



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

REVISED SYLLABUS 2019-2020

SCHEME

Semester – I

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSZ 511	LIFE AND DIVERSITY OF INVERTEBRATES	20	8	80	32	-	-	100
2	MSZ 512	LIFE AND DIVERSITY OF CHORDATES	20	8	80	32	-	-	100
3	MSZ 513	BIOCHEMISTRY	20	8	80	32	-	-	100
4	MSZ 514	CEL AND MOLECULAR BIOLOGY	20	8	80	32	-	-	100
5	MSZ 515	PRACTICAL I (Based on MSZ 511 & MSZ 512)	-	-	-	-	50	20	50
6	MSZ 516	PRACTICAL II (Based on MSZ 513 & MSZ 514)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	LIFE AND DIVERSITY OF INVERTEBRATES	MSZ- 511

Unit-1

A brief introduction and nomenclature - Level of Organization. Phylum Protozoa: General characters- Classifications. Type study-Paramecium-Structure and Reproduction. General Topic: Protozoan Diseases, General Characteristics of Protozoa, Importance of Protozoa, Pathogenic Protozoa That Cause Major Diseases of Domestic Animals, Protozoa Distribution

Unit-2

PORIFERA: Phylum Porifera: General characters- Type study- Ascon.

Phylum Coelenterata: Classification- Type study- Aurelia- Structure and life history. General Topic: Canal system in Sponges, Polymorphism in Coelenterates.

Unit-3

HELMINTHES: General characters and classification up to classes with examples; Type study - Taenia solium. Nematode parasites and diseases - Wuchereria bancrofti, Enterobius vermicularis, Ancylostoma duodenale.

ANNELIDA: General characters and classification up to classes with examples; Type study - Earthworm, Trochophore larva, and its evolutionary significance.

Unit-4

ARTHROPODA: General characters and classification up to classes with examples; Type study - Prawn. Peripatus and its affinities.

Unit-5

MOLLUSCA: General characters and classification up to classes with examples; Type study - Fresh water Mussel.

ECHINODERMATA: General characters and classification up to classes with examples; Type study - Sea star. Echinoderm larvae and their significance.

Reference Books

1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. 1 [Invertebrata], parts I and II.S. Viswanathan (Printers and Publishers) Pvt. Ltd; Madras.
2. Jordan, E.L. and P.S. Verma, 1993. Invertebrate Zoology, 12th Edition. S. Chand and Co. Ltd, New Delhi.
3. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
4. Parker and Haswell, 1964. Text Book of Zoolgy. Vol I (Invertebrata). A.Z.T; B.S. Publishers and distributors, New Delhi.
5. L.A. Borrardile and F.A. Pott. The Invertebrates. Cambridge University press.UK
6. Adam Sedgwick.1972 A student text book Zoology. Vol. I and II. Central book Depot. Allahabad.
7. P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
8. Hyman L.H. The Invertebrate Vol. I-VI. 1955, McGraw Hill Co New York.
9. Barrington, E.J.W. 1969. Invertebrate structure and function. ELBS Publication.
10. Barnes. Invertebrate Zoology. Toppan international Co.



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M.Sc (Zoology)

PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	LIFE AND DIVERSITY OF INVERTEBRATES	MSZ- 511

PRACTICAL

Invertebrates

1. Identification and study of selected Protozoan and Helminthes of medical importance.
2. Identification and study of : Trochophore larva, Nauplius larva, Zoea larva and Bipinnaria larva.
3. Dissection of nervous system of Prawn.
4. Mounting of mouth parts of Honey bee, Housefly and Mosquito.
5. Slides/Model/Chart – Identification (draw and label)

Cockroach: Mouth Parts.

Earthworm: Penial setae and body setae.

Honey bee, House fly, Mosquito - Mouth Parts.

Prawn - Appendages

Frog vertebrate: Brain and Hyoid apparatus.

Placoid Scales.



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M.Sc (Zoology)

Syllabus SEMESTER – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	LIFE AND DIVERSITY OF CHORDATES	MSZ- 512

Unit-1

Salient Features, General classification of Phylum Chordata upto orders; Origin of Chordata.

Prochordata: General Characters and affinities of Hemichordata, Cephalochordata & urochordata

Unit-2

PISCES: General characters and classification up to orders; Type study : Shark; Parental care.

AMPHIBIA: Class : Amphibia : General characters and classification - Type Study : Frog – External characters, Digestive , Respiratory, Circulatory and Reproductive systems - Structure of Brain

Unit-3

Class: Reptelia: General characters- Type study – Calotes- External characters- Digestive, Respiratory, Circulatory and Reproductive systems- Structure of Brain. General Topic: Identification of Poisonous and Non- Poisonous snakes. Golden age of Reptiles.

Unit-4

AVES: General characters and classification upto orders; Type study- Pigeon; Characters of Archaeopteryx; Ratitae ; Flight adaptation.

Unit-5

MAMMALIA: General characters and classification upto orders; Type study- Rabbit; Flying Mammals; Dentition in mammals ; Aquatic mammals.

References :

1. Ekambarantha Ayyar, M and T.N Ananthakrishnan 1992, A manual of Zoology Vol. II [Chordata]. S. Viswanaathan (Printers and Publishers] Pvt. Ltd., Madras.
2. Jordan E.L. and P.S. Verma 1995. Chordata Zoology and elements of Animal Physiology. S. Chand and Co., New Delhi.
3. Kotpal R.L. 1992. Vertebrata, Rastogi Publications, Meerut
4. Nigam.H.C. 1983 Zoology of chordates, Vishal publications, Jalandhar.
5. Waterman, Allyn J. et al. 1971, Chordate Structure and functions. Mac.Millan and Co., New York.
6. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
7. Hyman. L.H. Comparative vertebrate Zoology. McGraw Hill Co., New York.



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M.Sc. ZOOLOGY

SEMESTER – I

PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	LIFE AND DIVERSITY OF CHORDATES	MSZ- 512

PRACTICAL

Chordates

1. Dissection and display of aortic arches in Shark.
2. Dissection and display of portal system of Shark.
3. Dissection and display of V, IX and X cranial nerves of Shark.
4. Study of the following skulls with reference to dentition – Cat or Dog, Rat or Rabbit, Man
 - i. Pectoral girdles of Frog, Calotes, Pigeon, Rabbit/Rat.
 - ii. Pelvic girdles of Frog, Calotes, Pigeon, Rabbit/Rat.
 - iii. Fore limbs of Frog, Calotes, Pigeon, Rabbit/Rat.
 - iv. Hind limbs of Frog, Calotes, Pigeon, Rabbit/Rat.
 - v. Synsacrum.



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Syllabus SEMESTER – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	BIOCHEMISTRY	MSZ- 513

Unit -1

Water: Scope- Atoms, Molecules, Polymerization of organic molecules – major organic components – Chemistry of water – Biological importance, pH and Acid – Base balance. Henderson Hasselbach equation. Buffers – Biological importance; Acidosis, alkalosis. Electrolyte and water balance.

Unit – 2

Biomolecules: Chemical structures, nature and properties, Classification and importance in biological cells, Aerobic and anaerobic metabolism. Amino acids- Classification and properties. Structure, Zwitterion nature, Proteins- Classification, Structure and function. Primary, secondary, tertiary and quaternary structure, Proteolysis.

Unit – 3

Bioenergetics and Metabolism of Carbohydrate and Lipids **Carbohydrate-** structure, classification and biological significance; 1. Glycogenesis, 2. Glycogenolysis, 3. Glyconeogenesis, 4. Glycolysis, 5. Embden Meyerhof pathway, 6. Hexose mono phosphate shunt; **Lipids** – structure and classification, Lipids of biological significance, Biosynthesis and Oxidation of Fatty Acids. Bio Energetics.

