reference books :**

1. General and Comparative Physiology – William S. Hoar.
2. Chordate Zoology – E. L. Jordan and P. S. Verma, S. Chand and Co., New Delhi.
3. Comparative Animal Physiology – C. D. Prosser and F. A. Brown.
4. Textbook of Animal Physiology – R. Nagabhushanam, M. S. Kodarkar and R. Sarojini.
5. Kunt Schmidt – Nicolsen Animal Physiology – Adaptation and Environment, Cambridge University Press.
6. Gayton, A. C. and Hall, J. E., A Textbook of Medical Physiology, 9<sup>th</sup> Edn., Harcourt Brace and Company Asia Pvt. Ltd., W. B. Saunders Company.

**Biostatistics and Bioinformatics**

- Unit 1 :** **Collection of Data :** Primary and Secondary data –Methods of collecting primary data –sources of secondary data. **Sampling and Sample Designs :** Essentials of sampling –Methods of sampling –Random sampling methods –Non random sampling methods –Merits and Limitations of sampling. Classification and tabulation of data –Diagrammatic and graphic presentation of data.
- Unit II :** **Measures of Central Tendency :** Mean- Arithmetic mean –Weighted arithmetic mean – Median – Mode. **Measures of Dispersion :** Quartile deviation – Mean deviation – Standard deviation – Lorenz curve. **Skewness Moments and Kurtosis :** Measure of skewness –Absolute measure of skewness -Relative measure of skewness -Karl Pearson’s coefficient of skewness- Bowley’s coefficient of skewness. Moments. Measures of kurtosis. **Correlation analysis :** Types of Correlation –Methods of studying correlation Karl Pearson’s coefficient of correlation –Regression Analysis –Regression line, Regression equations.
- Unit III :** **Probability and Expected Value :** Concepts of probability –Types of events - Theorems of probability - conditional probability –Bayes’ Theorem. **Theoretical Distribution :** Binomial distribution -Poisson distribution - Normal distribution. **Statistical Inference :** Test of hypothesis -procedure of testing hypothesis. **Estimation :** Test of significance for large sample - Test of significance for small samples –Student’s t- distribution.
- Unit IV :** Chi square test and a Goodness of fit –Yates correction F-Test and Analysis of Variance – one way classification and two way classification .Experimental design – Randomized block design –Latin squares – The Sign Test – A rank sum test (The Mann-Whitney U Test).

**Unit V : Bioinformatics** : Information Technology in Biology - Types of sequences used in bioinformatics – Application of Bioinformatics. **Biological Database** : Objectives – Properties of Database –database retrieval system –Symbols used in data base – Nomenclature of DNA sequences Nomenclature of protein sequences –NCBI .SWISS-PROT. **Data Base Similarity Search Tools** : BLAST –FASTA – Application of bioinformatics tools –Homology search tools –Protein functional analysis tools –Sequences analysis tools –Structural analysis tools - Molecular modeling and visualizing tools –Polygenetic analysis tools .

### Text book

1. Gupta S.P. 2008 Statistical methods Sultan Chand & Co .New Delhi.
2. Khanum. A& I.A. Khan 2004 Fundamental of Biostatistics ,Ukazz Publication. Hyderabad.
3. Ramakrishnan P.1994 Biostatistics SARAS Publication TamilNadu
4. C.S.V.Murthy 2008 Bioinformatics Himalya Publishing House Pvt Ltd . New Delhi.
5. Sundararajan and Balaji 2007 Introduction to Bioinformatics Himalya Publishing House Pvt Ltd .Mumbai.

