



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER I

Subject Code	Subject title	Credit
MJ01ZOO	NON –CHORDATES	3

#### **UNIT I: Kingdom Protista**

General introduction and classification upto class

Locomotion in Protista

Reproduction and Nutrition in Protista

#### **UNIT II: Phylum Porifera, Cnidaria, Ctenophora**

General characters and classification upto class

Canal system in Porifera

Coral and coral Reef formation.

Alteration of Generation in cnidarian.

Evolutionary significance of ctenophore

#### **UNIT III: Helminthes**

General characters and classification of Platyhelminthes, Nematelminthes and Aschelminthes upto class

Life cycle of Fasciola hepatica

#### **UNIT IV: Annelida**

Segmentation in Annelids

Origin of coelom

#### **UNIT V: Arthropoda**

General characters, Classification upto class

vision in Arthropods, Appendages in Arthropods

#### **UNIT VI: Mollusca**

General characteristic of Mollusca. Classification upto class

Torsion and Detorsion in Mollusca

**2023 Onwards**



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### **UNIT VII: Echinodermata**

General characters, classification upto class

Water vascular system in Echinodermata

### **Chordates (Pisces to Mammals)**

#### **UNIT I: Chordata**

Introduction to chordates and its origin general characters and outline classification

#### **UNIT II: Protochordates**

1. General characters of Hemichordates Urochordates and Cephalochordates.

#### **UNIT III: Agnatha**

General characters and classification of cyclostomes.

#### **UNIT IV: Pisces**

General classification of chondrichthyes and Osteichthyes

Parental care in fishes

#### **UNIT V: Amphibia**

General Classes and classification of Amphibia

Parental care in Amphibians.

#### **UNIT VI: Reptilia**

Poison apparatus and Biting mechanism in snakes.

#### **UNIT VII: Aves**

General characters of Aves

Flight adaptations in birds

Flightless Birds, a brief idea.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### UNIT VIII: Mammalia

General characters and classification up to classes, Dentition in mammals.

#### Reference Books:

1. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Singh, S. Keshari S. and Abhishek, K.S. (2016). Medical Zoology and Parasitology, Jharkhand Jharokha, Classical Publishing Company.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL01ZOO	NON –CHORDATES LAB	1

### PRACTICALS:

1. Study of whole mount of Euglena, Amoeba and Paramecium; Binary fission and Conjugation in Paramecium. Sycon (including T.S. and L.S.), Obelia, Physalia Aurelia, Gorgonia, Metridium, Pennatula, Aphrodite, Nereis, Heteronereis, Pheretima, Hirudinaria, Sacculina, Cancer, Pila, Unio, Asterias, Antedon
2. Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/micro-photographs)
3. Study of adult Ascaris lumbricoides and their life stages (Slides/micro-photographs)
4. Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER III

Branch	Subject title	Credit
B.Sc. Zoology	CHORDATES	MJ02(ZOO)

#### UNIT I: Chordata

Introduction to chordates and its origin general characters and outline classification

#### UNIT II: Protochordates

1. General characters of Hemichordates Urochordates and Cephalochordates.

#### UNIT III: Agnatha

General characters and classification of cyclostomes.

#### UNIT IV: Pisces

General classification of chondrichthyes and Osteichthyes

Parental care in fishes

#### UNIT V: Amphibia

General Classes and classification of Amphibia

Parental care in Amphibians.

#### UNIT VI: Reptilia

Poison apparatus and Biting mechanism in snakes.

#### UNIT VII: Aves

General characters of Aves

Flight adaptations in birds

Flightless Birds, a brief idea.