Unit – 4

Hormones: General function, Classification – Steroid hormones, Protein Hormones; Tissue Hormones. Vasoactive Peptide Synthetic Hormones. Mechanism of Hormone action.

Unit – 5

Vitamins: Water and Lipid soluble Vitamins – structure, classification, sources and deficiencies in man. classification, functions, requirement and deficiency conditions, vitamin A, D, E, K, Ascorbic acid, Thiamine, Riboflavin, Niacin, Pyridoxine, Folic acid, Pantothenic acid. Metabolism of Xenobiotics – Detoxification and Biotransformation.

Reference Books

1. Murray, R. K, Granner, D.K. Maynes, P.A and Rodwell, V.W. 1998. Harper's Biochemistry. 25th Edition. McGraw Hill, New York.
2. Hames, B.D., Hoopa, N.M and Houghton, J.D. 1998. Instant notes in Biochemistry. Viva Books Pvt. Ltd. New Delhi.
3. Jain, J.L. Jain, S. and Jain N. 2005. Fundamental of Biochemistry, S. Chandra & Co. Ltd. New Delhi.
4. Vasudecan, D.M. and Sreekumar. S. 2000. Text of Biochemistry for Medical students. Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi.
5. Rama Rao, A.V.S.S. 1986. Text Book of Biochemistry. L.K. & S Publishers. A.P. 6. Ambika, S. 1990. Fundamentals of Biochemistry for Medical Students, Published by the author.
7. Lehninger, A.L. 2004. Principles of Biochemistry. CBS Publishers, New Delhi.
8. Zubay, G. 1989. Biochemistry, McMillan Publishing Co., New York.
9. Voet, D and Voet, J.G. 2004. Biochemistry. John Wiley and Sons, Inc.
10. Ambika Shanmugam – Test book of Biochemistry
11. Veerakumari (2002) Biochemistry MJP Publishers, Chennai.
12. Gurumani – Research Methodology for Biological Sciences. MJP Publishers, Chennai – 600 005.



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M.Sc. ZOOLOGY
SEMESTER – I
PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	PRACTICAL - BIOCHEMISTRY	MSZ- 513

PRACTICAL

Biochemistry

1. Qualitative detection of proteins, carbohydrates and lipid in tissue samples.
2. Quantitative estimation of total proteins and carbohydrates (glucose) in tissue samples.
3. Enzyme kinetics : Influence of pH, temperature, substrate concentration, enzyme concentration and time course on amylase activity.
4. Determination of amino acids in body fluid of Cockroach or grass hopper different animals using paper chromatography.
5. Quantitative estimation of blood glucose by Folin-Wu/Anthrone /DNS/O-Toluidine/Enzymatic method
6. Estimation of proteins by Biuret/ Lowry *et al.* method
7. Quantitative estimation of blood urea/ creatine/ uric acid
8. Quantitative estimation of cholesterol in the blood
9. Estimation of alkaline and acid phosphatases



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Syllabus

SEMESTER – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	CEL AND MOLECULAR BIOLOGY	MSZ- 514

Unit-1

STRUCTURE AND FUNCTIONS OF CELL ORGANELLES: Prokaryotic and eukaryotic cells – Ultrastructure and Organization. Plasma membrane–Ultra structure– Chemical composition and functions of modifications of plasma membrane. Endoplasmic reticulum: Morphology, Ultra structure, chemical composition and functions. Golgi complex: Ultra structure, chemical composition and functions.

Unit-2

NUCLEUS: Nuclear - cytoplasmic interactions. Nuclear transplantation - Cell fusion: homokaryons, heterokaryons. Cytoplasts and karyoplasts. Structure and function of Chromatin - Organisation of nucleosomes - Euchromatin and heterochromatin - Polytene and lampbrush Chromosomes

Unit-3

CELL CYCLES: Cell cycles - its components G₀-G₁ transition - Spindle organization - Chromosome movements - Regulation of cell division in normal and malignant cell, synchronization of cell division. Cancer cell: Differences between normal and cancer cell- structural and functional characteristics -Tumour Viruses-Oncogenes - Environmental factors inducing cancer. Hormones in relation to cancer-Theories of carcinogenesis.

Unit-4

INFORMATIONAL MACROMOLECULES: Chemistry of DNA - Polymorphism of DNA - Mechanism and enzymology of DNA replication - DNA repair mechanisms. Chemistry of RNA – Different types of RNA and their functions.

Unit-5

INFORMATION TRANSFER: Information transfer in Prokaryotes; information transfer in Eukaryotes. Transcription - Promoters - Initiators and terminators - Transduction. RNA processing - Trimming of introns and splicing of exons.



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Reference Books

1. De Robertis. E.D.F. and De Robertis. E.M.F. 2001. Cells and Molecular Biology, B.I Publications Pvt Ltd, India.
2. Lewin, B.2000 Genes VII. Oxford University Press, New York.
3. Howland J.L. 1973. Cell Physiology, McMillan Publishing Co., New York.
4. De Witt, 1977. Biology of the cell. An evolutionary approach. Saunders Company.
5. Karp, G. 1979. Cell Biology. McGraw Hill Ltd., Japan.
6. Avers. C.J., 1976. CellBiology. Van Nostrand Company, New York.
7. Korenberg. A. 1974. DNA Replication. Dorothy- W.H. Freeman and Company, San Francisco.
8. Hawkins, J.D.1996. Gene Structure and Expression, Cambridge University Press, London.
9. Shanmugam, G., 1988. A laboratory manipulation in fish. Madurai Kamaraj University.
10. Albert, B and Watson. J.D. 1990. Molecular Biology of the cell. Garland Publishing, London.
11. Malacinski, G.M. 2005. Essentials of molecular biology. Narosa Publish House, Chennai.
12. Lodish, H., Berk A .,Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, S.L.and Darnell, J. 2004. Molecular Cell Biology. W.H. Freeman & Co., New York.



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M.Sc (Zoology)

Syllabus
SEMESTER – I
PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	CEL AND MOLECULAR BIOLOGY	MSZ- 514

PRACTICAL

Cell and Molecular Biology and Biophysics

1. Micrometry – simple measurements of cells (any prepared slides) by micrometry.
2. Temporary and permanent squash preparation to study the mitotic and meiotic cell divisions (local insects to be studied)
3. Temporary squash preparation of salivary gland in Chironomous larva.
4. Histochemical localization of proteins, carbohydrates and lipids.



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SCHEME

Semester – II

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSZ 521	ANIMAL PHYSIOLOGY	20	8	80	32	-	-	100
2	MSZ 522	GENETICS	20	8	80	32	-	-	100
3	MSZ 523	DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY	20	8	80	32	-	-	100
4	MSZ 524(a)/ MSZ-524(b)/ MSZ-524(c)	EVOLUTION Population Ecology And Environmental Physiology/ Comparative Anatomy of Vertebrates	20	8	80	32	-	-	100
5	MSZ 525	PRACTICAL III (Based on MSZ 521 & MSZ 522)	-	-	-	-	50	20	50
6	MSZ 526	PRACTICAL IV (Based on MSZ 523 & MSZ 524)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



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Syllabus SEMESTER – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	ANIMAL PHYSIOLOGY	MSZ- 521

Unit-1

NUTRITION: Definition, optimum nutrition, nutritional status, good nutritional status, poor nutritional status, malnutrition, under nutrition, signs of good nutritional status, signs of poor nutritional status, definition and functions of nutrients

Unit-2

RESPIRATION AND CIRCULATION: Respiration in Invertebrates and Vertebrates - physiology of respiration in Man. Respiratory Pigments, nervous and chemical control of respiration, BMR.

Circulation - types of hearts - physiology of cardiac muscle - heart beat and its regulation - blood coagulation and theories.

Unit-3

EXCRETION AND OSMOREGULATION: Excretion – excretion of metabolic waste products in relation to the environment – physiology of excretion in Man Iono – osmoregulation in Invertebrates (crustaceans), fishes, birds and terrestrial animals –hormonal control.