### Reference book

1. Gerrold H Zar Fundamentals of Biostatistics 5<sup>th</sup> edition
2. Banergi,P.K. 2004Introduction to Biostatistics S Chand & company Ltd .NewDelhi.
3. Gurumani,N. 2004Introduction to Biostatistics .MJP Puplishers Chennai
4. Misra ,B.N.and Misra ,B.K.1998 Introductory Practical Biostatistics. Naya Prakash, Calcutta.
5. Pillai, RSN.and Bhavathi ,V.1989 Statistics S Chand & company Ltd .New Delhi
6. Schefler W.C.1980. Statistics for biological sciences Addison –Wesley Publishing Company, NewYork.
7. Sokal,R.R.and Rohif ,F.J. 1987 Introduction to Biostatistics .W.H.Freeman and Company New York.
8. Sundar Rao,P.S.S and Righard ,J.2002 An Introduction to Biostatistics .III edn Prentice Hall of India . NewDelhi.
9. N.J.Chikhale and V.S. Gomare 2007 Bioinformatics Theory and Practice Himalya Publishing House Pvt Ltd .Hyderabad.
10. Attwood T.K. Parry smith D.J. 2006
11. Introduction to biostatistics ,Dorling Kindersley (India ) Pvt Ltd .South Asia.

## Aquaculture

- Unit I** : Aquaculture: history, definition, scope & importance, fishery resources of India in general & Tamil Nadu in particular, a biotic and biotic factors of water necessary for fish life, ecological characteristics of lakes & rivers, general ecological characteristics of reservoirs of India.
- Unit II** : Fish culture: mono, poly, mixed & composite fish culture, fresh water and marine prawn culture and its prospects in India, culture of mussels, clams, oysters and pearl culture, sewage fed fish culture, paddy cum fish culture, frog culture, sea weed culture.
- Unit III** : Fish breeding in natural conditions, bundh breeding, hypophysation & stripping, transport of live fish and seed, different types of crafts and gears used for fish catching, plankton – its definition, culture & identification, common weeds of fish ponds& methods of their eradication, production of mono sex and sterile fishes, transgenic fishes, hybridization , polyploidy , role of bio technology in conservation of fishes.
- Unit IV** : Fresh water fish farm: selection of site, construction of fish farm and soil chemistry, designing layout and construction of different types of fish ponds, setting and management of fresh water aquarium, preservation and processing of fish, fish by products industry and their utility.
- Unit V** : Water pollution, its effects on fisheries and methods of its abatement, common fish diseases( bacterial, viral, fungal and nutritional deficiency diseases), biochemical composition and nutritional value of fish, fisheries economics and marketing, fisheries managements and extension.

**Reference Books (latest editions):**

1. T.V.R.Pillay & Dill: Advances in Aquaculture
2. Agarwal & S.C.Narendra: A Hand Book of Fish Farming
3. R.K.Rath: Fresh water Aquaculture
4. Schonder: Hypophysation in Indian Major Carp
5. C.B.Hall: Ponds & Fish Culture
6. C.B.L.Srivastava: Fishes of India
7. Jhingaran: Fish and Fisheries of India
8. S.S. Khanna: An Introduction to Fishes
9. B.S.Rath: Fresh Water Aquaculture
10. Gopalji Srivastava: Fishes of U.P.& Bihar
11. H.D.Kumar: Sustainability & Management of Aquaculture & Fisheries
12. A.J.K.Mainan: Identification of Fishes
13. R.Sanatam: A Manual of Fresh Water Aquaculture
14. S.K.Gupta: Fish and Fisheries

### Research Methodology

- Unit I** : Research – Characteristics – types of research – steps in research – objectives of research – research report formatting and typing – laboratory safety – intellectual property rights.
- Unit II** : Microscopy – Principles – types of light microscopes – bright field – dark field – phase contrast – fluorescence – scanning – micrometry. Electron microscopes and types – atomic force and magnetic force microscopes.
- Unit III** : Centrifuge – types – principles and applications. pH meter – types – principles and applications. Colorimeter – principles and applications. Cryopreservation and its applications. Freezing and freeze drying microtomes. Cytotechniques.
- Unit IV** : Chromatography – paper – thin layer – column – gas liquid chromatography – affinity chromatography. Electrophoresis – paper – cellulose acetate – gel – immune electrophoresis. Blotting techniques – southern – northern – western. Radioactive counters – autoradiography – labeling studies.
- Unit V** : Spectrophotometer - Spectrofluorimeter – ESR –NMR Spectrophotometer – Flame Emission Photometry.