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## B.Sc. Zoology

### **UNIT VIII: Mammalia**

General characters and classification up to classes, Dentition in mammals

#### **Books suggested:**

1. Young, J. Z.(2004).The Life of Vertebrates. III Edition. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International



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## B.Sc. Zoology

Branch	Subject title	Subject Code
B.Sc. Zoology	<b>CHORDATES LAB</b>	MJL02(ZOO)

### 1. Study of Museum specimen:

Petromyzon, Myxine, Scoliodon, Heteropneustes, Labeo, Exocoetus, Hippocampus, Tetrodon, Bufo, Hyla, Alytes, Salamandra, Uromastix, Draco, Vipera, Naja, Hydrophis, Columba, Bat

1. Types of beaks and claws
2. Types of Hoofs in animals.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ03ZOO	Fundamentals of Ecology	3

### UNIT I: An Overview of Ecology

1. Structure and function of an ecosystem
2. Energy flow in an ecosystem: Lindeman's trophic dynamic concept
3. Laws of limiting factor: Shelford's law of tolerance
4. Food chain and Food web
5. Productivity and its management
6. Biome: An introduction and its type.

### UNIT II: Population Ecology:

1. Population attributes, Survivorship curve.
2. Exponential and logistic growth.
3. Population Regulation – Density and density independent factors/

### UNIT III: Community Ecology:



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## B.Sc. Zoology

1. Community Characters, Analytical and synthetic characters
2. Community Diversity Indices
3. Community Interactions – positive and Negative interactions
4. Niche concept: Niche overlap. Gause's principle with laboratory and field examples.
5. Community Dynamics - Succession and climax concept

### **UNIT IV: Environment Management:**

1. Natural resources - types
2. Biogeochemical cycles – Water, Carbon, Nitrogen
3. Biodiversity - Alpha, Beta, Gamma. Hotspots

### **Books Suggested:**

- Raziuddin, M., Mishra P.K. 2014, A Hand book of Environmental Studies, Akanaksha Publications Ranchi.
- Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
- Gleeson, B. and Low, N.(eds.) 1999. Global Ethics and Environment, London, Routledge.



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<b>Subject Code</b>	<b>Subject title</b>	<b>Credit</b>
MJL03ZOO	<b>Ecology-Lab</b>	1

1. Study of life tables and plotting of survivorship curves of different types from the hypothetical/ real data provided'
2. Determination of population density in a natural/hypothetical community by quadrat method and calculation on of Shannon – Weiner diversity index for the same community.
3. Study of an aquatic ecosystem: phytoplankton and zooplankton; Measurement of area, temperature, turbidity/penetration of light, determination of pH, a Oxygen content Oxygen content (Winkler's method), Biological Oxygen Demand, Chemical Oxygen Demand and free CO<sub>2</sub>.
4. Report on a visit to National Park/ Biodiversity Park/ Wildlife sanctuary



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### SEMESTER III

Subject Code	Subject title	Credit
MJ04(ZOO)	Biochemistry	3

#### **UNIT I: Biomolecules: A brief account of Carbohydrates, protein and lipids.**

#### **UNIT II: Carbohydrates:**

1. Structure and classification. Metabolism of carbohydrates. Glycolysis, Krebs's cycle, ETS and ATP synthesis.
2. Glycogenesis, Gluconeosis. Glycogenesis HMP shunt.

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

Structure and classification. Steroids keto genesis and synthesis of Palmitic Acid.

#### **UNIT IV: Proteins**

1. Composition, structure and biological significance.
2. Amino acids: structure and classification.
3. Catabolism of Amino acid: Transamination & Deamination.

#### **UNIT V: Enzymes**



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## B.Sc. Zoology

1. Nomenclature and classification.
2. Enzyme kinetics. Regulation of Enzyme action Coenzymes and Iso enzymes.
3. Enzyme inhibition and Km equation Organic reactions and their mechanism:  
Addition, Elimination and Substitution reactions

### Reference Books:

1. Cox, M. M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
3. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009,). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw – Hill Companies Inc.