Unit-4

COORDINATION: Neuro muscular co-ordination - types of neurons, transmissions of nerve impulse and reflex action. Molecular structure and chemical composition of muscle fiber and physiology of muscle contraction. Myoneural Junction. Endocrine glands in mammals - Hormones and Functions. Physiology of mammalian reproduction - reproductive cycle - hormonal control of reproduction.

Unit-5

BEHAVIOURAL PHYSIOLOGY: Bioluminescence - chemistry and functional significance. Behaviour (types - trophism, taxis, kinesis, reflex, learning). Temperature regulation in poikilotherms, homeotherms and heterotherms - hibernation, aestivation - diapause.

REFERENCE BOOKS

1. Hoar, W.S.1991. General and Comparative Physiology. Prentice Hall of India, NewDelhi.
2. Prosser, C.L. 1973. Comparative Animal Physiology,3rd edn. W.B. Saunders & Co., Philadelphia.
3. Barrington, E.J.W.1975 . An Introduction to General and Comparative Endocrinology. Clarendon Press, Oxford
4. Bentley,P.J.1971. Endocrine and osmoregulation, Springer Verlag, New York.
5. Palmen,J.D. Brown, I.R and Hastings, J.W.1970. Biological clocks, Academic Press, London.
6. Welson, A. 1979. Principles of Animal Physiology.McMillan Publishing Co. Inc. New York.
7. Schmidt Nelssen, K.1985. Animal Physiology. Adaptation and Environment Club, London.
8. Herkat, P.C.and Mathur, P.N.1976. Text Book of Animal Physiology.S.Chand Co. Pvt, Ltd., New Delhi.



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M.Sc (Zoology)

SEMESTER – II
PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	PRACTICAL- ANIMAL PHYSIOLOGY	MSZ- 521

PRACTICAL

Animal Physiology

1. Qualitative study of digestive enzymes in cockroach.
2. Determination of rate of salt loss and salt gain in fish / crab using different experimental media.
3. Determination of RQ in an aquatic animal in relation to light and temperature (Fish/crab).
- 4.. Estimation of RQ in Fish with reference to temperature.
5. Oxygen Consumption in a terrestrial animal (Cockroach)
6. Salt loss and salt gain in fish
7. Estimation of Proteins, Carbohydrates and Lipids in the tissues of Fish
8. Effect of Insulin and Adrenalin on Blood Glucose level
9. Qualitative Urine test for pregnancy
10. Estimation of Blood Urea and Cholesterol.
11. Blood Clotting Time, Bleeding Time, Rouleaux Formation, Preparation of Haemin Crystal, Estimation of Haemoglobin and ESR.
12. Principle and Application of Sphygmomanometer, Kymograph, Electrophoresis, Haemoglobinometer, ESR



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Syllabus

SEMESTER – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	GENETICS	MSZ- 522

Unit-1

MOLECULAR STRUCTURE OF GENETIC MATERIAL: History of Evolutionary thought - Origin of life – Chemical evolution. Evolution of self replicating systems –DNA world and RNA world. Genetics of bacteria - Gene transfer in bacteria - Transformation, transduction and conjugation - mechanism and their use in genetic mapping, DNA transfections: Replication, repair, recombination, restriction and modification.

Unit-2

REGULATION OF GENE ACTION: Enzyme regulation of gene action. Gene regulation of gene action - Operon concept - GAL and LAC Operon system. Evidence of regulation of gene action; Genes and metabolism. Inborn errors of metabolism in Man (With reference to protein, carbohydrates, Lipid and nucleic acid metabolism).

Unit-3

CHROMOSOME AND GENETICS DISORDERS: Evolution of sex chromosomes. Dosage compensation - X inactivation. Geneomic imprinting. Human Genetics. Normal human karyotype - Variations in karyotypes (autosomal and sex chromosomal, structural and numerical) with special reference to classical syndromes in man. Principles and methods of pedigree analysis - statistical evaluation. Genetic counselling - Objectives, ethics and principles . Methods of counselling for point mutation, disorders, structural and chromosomal disorders.

Unit-4

GENES IN DEVELOPMENT, RADIATION GENETICS AND POPULATION GENETICS: Genes in development and differentiation Mechanism of chromosomal breakage - physical chemical and biological factors or agents. Mutagens and mutagenesis and carcinogenesis - genetic changes in Neoplasia in man. Population genetics: Population and gene pool. Hardy Weinberg Law-Genetic equilibrium, Calculation of gene frequencies for Autosomal (Complete dominance, codominance and multiple alleles) and sex linked genes. Factors affecting Hardy Weinberg equilibrium.

Unit-5

GENETIC ENGINEERING AND APPLIED GENETICS: Genetic Engineering - Restrictive enzymes - Recombinant DNA techniques. Applications of Recombinant DNA technology. Applied Genetics - Application of genetics in animal breeding. Application of genetics in Crime and Law - DNA fingerprinting, Genetic basis of intelligence. Studies on Twins.



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Reference Books

1. Watson, J.D. Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1987 Molecular Biology of the Gene. W.A. Benjamin/Cummings Co., New York.
2. Sinnot. E.W., Dunn. L.C., Dobzhansky, T.H. 1973. Principles of Genetics. McGraw Hill Co., New Delhi.
3. Daniel L. Hartl. 1994. Geneties. Jones and Barflaff Publishing, Boston.
4. Lewin, B. 2000. Genes VII. Oxford university Press, New York.
5. Ayala, F. I. and Kieger, J.A. Jr., 1980, Modern Genetics. The Benjamin Publishing Co. London,
6. Goodenough, U. 1984. Genetics. Saundes College Publishing Co., London.
7. Curs Sten 1973 Principles of Human Genetics. W.H. Freeman and Co., New York.
8. Jenking, J.B. 1983. Human Geneties. The Benjamin Cummings Publishing& Co ., Londen.
9. Market, C.L. & Ursprung, 1973. Development Genetics, Prentice Hall.
10. Gardner E.J. Simmons, M.J. and Snustad, D.P.1991 John Wiley & Sons, New York.
11. Tamarin, R.H. 1996. Princples of Geneties, WCB Publishers Munro.
12. Stickberger, M.W. 1985. Genetics. Printice – Hall of India, Pvt. Ltd., New Delhi.
13. Pandian, T.J. and Muthukrishnan, J. 1988. Workshop on Research Methods for Chormosomal Manipulation in Fish. Department of Biotechnology Govt. of India, New Delhi.
14. Pandian, T.J. and Muthukrishnan, J. 1990. Research Methods for Gene and Chorosome Manipalation in Fish. Department of Biotechnology, Govt. of India, New Delhi.

SEMESTER – II PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	GENETICS	MSZ- 522

PRACTICAL

Genetics

1. Culture, sexing and etherization of *Drosophila*.
2. Study of Mutants in *Drosophila*.
3. Genetics problems (Di hybrid cross, test cross and sex linked inheritance).
4. Abnormal human karyotypes



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Syllabus

SEMESTER – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY	MSZ- 523

Unit-1

EARLY DEVELOPMENT AND ORGANOGENESIS: Gastrulation movements: role of egg cortex - cell surface in morphogenesis. Cell adhesion and cell communication. Chemotactic induced aggregation - aggregation in sponges. Experimental analyses in the early development of Echinoderms, Amphibians and birds. Organogenesis - formation of organ rudiments, differentiation and development of thymus, spleen, salivary glands, heart and kidney in different mammals. Organiser, Inductive tissue interactions in developments.