### Reference Books

1. Gurumai, N., 2006. Research Methodology for Biological Sciences, MJR Publishers, Chennai.
2. Rana, S. V. S., Biotechniques, Rastogi Publications, Meerut.
3. Vijayalakshmi, G. and Sivapragasam, C., 2008. MJP Publishers, Chennai.
4. Wilson, K. and Walker, J., Practical Biochemistry, Cambridge Publications.
5. Palanivelu, R., Analytical Biochemistry and separation techniques. Tulsi Book Centre, Town Hall Road, Madurai.



### **Bioinstrumentation**

- Unit I** : Microscopy, principles & applications – Light microscope and phase contrast microscope – Fluorescence microscope – Electron Microscope (SEM and TEM) – Confocal microscopy – Photo Micrography – Camera Lucida. General Principle and applications of Colorimeter – Spectrophotometer (UV / VIS) – Ultra Centrifuge – Flame Photometer – Beer and Lambert’s Law. Infra Red Spectroscopy, Atomic Absorption Spectroscopy, ESR and NMR, FT-IR and Raman Spectroscopy.
- Unit II** : Cryotechniques : Cryopreservation of cells, tissues, organs and organisms. Cryosurgery – Cryotomy – Freeze fracture and freeze drying. Separation techniques : Chromatography – Principle type and applications – Paper, Thin layer, Ion Exchange, Affinity and HPLC. Electrophoresis : Principles, types and applications, PAGE and Agarose Gel Electrophoresis.
- Unit III** : Radioisotope and main isotope techniques in biology : a. Sample preparation for radioactive counting – Autoradiography. Immunological techniques : Immunodiffusion (single & double) – Immuno electrophoresis. Techniques immune detection : Immunocyto / histochemistry – Immunoblotting, immunodetection, immunofluorescence. Surgical techniques : organ ablation (e.g. Ovariectomy, adrenalectomy) – Perfusion techniques – Stereotaxy – Indwelling catheters.
- Unit IV** : Histology techniques : Principles of tissue fixation – Microomy – Staining – Mounting – Histochemistry. Cell culture techniques : Design and functioning of tissue culture laboratory – culture media, essential components and preparation – Cell viability testing.

**Unit V** : Cytological techniques – Mitotic and meiotic chromosome preparations from insects – Chromosome banding techniques (G.C.Q. R. Banding) – Flowcytometry. Molecular cytological techniques – In site hybridization (radio labeled and non-radio labeled methods) – FISH – Restriction banding. Molecular biology techniques – Isolation of plasmid and chromosomal DNA – Staining and quantification of DNA.

### References

1. Introduction to instrumental analysis – Robert Braun – Mc Graw Hill.
2. A biologist guide to Principles and Techniques of Practical Chemistry – K. Wilson and K. H. Goulding EIBS Edn.
3. Clark & Swizer, Experimental Biochemistry, Freeman, 2000.
4. Locquin and Langeron, Handbook of Microscopy, Butterworths, 1983.
5. Boyer, Modern Experimental Biochemistry, Benjamin, 1993.
6. Freifelder, Physical Biochemistry, Freeman, 1982.
7. Wilson and Walker, Practical Biochemistry, Cambridge, 2000.
8. Cooper, The Cell – A Molecular Approach, ASM, 1997.
9. John R. W. Masters, Animal Cell Culture – A Practical Approach, IRL Press.
10. Robert Braun. Introduction to instrumental analysis, Mc Graw Hill.
11. Nuclear Magnetic Resonance : Williams.
12. Biochemical Techniques theory and practice, White R.
13. Analytical Chemistry : Christion, G. D.
14. An Introduction to Practical Biochemistry, Plummer, D. T.
15. Sandhu, G. S., 1990. Research Techniques in Biological Sciences, Anmol Publications, New Delhi.
16. Srivastava, P. K., 2006. Elementary Biophysics. An Introduction, Narosa Publishing House, New Delhi.
17. Varghese, T. and Balakrishna, K. M., 2012. Nanotechnology – An Introduction to Synthesis, Properties and Applications of Nanomaterials. Atlantic Publishers and Distributors (P) Ltd., New Delhi.
18. Weesner, F. M., 1960. General Zoological Microtechniques. The Willams & Wilkins Co., Baltimore, USA.