Unit-2

GENES AND DEVELOPMENT: Nuclear transplantation. Cellular differentiation and protein synthesis. Differential activation. Developmental genetic defects. Role of cell death in development. Teratogenesis - Ageing, transgenics

Unit-3

REGULATION OF DEVELOPMENT: Metamorphosis - morphological and biochemical changes during amphibian metamorphosis. Hormonal control of metamorphosis in amphibians - Neuro endocrine control of insect metamorphosis - Biochemistry and mechanism of action of hormones during metamorphosis - Neoteny, Malignant growth - Neoplasia - Teratoma - Gene activation in neoplasia.

Unit-4

IMMUNOGLOBULINS: Historical perspectives - overview of immune system, innate and acquired immunity, immune -systematic structure and organization.

Antigen and antigenicity, Immunoglobulins - structure, complements, antigen - antibody interaction - monoclonal antibodies

Unit-5

MECHANISM AND MEDIATORS OF IMMUNE SYSTEM: Antigen - Antibody interaction and immunodiagnostics. MHC - Restriction. Organization and inheritance of MHC, Antigen processing and presentation; B-cell receptors, T-cell receptors, cytokine, adhesion molecules, complement, Hypersensitivity reaction, Transplantation immunology.



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Reference Books

1. Balinsky, B.I.1981 An Introduction to Embryology. W.B Saunders Co., Philadelphia.
2. Karp,G. and Berrill,N.J.1981. Development. McGraw Hill, New York.
3. Saunders,J.W.1982. Developmental Biology. MacMillan Co., London.
4. Nagabhushanam,R. and Sarojini,R.2002 Invertebrate Embryology. Oxford and IBA Publishing Co.
5. Tyagi,Rajiv and Shukla,A.N.2002.Development of Fishes. Jaya Publishing House, New Delhi.
6. Browder,W.1984.Developmental Physiology. Saunders College Publishing, Rinchert and Winston.
7. Gilbert,S.F.2003.Developmental Biology. Sinamer Associates Inc. Saunderland, Massachusets, U.S.A.
8. Oppenheimer,S.B.1980.Introduction to Embryonic Development. Allyn and Bacon,Inc. U.S.A.
9. Mitra,S.1994. Genetics, A Blueprint of Life. Tata McGraw- Hill Publishing Company Ltd., New Delhi.
10. Roitt,I.M.1994.Essential Immunology. Blackwell Scientific, Oxford.
11. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. Kuby Immunology.Freeman and Co., New York.
12. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey.
13. Janeway,C.A and Travers,P. 1997.Immunobiology.Current Biology Ltd., London.
14. Paul,W.E.M.1989. Fundamentals of Immunobiology. Raven Press, New York.
15. Srivastava,R.,Ram,B.P. and Tyle,P.1991. Molecular Mechanism of Immune Regulation. VCH Publishers, New York.
16. Champion,M.D. and Cooke,A.1987.Advanced Immunology. J.B.Lippincott Ltd., Philadelphia.
17. Kannan,I.2007. Immunology. MJP Publishers, Chennai.



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M.Sc (Zoology)

M.Sc. ZOOLOGY SEMESTER – II_ PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	IMMUNOLOGY	MSZ- 523

PRACTICAL

Developmental Biology

1. Different stages in development - frog.
2. Development of chick stage - observation of living chick embryo and vital staining (demonstration only) - slide showing C.S.of heart, kidney lens and limb to demonstrate induction and organization.
3. Slides showing the uterine cycles in a mammal (Rat).
4. Study of slides showing of larval forms: Nauplius, Zoea, Bipinnaria, Leptocephalus.
5. Blastoderm Mounting of chick/Duck embryo.
6. Vital staining and Mounting of chick blastoderm of various stages.
7. Amphibia - identification of developmental stages.
8. Study of different types of placenta.
9. Development of vertebrates : eggs –cleavage – blastula – gastrula.

Immunology

1. Haemagglutination - Quantitative analysis - haemagglutination titration.
2. Preparation of Antigen - RBC - Demonstration.
3. Ouchterlony technique - Demonstration.
4. Immunoelectrophoresis - Demonstration.



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M.Sc (Zoology)

Syllabus

SEMESTER – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	EVOLUTION	MSZ- 524(a)

UNIT- I

EVIDENCES

Evidences: The need of evidences for the fact of evolution - evidences from comparative anatomy, embryology, physiology and biochemistry - visual pigments, hemoglobin, protein sequences in phylogeny.

Biogeography, Plate tectonics and continental drift - Evidences from systematic, evolutionary taxonomy -

Evidences from paleontology - evolutionary trends in fossils, types of fossils. Process of fossilization -

Evolution of homeotherms - Evidences from genetics - gene and chromosome homology, hybridization,

universality of the genetic code. Introduction to Storage Technology: Data proliferation, evolution of various storage technologies, Overview of storage infrastructure components, Information Lifecycle

Management, Data categorization.

UNIT- II

MECHANISM OF EVOLUTION

Mutationism - Views of De Vries and of R.B. Golschmidt; hopeful monsters. Inadequacies of mutationism.

Lamarckism - Life of Lamarck - Lamarckian postulates - inadequacies of Lamarckism.\

Natural selection - In nature and laboratory - Creative aspects of natural selection - modern understanding of selection, stabilizing and diversifying and directional selection.

Adaptation - Nature and types of adaptation - Adaptive trends - Quantifying adaptation - Batesian and Mullerian mimicry and evolution.

Polymorphism - Transient and stable - Maintenance of polymorphism.

UNIT- III

GENETIC BASIS OF EVOLUTION AND SPECIATION

Mutations and their role in evolution - the neutralist hypothesis - population size and evolution - the role of genetic drift - hybridization and evolution - The role of polyploidy, isolating mechanisms - premating, post mating - problems of the origin of isolating mechanism.

History of Evolutionary thought - Origin of life –Chemical evolution. Evolution of self replicating systems –DNA world and RNA world.

Evidences from Paleontology -Comparative anatomy, Embryology, Physiology and Bio chemistry. Biogeography –Distribution in continents ,Continuous and discontinuous distribution - Endemism

Structure of species - Clones, peripheral population isolates,

Genetics and Ecology of speciations. Mayer's founder principle and genetic evolution in the peripheral isolates -

Ecological opportunities for speciation.

Unit-VI

ORIGIN OF HIGHER TAXA - I

Definition Simpson's definition of the higher taxa - Evidence for the origin of higher taxa from living forms -

Evidences for the origin of higher taxa from the fossil record.

Mechanisms in the origin of higher taxa Polyploidy - Deviation, Allometry - Caenogenesis followed by neoteny.



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M.Sc (Zoology)

Unit-V

ORIGIN OF HIGHER TAXA - II

Modes of origin of higher taxa (1) Mosaic mode. Connecting links between vertebrate classes, (2) Quantum evolution. Simpson's adaptive grid. Rate of evolution Horotely, Bradytely and Tachytely. Gradualism versus punctuated equilibrium - Extinction and its causes.

HUMAN EVOLUTION

Sociobiology Definition and scope - selfish gene, altruism and kin selection bioethics.

REFERENCE BOOKS

1. P.A.Moody. 1978. Introduction to Evolution. Harper International.
2. G.L. Stebbins. 1979. Process of Organic Evolution. Prentice Hall India, New Delhi.
3. E.O.Dodson. 1990. Evolution. Reinhold, New York.
4. D.S.Bendall. 1983. Evolution from molecules to man. Cambridge University Press.UK
5. M. Grene. 1983. Dimensions of Darwinism. Cambridge University Press. UK
6. E.C.Minkoff. 1984. Evolutionary Biology. Addison - Wesley. London.
7. Montagu. 1980. Sociobiology examined. Oxford University press.
8. Abraham, J.C.B. 1987. Evolution: A Laboratory Manual. Macmillan India Ltd., Madras.

SEMESTER – II **PRACTICAL**

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	EVOLUTION	MSZ- 524

Evolution

1. Observation of forelimbs or hindlimbs of vertebrates (Frog, Calotes, Bird and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
2. Observation of fossils for paleontological evidences of evolution.
3. Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic colouration and natural selection.
4. Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
5. Study of fossils.



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M.Sc (Zoology)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	Population Ecology And Environmental Physiology	MSZ- 524(b)

Unit I

1. Populations and their characters.
2. Demography : Life tables, generation time, reproductive value.
3. Population growth: Growth of organisms with non-overlapping generations, stochastic and time lag models of population growth, stable age distribution.
4. Population regulation: Extrinsic and intrinsic mechanisms.

Unit II

1. Adaptations : Levels of adaptation, significance of body size.
2. Aquatic environments : Fresh water, marine, shores and estuarine environments.
3. Eco-physiological adaptations to fresh water environments.
4. Eco-physiological adaptations to marine environments.
5. Eco-physiological adaptations to terrestrial environments.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory-prey relationship, predator dynamics, optimal foraging theory (patch choice, diet choice, prey selectivity , foraging time)
4. Mutulism , evolution of plant pollinator interaction.

Unit IV

Environmental pollution and human health.

1. Conservation management of natural resources .
2. Environmental impact assessment.
3. Sustainable development.

Unit V

1. Concept of homeostasis.
2. Endothermi and physiological mechanism of regulation of the body temperature
3. Physiological response to oxygen deficient stress.
4. Physiological response to body exercise.
5. Meditation, yoga and their effects.



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M.Sc (Zoology)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	Comparative Anatomy of Vertebrates	MSZ- 524(c)

Unit-1

1. Origin of Chordata: Concept of Protochordata
2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs)
3. Respiratory system : Characters of respiratory tissue, external and internal respiration. Comparative account of respiratory organs.
4. Comparative account of Digestive System.

Unit-2

1. Evolution of heart.
2. Evolution of aortic arches and portal systems.
3. Blood circulation in various vertebrates groups.
4. Comparative account of jaw suspensorium and vertebral column.

Unit-3

1. Evolution of urinogenital system in vertebrates.
2. Comparative account of organs of olfactory and taste.
3. Comparative anatomy of brain and spinal cord (CNS).
4. Comparative account of peripheral and autonomous nervous system.

Unit-4

1. Comparative account of lateral line system.
2. Comparative account of electroreception.
3. Flight adaptations in vertebrates.
4. Aquatic adaptations in birds and mammals.

Unit-5

1. Origin, evolution general organization and affinities of Ostracoderms .
2. General organization, specialized, generalized and degenerated characters of Cyclostomes.
3. Origin, evolution general organization of early Gnathostomes .
4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossoptergii

List of Practicals



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M.Sc (Zoology)

1. Exercise on Hematology, Blood group, Total and Different counts.
2. Demonstration of Enzyme Action, and chromatography
3. Estimation of pH
4. Detection of protein carbohydrate and fats
5. Endocrinology spots comments on prepared histological slides
6. Detection of Nitrogenous products in given samples
7. Study of Specimens, slides, and bones related to theory papers.
8. Major Dissection :- Various system of Labeo, Wallogo, Torpedo
9. Minor Dissection: -
 - A . Accessory respiratory organs of Anabas, Clarias, Heteropneustes
 - B. Herdmania
 - C. Amphioxus
10. Viva Voce
11. Practical Records



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

SCHEME

Semester – III

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSZ 531	BIOPHYSICS	20	8	80	32	-	-	100
2	MSZ 532	MEDICAL LABORATORY TECHNIQUES	20	8	80	32	-	-	100
3	MSZ 533	BIostatISTICS AND COMPUTER APPLICATIONS	20	8	80	32	-	-	100
4	MSZ 534	BASIC CONCEPTS OF BIOTECHNOLOGY	20	8	80	32	-	-	100
5	MSZ 535	PRACTICAL V (Based on MSZ 531 & MSZ 532)	-	-	-	-	50	20	50
6	MSZ 536	PRACTICAL VI (Based on MSZ 533 & MSZ 534)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



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M.Sc (Zoology)

Syllabus SEMESTER – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	BIOPHYSICS	MSZ- 531

Unit-1

STRUCTURE OF BIOMOLECULES: Electron configuration of an atom. Bonds - Covalent bond, Hydrogen bond, Disulphide bond, Peptide bonds. Forces between Molecules - Electrostatic force, Van der Waal's forces - hydrophobic and hydrophilic - biological importance.

Unit-2

THERMODYNAMICS AND BIOLOGICAL OXIDATION: Laws of Thermodynamics - Concept of free energy and entropy - Exergonic and Endergonic reactions. Rate of reactions - Effect of sunlight and temperature on reactions. Energy of Activation - Arrhenius expression.

Diffusion - Fick's Laws, constant laws. Osmotic coefficient - Gibbs Donnan equilibrium.

Oxidation and reduction reactions - Redox potentials in biological system, High energy phosphate group. Bioluminescence.

Unit-3

Microscopy and Staining Techniques

Bright Field, Dark Field, Phase Contrast, Fluorescence and Scanning and Transmission Electron Microscopy, Stains and staining techniques- Stains and Dyes: classification and types, Types of staining- Simple (Monochrome, Negative), Differential (Gram and Acid fast).

Unit-4

PHOTO BIOPHYSICS: Electromagnetic spectrum - visible and invisible region. Principles involved in Photoelectric colorimetry. Principle of Spectroscopy - UV & IR Spectroscopy in biological investigation. Effects of UV on biological systems.

Delayed effects of radiation - Ageing, reduction in life span, cancer.

Radioactive isotopes - measurements - GM tubes, Liquid Scintillation counters. Autoradiography. Effects of radiation.

Unit-5

BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY

Biophysical aspects of vision, hearing, nerve conduction and muscle contraction.

REFERENCE BOOKS

1. Bose, S. 1982. Elementary Biophysics. Jyoth Books,
2. Bums, D.M. and MacDonald, S.G.G. 1979. Physics for Biology and Premedical students. ELBS and Addison - Wesley Publishers Ltd., London.
3. Casey, E.J. 1962. Biophysics concepts and Mechanism. Affiliated East-West Press Pvt. Ltd., New Delhi.
4. Das, D. 1982. Biophysics and Biophysical Chemistry. Academic Publishers. New Delhi.
5. Epstein, H.T. 1963. Elementary Biophysics, selected topics. Addison - Wesley Publishing Company Inc. London.
6. Palanichamy, S and Shanmugavelu, M. 1991. Principles of Biophysics. Palani Paramount, Publication; Tamil Nadu.
7. Roy, R.N. 1996. A Text Book of Biophysics, New Central Book Agency Ltd, Calcutta.



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

Syllabus

SEMESTER – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	MEDICAL LABORATORY TECHNIQUES	MSZ- 532

Unit - 1

Instrumentation: The laboratory: Accidents – Universal work precautions (UWP) for laboratory personnel; Sterilization : Introduction – sterilization by heat – cold – ultra violet radiation – Ionizing radiations – Filtration – chemical sterilization – Glass preparation for use.

Unit – 2

Knowledge and skill in collecting blood samples. Analysis of blood and basic haematological techniques. Blood cell morphology in health and disease – RBC, WBC, Total count and differential count, Haemoglobin estimation. Centrifugation – Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard sedimentation Coefficient,

Unit – 3

Haematocrit, packed cell volume, MCH, MCHC, MCV, Erythrocyte sedimentation rate, RBC fragility test, platelet count. Reticulocytocrit, haemorrhagic disorders, clotting time, Bleeding time, prothrombin time.

Unit – 4

Clinical Analysis: Knowledge and skill in the study and analysis of urine. Physical parameter, Colour, Odor, pH, Density. Chemical parameters routinely required to be analysed – Sugar, Albumin, Ketone bodies and their clinical significances pregnancy tests.