### **Animal Physiology**

#### **Practical**

1. Estimation of haemoglobin – Any method.
2. Determination of erythrocyte sedimentation rate (ESR)
3. Detection of haemin crystals in blood.
4. Estimation of salt loss in fish.
5. Estimation of salt gain in fish.
6. ECG, EEE, conditioned reflex, Kymograph Sphymomanometer – Chart.
7. Rate of oxygen consumption in a fish
8. Opercular activity of fish in relation to salinity
9. Opercular activity of fish in relation to temperature.
10. Qualitative analysis of excretory products in Ammonotelic, Ureotelic and Uricotelic animals.

### **Biostatistics and Bioinformatics**

#### **Practical**

1. Diagrammatic and graphic presentation of any data collected from the college campus.
2. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation - individual observation.
3. Calculation of mean, median, mode, standard deviation, standard error, variance and coefficient of variation – continuous series.
4. Calculation of correlation coefficient – length and width of leaves.
5. Calculation of correlation coefficient – height and weight of students in the class.
6. Calculation of regression co-efficient using length and weight of leaves.
7. Probability experiment with coin tossing (one coin, two coins and three coins).
8. Test of significance for small samples – one sample and two samples – student's t test.
9. Verifying the biasedness of the coin, Mendel's monohybrid cross and dihybrid cross using chisquare test.
10. PubMed, NCBI, EMBL, SWISS-PROT – printout.

## Aquaculture

### Practical

1. Morphometry of a pond
2. Estimation of fish population using mark and recapture method
3. Estimation of primary productivity of macrophyte
4. Physical chemical analysis of dissolved oxygen, salinity and alkalinity in any two water samples
5. Study of fish pathology
6. Taxonomic description of cultivable fishes(Indian major carps, 3exotic carps, Heteropneustes fossilis, Oreochrompus mossambica
7. Collection & identification of fresh water and marine planktons
8. Morphological feature of paenaid and non paenaid prawn
9. Determination of age of fishes.
10. Visit to an aquatic ecosystem- submit the report.

### Biotechnology

- Unit I** : Principles of genetic engineering - Recombinant DNA technology - restriction endonucleases – linkers, adapters, vectors and ligases – transformation – selection of recombinants, hybridization techniques – Southern and Northern blotting techniques.
- Unit II** : Plasmid Biology – Cloning vectors based on pBR 322, lamda phage, yeast, Simian Virus 40 and cloning vector for *Agrobacterium tumifaciens* – gene transfer technology – transformation – Electrophoration - microinjection – particle bombardment – liposome fusion techniques.
- Unit III** : Bioreactor – microbial products – primary and secondary metabolites – antibiotics – hybridoma technology and monoclonal antibodies – wine production – biopesticides – biofertilizers – botanical pesticides – biosensors
- Unit IV** : Medical Biotechnology – Application of RFLP in forensic science – disease diagnosis using ELISA – microbial transformation for production of important pharmaceuticals (enzymes, hormones, steroids and semi synthetic antibiotics)
- Unit V** : Nano biotechnology – introduction to super small particles and nanofabrication – nanolithography – nanotubes and bucky balls – Applications of Nanobiotechnology – drug delivery systems – drug discovery – health risks concerns of Nanobiotechnology

### Reference Books

1. Biotechnology by Sathyanarayana (2007) Uppala Another Publisher Interlinks, vijayawada
2. Introduction to Genetic Engineering by Ignacimuthu (2005) Blackwell Science Publications
3. Biotechnology by Purohit S.S (2008) Students edition – Nerosh Publishing house New Delhi
4. Biological Molecules in Nanotechnology – By Ratner M and Ratner D – Nerosh Publishing house, New Delhi.