Unit – 5

Clinical Studies: Analysis of faeces, semen, cerebrospinal fluid for clinical investigation. Study of vectors in the transmission of diseases with suitable examples. Agglutination and precipitation reactions, Hemagglutination and PHA, Immunofluorescence, ELISA, RIA, Coombs test (Direct and Indirect), Complement- Components and biological activities.

Text Book

1. SOOD, RAMNIK, (1985). Medicinal Laboratory Technology, Jaypee brothers, New Delhi – 384 pp.
2. KANAI. L MUKHERJEE (1988), Medical Laboratory Technology, vol. I to III, Tata McGraw Hill publishing company Ltd., New Delhi.



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M.Sc (Zoology)

SEMESTER – III

PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	MEDICAL LABORATORY TECHNIQUES	MSZ- 532

Medical Laboratory Techniques

1. Genetic and immunological basis of human blood grouping (A,B,AB,O, and Rh)
2. Estimation of haemoglobin (Hb) and Erythrocyte Sedimentation Rate (ESR).
3. Preparation of RBCs and WBCs.
4. Preparation of antiserum.
5. Electrophoretic analysis of blood serum.
6. Blood-clotting time, bleeding time, rouleux formation – preparation of Haemin crystals.
7. Qualitative analysis of urine for proteins, glucose, acetone and ketone bodies.
8. Micrometry- principle and measurement of microscopic objects: Low power and high power.
9. Camera Lucida drawing with magnification and scale.
10. Principle and working of phase contrast microscope, micro-photographic equipment and pHmeter.
11. TLC using amino acids from purified samples and biological materials.
12. Study of Enzyme kinetics - Salivary amylase on maltose standards- influence of temperature and Substrate concentration on enzyme activity (Lineweaver Burk Plot) on enzyme activity.



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

Syllabus

SEMESTER – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	BIOSTATISTICS AND COMPUTER APPLICATIONS	MSZ- 533

Unit - 1

Classification And Presentation Of Data: Definition – Statistics and its application in Biology – Collection of data; Classification : Qualitative and Quantitative; Tabulation: Diagrammatic representation – Graphical representation – frequency curves – frequency polygon and Ogive curve – Population statistics.

Unit –2

Descriptive And Inferential Statistics

Introduction and Definition of Biostatistics, Tabulation and classification of data, Frequency distribution and Graphical distribution of data, Measures of central tendencies Mean, Median, Mode and their properties. Computation of mean, variance and standard deviation, t-test.

Unit – 3

Correlation And Regression: Correlation : Correlation of Karl Pearson's Co-efficient of correlation – testing its significance – interpretation; Regression Analysis : Regression coefficient – construction of regression lines – properties – application.

Unit – 4

Basic Concept On Computers

Introduction to computers – characteristics of computers – Classification of digital computer systems – Anatomy of a digital computer – memory units.

Unit – 5

Computer Applications

Computer Software : Programming languages (BASIC, COBOL, FORTRAN, and C – only basic concept) – Windows (WORD). Data processing and Database Management – Internet – E-Mail – Computer applications in Science and Technology.



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M.Sc (Zoology)

Text books :

1. PALANICHAMY, S. and MANOHARAN, M. (1991), "Statistical Methods for Biologists", Palani Paramount Publications, Palani, T.N.
2. GURUMANI, N. (2005), "An Introduction to Biostatistics", II Edition, MJP Publishers, Chennai – 600 005.
3. SHARMA, A.K (2005) Text book of Biostatistics, Discovery publ. House, New Delhi – 110002.
4. VEER BALA RASTOGI (2007) Fundamentals of Biostatistics. Are Books India New Delhi.
5. P.N. ARORA & P.K. MALHAN (2007) Biostatistics – Himalaya publ. House, Mumbai.
1. ALEXIS LEON and MATHEWS LEON (1998; "Fundamentals of Computer Science ani Communication Engineering", Leon Techword Chennai.
2. RAJARAMAN, V. (1992), "Fundamentals of computers" 8th Edition, Prentice - Hall of India Private Limited New **Delhi**.
3. PRADEEP K. SINHA and PRITE SINHA (2005). Computer Fundamentals BPB Publications – New Delhi.

REFERENCE BOOKS

1. RAJARAM, R. (1998), "Basic Computer Science and Communication Engineering". SciTech publications, Chennai-87.
2. MORRIS MANO, M.(1988), "Computer system Architecture", II Edition, Prentice - Hall of India private Ltd., New Delhi - 110001.
3. THOMAS BARTEE, C. (1987), "Digital computer fundamentals", 6th Edition, MCGRAW - HILL BOOK COMPANY, NEWYORK.
4. SUBRAMANIAN,N.(1986) "Introduction to Computers", Tata McGraw – Hill Publishing company Limited, New Delhi.
5. RAM, B. (1997), "Computer Fundamentals -Architecture and Organization", 2nd Edition, New Age International (p) Ltd., Publishers, New Delhi.
6. ALEXIS LEON and MATHEWS LEON (1999), "Fundamentals of Information Technology" Leon Vikas, Chennai.



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M.Sc (Zoology)

SEMESTER – III PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC	BASIC CONCEPTS OF BIOTECHNOLOGY	MSZ- 533

Biostatistics

Calculation of mean, median and mode from grouped data

Calculation of mean deviation and standard deviation from grouped data

Calculation of Pearson correlation coefficient.

Calculation of regression coefficient and regression equation („x” on „y” only)

Calculation of length-weight relationship

Calculation of „Z” value (small sample only)

Calculation of Chi square value (2×2 table only)

Calculation of „t” value (for small sample comparing two variable)

Draw line graph, vertical bar diagram, horizontal bar diagram, histogram, frequency polygon, frequency curve, pie diagram and ogives on graph paper for simple grouped data.

Computer applications

1. Demonstration : computers and accessories – their usage.

CPU, Monitor,. Key board,. Mouse

2. MS Excel: Preparation of table

3. MS Excel: Preparation of graphs (bar, pie and ogives)

4. MS Excel: Formula writing (Addition, Subtraction, Multiplication, Division, Power and Root)

5. MS Excel: Correlation Analysis

6. MS Power Point: Preparation of a presentation with minimum 5 slides based on First Semester theory topics.



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M.Sc (Zoology)

Syllabus

SEMESTER – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc(Zoology)	BASIC CONCEPTS OF BIOTECHNOLOGY	MSZ- 534

Unit - 1

Techniques of Genetic Engineering: Biotechnology : Definition – Scope – Importance – Land marks in the history – Gene cloning – the basic steps – various types of restriction enzymes – ligase linkers and adaptors – c DNA – transformation – Selection of recombinants. Hybridization techniques chemical synthesis of oligonucleotides; Gene probe- Molecular finger printing (DNA finger printing) – RFLP – the PCR techniques – Genomic library – Blotting techniques – Southern blotting – Northern blotting – Western.

Unit – 2

Cloning Vectors: Plasmid biology – cloning vector based on E. coli, PBR 322 and bacteriophage; Cloning vector for yeast. Cloning vector for Agrobacterium tumefaciens. Cloning vector for mammalian cells – Simian virus 40 – Gene transfer technology – Particle bombardment – Micro injection techniques.

Unit - 3

Plant And Animal Biotechnology: Plant tissue culture-Explants, Sterilization, Media preparation, micro propagation, Green house. Animal Cell culture-organ culture-whole embryo culture- Embryo transfer-Invitro fertilization (IVF), Artificial Insemination, Germ cryopreservations and embryo transfer in human – Human gene therapy.

Unit – 4

Fermentation technology: Bioreactor – Microbial products – primary and secondary metabolites (Lactic acid, Alcohol, Vitamins, Penicillin, Vinegar and Enzymes).

Food biotechnology : Single cell protein (SCP) and mycoproteins, production of SCP from bacterial, algal, fungal and yeast biomass.

Enzyme Biotechnology : Enzymes: Classification, Characteristics, Factors affecting enzyme activity. Enzyme Kinetics, Km & Vmax, Activation and Inhibition of Enzymes. Non- Protein Enzymes, Application of Enzymes *invitro* and *in vivo*.

Unit - 5

Environmental Applications Biotechnology: Bioremediation –bioremediation of hydrocarbons – Industrial wastes – Heavy metals – Xenobiotics – bioleaching – biomining – biofuels. Applications of biotechnology in agriculture, medicine and food science. Genetically modified organism (GMO'S) – GM foods. Biotechnology & biosafety – IPR.



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M.Sc (Zoology)

Text Books

1. IGNACIMUTHU, S (1998) Basic Biotechnology, Tata McGraw Hill publishing Co., New Delhi.
2. KUMAR, H.D. (1998), Modern concepts of Biotechnology, Vikas Publishing, New Delhi.
3. DUBEY, R.C. (2001), A textbook of Biotechnology, Rajendra Printer, New Delhi.
4. Ramadass (2009), Animal Biotechnology – Recent Concepts and developments MJP. Publishers Chennai – 600 005.
5. Colin Ratlege and Bjorn Kristiansen (2006) Basic Concepts of Biotechnology Cambridge University Press.

Reference Books

1. Purohit, S.S. and S.K.Mathur. 1999. Biotechnology Fundamentals and Application. Agro Botanica, New Delhi.
2. Alan Scragg. 1999. Environmental Biotechnology, Longman Publication.
3. R.C.Dubey 2001 A text book of biotechnology. Rajendra Ravindra Printer. New Delhi.
4. T.A. Brown 2004 Gene cloning and DNA analysis. Blackwell Science, Osney Mead, Oxford.
5. Dawson, M.T., Powell . R, and Gannon, F.1996. Gene Technology. Bios Scientific Publishers.
6. Chopra, V.L. and Nanin, A.1992. Genetic Engineering and Biotechnology. Oxford and I BH Publishing Co., New Delhi.
7. Marx, J.L.1989 A Revolution in Biotechnology. Cambridge University, Press Oxford.
8. Old, R.W. and Primrose, S.B. 1985 Principles of Gene Manipulations. An introduction to Genetic Engineering. Oxford Blackwell Publishers, London.
9. Winnacker, E.L. 2003. From Genes to Clones. Panima Publishing Corporation, New Delhi.
10. Gupta, P.K. 2004. Biotechnology and Genomics. Rastogi Publications, Meerut.
11. Das. H.S. 2004. Text Book of Biotechnology. Wiley Dreamtech India Pvt. Ltd., New Delhi



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M.Sc (Zoology)

SEMESTER – III

PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	BASIC CONCEPTS OF BIOTECHNOLOGY	MSZ- 534

Biotechnology

1. Squash preparation of grasshopper testis to study meiotic stages.
2. Squash preparation and identification of salivary gland chromosomes in *Drosophila* / *Chironomus* larva.
3. Determination of mitotic index in the squash preparation of onion root tip.
4. Effect of drugs on cell division (Colchicine or any other inhibitor)
5. Preparation of Microtome section, spreading and histochemical staining of carbohydrates (PAS), Protein (Bromophenol blue), lipids (Sudan Black), DNA (Fuelgen stain).
6. Cell fractionation and Differential Centrifugation to isolate mitochondria and nuclei Isolation of genomic DNA using Agarose gel electrophoresis
7. Isolation of Plasmid DNA.



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M.Sc (Zoology)

SCHEME

Semester – IV

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSZ 541	ENVIRONMENTAL SCIENCE	20	8	80	32	-	-	100
2	MSZ 542-(a)/ MSZ 542 – (b)/ MSZ 543 – (c)	AQUACULTURE AND FARM MANAGEMENT/ Pisci Culture and Economic Importance of Fishes/ WILD LIFE CONSERVATION	20	8	80	32	-	-	100
3	MSZ 543	DISSERTATION	-	-	-	-	250	125	250
4	MSZ 544	PRACTICAL VII (BASED ON MSZ 541 & MSZ 542)	-	-	-	-	50	20	50
Total			40	16	160	64	300	145	500



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M.Sc (Zoology)

Syllabus

SEMESTER – IV

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	ENVIRONMENTAL SCIENCE	MSZ- 541

Unit - 1

Ecosystem, energy flow and ecological succession. Habitats – Terrestrial – Aquatic – Marine, Fresh water and estuary. Environmental resources- renewable and non renewable resources. Forest resources- Protection – Chipko movement- A forestation. Wild life management- Wild life sanctuaries and National Parks

Unit – 2

Natural Resources And Their Conversation: Survey of natural resources : Renewable (forest, wood and water) – forest management – Deforestation and Aforestation – conservation and protection (chipko movement) wild life resources – conservation projects (Girline, Tiger, Crocodile, Rhinoceros and Elephant).

Unit -3

Energy Resources: Non-Renewable resources (land, Energy and mineral) : Conventional (coal, lignite, petroleum and natural gas) Renewable : Non conventional (solar and wind energy) Conventional : Hydel, tidal powers, salinity energy, geothermal Nuclear power; Biogas programme in India : solar photo volt technology – Programmes in India – solar thermal technology (ST) programmes in India – Tidal power programmes in India – Principles of salinity energy conservation – geotherma) Programme in India – Types of nuclear reactors – nuclear power status around the world and country.

Unit - 4

Pollution And Management Pollution : Sources, effects and control of air, soil pollutants (solid wastes) and water pollutants – Heavy metals (Mercury, fluoride and lead) – Ground water pollution – Sewage wastewater – sewage treatment – prevention and control – Noise pollution – Radio active pollution – protection – indicator organisms – Bioaccumulation Biomagnification – Bio monitoring of pollutants.



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M.Sc (Zoology)

Unit -5

Environmental Education: Goals and objectives, principles of Environmental Education – programmes – status in India – Environmental organizations and agencies – international bodies – man and biosphere programme (MAB) – National organization – Department of environment – forests and wild life (Government of India).

Text Books

1. AGARWAL, K.C., (1999) Environmental Biology, Published by Agro Bolanica, 4.E, 176, J.N. Vyas Nagar, Bikaner, India.
2. ODUM, E.P, (1996) Fundamentals of Ecology (III Edn), Natraraj Publishers, Dehradum.
3. CASTRI, F.D and YOUNES, T. (1996) “Biodiversity; Science And Development” Cab Int., Wallingford, UK.

Environmental science

1. Identification, qualitative analysis of planktons (freshwater/marine).
2. Study of gut content of various fishes in relation to feeding habits.
3. Hydrobiological studies of water samples with special reference to pollution – O₂, free CO₂, Alkalinity, Salinity, (Carbonates and Biocarbonates).
4. Animal association – parasitism and mutualism.
5. Report on ecological collection representating different habitats – sandy, muddy and rocky shores.

Visits : Candidates are expected to study the ecology of chosen habitats and make observations of ecological interest during field studies.



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

Syllabus SEMESTER – IV

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	AQUACULTURE AND FARM MANAGEMENT	MSZ- 542(a)

Unit-1

Introduction to Aquaculture

Overview - Importance of aquaculture, Global Scbal scenario, Present in India - Prospects and scope. Aquaculture Farms; Site selection, topography, water availability and supply, soil conditions and quality. Design and layout, farm design, structure and construction.

Unit-2

Biology of important cultivable species and their economics: Standard guidance for choosing cultivable species - Seaweeds, Crustaceans (Prawns & Lobsters), Molluses (Clams, Cockles, Mussels and Oysters) and fishes - biological criteria - Environmental adaptability and compatibility, adaptability to intensive culture - Economic importance - economics, market values, by-products and availability in adkacent region.

Unit-3

Survey of seed Resources and Seed & Feed Production: Distribution and abundance of natural seed resources, collection methods and segregation.