## Genetics

- Unit I** : Genetic Transmission : Concepts and definitions. Mendelian principles – Allelic and non-allelic interactions – Pleiotropy – Penetrance and Expressivity – Phenocopies – Multiple alleles – polygenic inheritance.
- Unit II** : Gene Fine Structure : Simple and split genes – Cistran, recon, muton, intro and exon – Gene Expressions : Genes on protein synthesis – Genetic code : redundancy and wobble hypothesis – works of Khorana and Kornberg – Regulation of gene action.
- Unit III** : Chemistry of DNA – DNA damage and repairing mechanisms – Transposable elements – Inbreeding and outbreeding : Inbreeding depression, Heterosis – Somatic cell hybridization – Eugenics, Euthenics, Euphenics – Extra chromosomal inheritance : Kappa particle and shell ceiling – Estimation of Heritability.
- Unit IV** : Population Genetics : Mendelian population – Gene pool and gene frequency – Hardyt Weinberg law, Applications of Hardy-Weinberg law in calculating gene frequencies in a population – Calculation of gene frequencies for sex linked genes – Factors affecting Hardy – Weinberg equilibrium.
- Unit V** : Human Genetics : Pedigree analysis – Aminocentesis – Inborn errors metabolism – Sickle cell anemia – Karyotype – Twins – Chromosomal abnormalities – Genetic Pregnosis – Genetic Counselling – Gene Therapy – Drugs on Human heredity – simple Mendelian traits in man – genetic analysis of complex traits – Threshold traits – DNA finger printing and dermatoglyphics – Genetics and social behavior.

**Reference books :**

1. Elof Axel Carlson, 1985. Human Genetics. Tata Mc Graw-Hill Publishing Co., New Delhi.
2. Jain, H. K., 1999. Genetics : Principles, concepts and implications, Oxford & Publishing Co., New Delhi.
3. Benjamin Lewin, 1997. Genes VI, Oxford University Press, Oxford.
4. Sandhya Mitra, 1994. Genetics – A blueprint of life. Tata Mc Graw Hill Publishing Co., New Delhi.
5. Strickberger, M. W., 1996. Genetics, 3<sup>rd</sup> Edn., Prentice Hall of India, New Delhi.
6. Gardner et al., 1991. Principles of Genetics, 8<sup>th</sup> Edn., John Wiley & sons Inc., New York.
7. Stansfield, W. D., 1991. Schaum's Outline of theory and problems of Genetics, 3<sup>rd</sup> Edn., Schaum's Outline Series, Mc Graw Hill Inc., New York.
8. Stent, G. S. and Calender, R., 1986. Molecular Genetics : An introductory narrative, 2<sup>nd</sup> Edn., CBS Publishers & Distributors, New Delhi.
9. Goodenough, U., 1984. Genetics, 3<sup>rd</sup> Edn., Saunders College Publishing, New York.
10. Miglani, G. S., Fundamentals of Genetics, Narosa Publishing House, New Delhi.
11. Lewis, Genes X – Jones and Bartlett Publishers, Oxford Publication.
12. Michael R. Commings, Genage Learning Pvt. Ltd., New Delhi.

## Immunology

- Unit I :** Origin of Immune system in Invertebrates. Origin of vertebrate Immune system. Innate immunity : First line of defense – skin, gastrointestinal tract, urinogenital tract, mammary gland, respiratory tract. Second line of defense : physiological barriers, Alternate pathway of complement, endocytosis, phagocytosis (oxygen dependent and oxygen independent). Third line of defense : Inflammatory response. Mechanism of innate immune recognition. Acquired immunity : Naturally acquired passive immunity, Artificially acquired passive immunity, Naturally acquired active immunity, Artificially acquired active immunity. Cells of immune system : Lymphoid lineage –T cells and its types, B cells and its types, Null cell and its types - Myeloid lineage –Eosinophil, Basophil, Neutrophil, Mast cell, Platelets, Monocytes , Macrophages, Antigen presenting Cells. Organs of immune system : Primary lymphoid organs - Thymus, Bone marrow, Bursa of Fabricius. Secondary lymphoid organs - Lymph node, Spleen, Payers patches, Tonsil
- Unit II :** antigens : Properties and types of antigen, Adjuvants, Epitopes, Haptens, Super antigen. Antibodies (immunoglobulins) : Immunoglobulin structure and function - Immunoglobulin classes –IgG, IgM, IgA, IgE, IgD. Major histocompatibility complex (MHC) : Structure of MHC molecules, Class I, II and III MHC molecules, Distribution and Regulation of MHC Expression. Antigen –antibody interaction and hypersensitivity : Antigen – Antibody interactions - Propitiate reaction, Immunodiffusion, Radial immunodiffusion, Immuno electrophoresis, Two dimensional immuno electrophoresis, Counter current immuno electrophoresis, Agglutination reaction, Radio immune assay (RIA), Enzyme Linked Immunosorbent Assay (ELISA), Immuno fluorescence, Western Blotting. Hypersensitivity - Type I –Anaphylactic hypersensitivity, Type II –Antibody dependent cytotoxic hypersensitivity, Type III –Immune complex mediated hypersensitivity, Type IV – Cell mediated hypersensitivity, Type V –Stimulatory hypersensitivity. Complement system : Complement compound, Classical



complement pathway, Alternative complement pathway, Consequents of complement activation, Complement deficiencies.

**Unit III :** b -cell maturation, activation and differentiation : B Cell maturation, Bone marrow micro environment, Ig –gene rearrangements and formation of pre B-Cells receptor, selection of immature self reactive B Cells, B Cell activation and proliferation. T–cell maturation activation and differentiation : T –Cell maturation, discrete stages in early T cell development, Thymic selection of T cell repertoire, T cell activation, costimulation in T cell response, T cell clonal anergy. Antigen processing and presentation :Cytosolic pathway of antigen presentation, Endocytic pathway of exogenous antigen presentation. Effectors responses of cell mediated and humoral immunity : Cell mediated direct cytotoxic response, Natural killer cell mediated cytotoxicity, Antibody dependent cell mediated cytotoxicity, Regulation of immune effectors response, Immunological memory. Cytokines : General properties and functions.

**Unit IV :** Immune response infectious diseases : Immune response against viral infection, Immune response against bacterial infection, Immune response against protozoan parasites, Immune response against helminthine parasites. Autoimmune diseases : Organ specific autoimmune diseases, Diseases mediated by direct cellular damage, Diseases mediated by stimulating or blocking antibodies, Systemic auto immune diseases, Treatment of autoimmune disease. Immuno deficiency diseases :Phagocytic deficiencies, Humoral deficiencies, Cell mediated deficiencies Combined immuno deficiencies.

**Unit V :** Transplantation immunology : Classification of grafts, Method of graft rejection, Graft versus host reaction, Tissue and organ transplantation, Immuno suppressive therapy during transplantation, Immunological tolerance –Mechanism of tolerance. Immunology of tumors : Tumor antigens, Immune response to tumor antigens, Immunologicalsurveillance, Immune therapy of cancer. Vaccines : Vaccines from whole organisms, Polysaccharide vaccines, Outer membrane protein vaccines,

Toxoid vaccines, Vaccines from recombinant vectors, DNA as vaccines, Vaccines from synthetic peptides.

**Text books:**

1. C.V.Rao, An Introduction to Immunology Narosa Publishing House, 35, Greams Road, Thousand light, Chennai -600006.
2. Immunology, 2007. I.Kannan. MJP Publishers, Chennai.