Artificial seed production - breeding under controlled condition, induced breeding technique, larval rearing, packing and transportation.

Live feed - Microalgae, Rotofer and Artemia - their culture. Feed formulation - Conventional and non-conventional ingredients, feed additives, feed attractants and feed formulations.

Unit-4

Culture systems: Traditional, Extensive , Semi-intensive and intensive systems, composite fish culture, paddy-cum-fish culture, integrated fish culture, sewage water fish culture, raceway culture, cage, pen and rack culture Culture system management - pond preparation, production and economics.

Unit-5

Farm Management: Water quality management - temperature, salinity, pH, O₂,CO₂ levels, nutrients and trace elements; Control of parasites, predators, weeds and diseases in culture ponds.

Disease diagnosis - ELISA, Western blotting - DNA based diagnosis of diseases and fish vaccines.

Reference Books

1. Balugut, E.A.1989. Aquaculture system and practices. A selected review publishing House, New Delhi.
2. Dash, M.C. and Patnik, P.N.1994. Brackish water culture. Palani Paramount publications, Palani.
3. Michael, B.N. and Singholka, B. 1985. Freshwater Prawn Farming. A manual of culture of Macrobrachium rosenbergii. Daya Publishing House, New Delhi.



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M.Sc (Zoology)

4. Paul Raj, S. 1995. Shrimp Farming techniques, Problems and solutions. Plani Paramount Publications, Palani.
5. Paul Raj, S. 1996. Aquaculture for 2000 A.D. Palani Paramount Publications, Palani.
6. Pillay, T.V.R. 1990 Aquaculture Principles and Practices. Blackwell Scientific Publications Ltd.
7. Ponnuchammy, R.1997. Practical Guide to shrimp farming .Palani Paramount Publications,palani.
8. Post, G.M. 1983. Text Book of Fish Health. TFH Publication.
9. Sinha, V.R.P. and Srinivastava, H.C. 1991. Aquaculture Productivity. Oxford and IBH Publications Co., Ltd., New Delhi.

SEMESTER – IV

PRACTICAL

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	AQUACULTURE AND FARM MANAGEMENT	MSZ- 542

AQUACULTURE, FARM MANAGEMENT AND ECONOMIC ZOOLOGY

1. Study of feeding habits of fish through qualitative and quantitative analysis of gut contents of herbivore, carnivore and omnivore species.
2. Study of the scale, vertebra and otolith for determination of age.
3. Determination of gonadosomatic index.
4. Estimation of fecundity.
5. Measurement of ova diameter.
6. Length-weight relationship.
7. Study of the principal stages in the life history of prawn.
8. Methodology of induced breeding of fish through hypophysation.
9. Dissection, collection and preservation of pituitary gland.
10. Preparation of pituitary extract.
11. Dosage and technique of injecting pituitary extract(demonstration)
12. Estimation of total protein and identification of amino acids in fish muscle(two directional chromatography).
13. Extraction and estimation of liver and body oil from commercially important fishes.
14. Fishing crafts and gears-identification of various components of a mechanized fishing craft 15. from actual specimen/model/drawing.
16. Study of principal types of fishing gears from actual specimen/model/drawing.
17. Identification of fishing gear materials:twines, ropes, floats,sinkers,buoys and anchors.
18. Identification of fishery by-products.
19. Collection and identification of aquatic weeds and aquatic insects.
- 20 Formulation and preparation of artificial fish food for Indian major carps and Prawns.
- 21 Soil texture using micrometry from two different sites.
- 22 Determination of moisture content.
- 23 Determination of soil pH from at least three different locations and correlate it with the soil type.
- 24 Determination of Chloride, Calcium, Magnesium, Potassium and Phosphorous.
- 25 Determination of Calcium Carbonate in Egg shell- (Three different types of egg; calculate the mean value and the standard deviation, and compare it with the standard values).
26. Estimation of primary productivity in two different aquatic ecosystems and interpretation of the results.
27. Compare the results of Dark and Light bottle method and Chlorophyll method.
28. Identification of trophic levels from gut analysis (Fish or insect)
29. Study of biodiversity in Forest/Grass land and Pond/River and report the species richness, abundance and animal interactions. Calculate frequency, abundance, evenness and diversity indices



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	Pisci Culture and Economic Importance of Fishes	MSZ- 542(b)

UNIT-1

1. Collection of fish seed from natural resources.
2. Dry bundh breeding of carps.
3. Wet bundh breeding of carps.
4. Hypophysation and breeding of Indian major carps.

Unit-2

1. Drugs useful in induced breeding of fish
2. Types of ponds required for fish culture farms
3. Management of hatcheries, nurseries and rearing ponds
4. Management of stocking ponds

Unit-3

1. Composite fish culture
2. Prawn culture and pearl industries in India.
3. Fisheries resources of MP
4. Riverine fisheries.

Unit-4

1. Coastal fisheries in India.
2. Offshore and deep sea fisheries in India.
3. Role of fisheries in rural development.
4. Sewage fed fisheries.

Unit-5

1. Methods of fish preservation.
2. Marketing of fish in India.
3. Economic importance and by product of fishes.
4. Shark liver oil industry in India .
5. Transport of live fish & fish seed



RKDF UNIVERSITY, BHOPAL

M.Sc (Zoology)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Zoology)	WILD LIFE CONSERVATION	MSZ- 542(c)

Unit-1

1. **Wild life -**
 - (a) Values of wild life - positive and negative.
 - (b) Our conservation ethics.
 - (c) Importance of conservation.
 - (d) Causes of depletion.
 - (e) World conservation strategies.
2. **Habitat analysis, Evaluation and management of wild life.**
 - (a) Physical parameters - Topography, Geology, Soil and water.
 - (b) Biological Parameters - food, cover, forage, browse and cover estimation.
 - (c) Standard evaluation procedures - remote sensing and GIS.
3. **Management of habitats -**
 - (a) Setting back succession.
 - (b) Grazing logging.
 - (c) Mechanical treatment.
 - (d) Advancing the successional process.
 - (e) Cover construction.
 - (f) Preservation of general genetic diversity.

Unit-2

1. **Population estimation.**
 - (a) Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation.
 - (b) Faecal analysis of ungulates and carnivores - Faecal samples, slide preparation, Hair identification, Pug marks and census method.
2. **National Organization.**
 - (a) Indian board of wild life.
 - (b) Bombay Natural History Society.
 - (c) Voluntary organization involved in wild life conservation.
3. **Wild life Legislation -** Wild Protection act - 1972, its amendments and implementation.

Unit-3

1. Management planning of wild life in protected areas.
2. Estimation of carrying capacity.
3. Eco tourism / wild life tourism in forests.
4. Concept of climax persistence.
5. Ecology of perturbation.

Unit-4

1. Management of excess population & translocation.
2. Bio- telemetry.
3. Care of injured and diseased animal.
4. Quarantine.
5. Common diseases of wild animal.

Unit-5

1. Protected areas National parks & sanctuaries, Community reserve.



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M.Sc (Zoology)

2. Important features of protected areas in India.
3. Tiger conservation - Tiger reserve in M.P, in India.
4. Management challenges in Tiger reserve.

List of Practicals

- 1. Identification and comments upon wild life animals.**
- 2. Study of endangered species.**
- 3. Study of local birds and their habit habitats**
- 4. Study of ecosystem**
- 5. Study of local Biodiversity.**
- 6. Distribution of wild life India.(National parks and sanctuaries)**
- 7. Soil and Water Analysis.**
- 8. Study of plankton.**
- 9. Preparation and Maintenance of Aquarium.**
- 10. Study of common weeds of fish ponds.**
- 11. Methods of culture related to theory papers.**
- 12. Study of abiotic factors of water related to fish life.**
- 13. Identification and comments on Aquaculture animals.**
- 14. Viva – voice**
- 15. Practical Record.**