**Reference books:**

1. Janis Kuby, Immunology W.H.Freeman and Company, New York.
2. Klans.D.Elgert, Immunology Wiley –Liss Pub. Co. U.S.A.
3. R.M.Coleman, M.F.Lomb and R.E.S.Cord Fundamental Immunology 2<sup>nd</sup> Edn. W.C.Brown Publishers U.S.A.
4. I.M.Roitt, Essential Immunology E.L.B.S.
5. Donald M.Weir and John Shewart Immunology Churchill Livingstone 9<sup>th</sup> Edn.
6. Geroge Pinchuk 2004.Schum’s Outlines Immunology Tata McGraw –Hill.
7. Aruna Bhatia Manual of Practical Immunity Vikas Pub. House Ltd., New Delhi.
8. Talwar .G.P. A hand book practical immunology - Third edition ,Backwell scientific publication-ISBN 0-632-01491-1

### **Animal Physiology**

#### **Practical**

11. Estimation of haemoglobin – Any method.
12. Determination of erythrocyte sedimentation rate (ESR)
13. Detection of haemin crystals in blood.
14. Estimation of salt loss in fish.
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17. Rate of oxygen consumption in a fish
18. Opercular activity of fish in relation to salinity
19. Opercular activity of fish in relation to temperature.
20. Qualitative analysis of excretory products in Ammonotelic, Ureotelic and Uricotelic animals.

### **Biostatistics and Bioinformatics**

#### **Practical**

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15. Calculation of correlation coefficient – height and weight of students in the class.
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19. Verifying the biasedness of the coin, Mendel's monohybrid cross and dihybrid cross using chi-square test.
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### **Aquaculture**

#### **Practical**

11. Morphometry of a pond
12. Estimation of fish population using mark and recapture method
13. Estimation of primary productivity of macrophyte
14. Physical chemical analysis of dissolved oxygen, salinity and alkalinity in any two water samples
15. Study of fish pathology
16. Taxonomic description of cultivable fishes(Indian major carps, 3exotic carps, Heteropneustes fossilis, Oreochrompus mossambica
17. Collection & identification of fresh water and marine planktons
18. Morphological feature of paenaid and non paenaid prawn
19. Determination of age of fishes.
20. Visit to an aquatic ecosystem- submit the report.

## Biotechnology

### Practical

1. Estimation of citric acid in citrus fruits
2. Preparation of wine
3. Preparation of bread - Demonstration
4. Preparation of yoghurt - Demonstration
5. Diagnosis of diseases using ELISA - Demonstration
6. Preparation of Vermicompost - Demonstration
7. Extraction of genomic DNA from bacteria - Demonstration
8. Demonstration of Southern and Northern blotting techniques
9. Flow Charts - Antibiotics production and Bioreactor.
10. Spotters
  - pBR322
  - Lamdapage
  - Dolly
  - RAPD
  - Gene cloning
  - Stem cells

### Practical

#### Genetics

1. Analysis of simple mendelian inheritance in a small population.
2. Breeding experiments to be demonstrated with the help of colour beads – Monohybrid cross. (Chisquare test not required).
3. Breeding experiments to be demonstrated with the help of colour beads – Dihybrid cross. (Chisquare test not required).
4. Estimation of gene and genotype frequencies in the light of Hardy-Weinberg law based on facial traits.
5. Estimation of gene and genotype frequencies in the light of Hardy – Weinberg law based on ABO blood groups.

6. Random genetic drift – using colour beads.
7. Analysis of dermatoglyphic patterns.
8. Charts, models and flash cards pertaining to theory syllabus
  - a. DNA replication
  - b. Karyotyping
  - c. Operon concept
  - d. Transposable elements.
  - e. Syndrome

Inborn errors of metabolism.

## **Practical**

### **Immunology**

1. ABO blood grouping by haemagglutination technique.
2. Immunodiffusion technique.
3. Separation of blood cells by centrifugation.
4. Counting of white blood corpuscles and red blood corpuscles.
5. Primary and secondary lymphoid organs in man (chart).
6. Lymphoid organs in rat (chart).
7. Cells of immune system – (slides).
8. Immunoglobulin G (chart).
9. Monoclonal antibody preparation (chart).
10. Histology of lymphoid organs: Primary organs – Thymus, Bone marrow. Secondary organs – Lymphnode, Spleen. (slides).

**MSU / 2016-17 / PG-Colleges / M.Sc.(Zoology) / Semester-IV / Ppr.no.22 / Project**

**Major Project**