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<b>Subject Code</b>	<b>Subject title</b>	<b>Credit</b>
MJL04ZOO	<b>Biochemistry-Lab</b>	1

1. Quantitative test of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ05ZOO	Evolution & Bioinformatics	3

### **Evolution:**

Concept of Evolution,

Theories of organic evolution: Neo Darwinism Synthetic theory of Evolution Population,

Gene frequency,

Hardy Weinberg's law in genetic stability Genome evolution – Evolution of Multigene family, Genetic Drift, Isolation,

### **Bioinformatics:**

Principles of bioinformatics and its application biological databases:

- Nucleic acid sequence databases
- Protein sequence databases
- Protein structure databases
- Literature database Data retrieval systems: Search engines, Entrez Molecular sequence analysis software packages and tools: BLAST, RasMol, Biologist's Workbench – PERL

Books referred:

1. Evolutionary Biology: Organic Evolution by Veer Bala Rastogi.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL05ZOO	Evolution & Bioinformatics-Lab	1

### **Bioinformatics lab.**

- (a) Use of search engines
- (b) Use of data bases – Gene Bank, PubMed.
- (c) Demonstration of software packages – BLAST and CLUSTAL



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## B.Sc. Zoology

### SEMESTER IV

Subject Code	Subject title	Credit
MJ06ZOO	CELL BIOLOGY AND BIOSTATISTICS	3

#### GROUP A

**UNIT I:** A general concept of prokaryotic and eukaryotic cells Cell theory, General structure of different cell organelles including Mitochondria, Golgi complex,

**UNIT II:** Endoplasmicreticulum, Nucleus. Ribosome, Lysosome

**UNIT III:** Cytoskeleton – Composition and function. Micro tubules and micro filaments  
GERL system

**UNIT IV:** Cell membrane structure: Chemical composition of Plasma membrane of Erythrocyte, Active and Passive transport, (Diffusion and osmosis) AT Pase Pump and Exchange.

**UNIT V:** Cell Adhesion Molecules and ECM

**UNIT VI:** Cell cycle, cell signalling, and cell culture:



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1. A brief introduction to cell cycle, its various phases
2. Mitosis and Meiosis, Cell division, Check points and its regulation.
3. Apoptosis and Cancer
4. Cell signalling, Regulation of signalling pathways.(GPCR and RTR)
5. Cell communication

**UNIT VII:** Types of culture media: Sterilization method Somatic cell hybridization.

**Biostatistics** Types of data: Primary and secondary data

1. Mean, Median, Mode, Standard Deviation, Standard error, Chisquaretest, t-test, f-test, ANOVA, Correlation, Regression Analysis.
2. Basics of statistics software – SPSS, XLSTAT etc.

### Reference Books:

#### GROUP-A

1. Karp, G.(2010).Cell and Molecular Biology: Concepts and Experiments.VI Edition.
2. John Wiley and Sons.Inc.
3. DeRobertis, E.D.P. and DeRobertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009).The Cell: A Molecular Approach. V Edition.

#### GROUP B

1. W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences (10<sup>th</sup> edition) John Wiley.



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2. Milton, J.S. & Tsokos, J.O.(1992) Statistical Methods in the Biological and Health Sciences (2<sup>nd</sup> edition) Mc Graw Hill.
3. Zar, J.H.(2013) Biostatistical Analysis (5<sup>th</sup> edition) Pearson.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL06ZOO	Cell Biology And Biostatistics-Lab	1

### PRACTICALS:

#### GROUP A

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. Study various stages of meiosis from permanent slides.
3. Preparation of permanents slide to show the presence of Barr body in human female blood cells/ cheek cells.
4. Preparation of permanent slide to demonstrate:
  - a. DNA by Feulgen reaction
  - b. DNA and RNA by MGP
  - c. Mucopolysaccharides by PAS reaction
  - d. Proteins by Mercurobromophenol blue/ Fast Green.

#### GROUP B

1. Calculation of mean, standard deviation and standard error.
2. Calculation of correlation coefficient values and finding out the probability
3. Student's t-test dependent and independent, hand calculation and calculation using MS-Excel.
4. ANOVA- hand calculation and calculation using MS-Excel.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ07(ZOO)	Animal Physiology	3

### **UNIT I: Tissue**

Structure and classification, Bone and Cartilage

### **UNIT II: Digestive System**

Gastrointestinal tract and its associated glands, Mechanical and Chemical digestion of food, Absorption of Carbohydrate, Protein and Lipid

### **UNIT III: Respiratory System**

Histology of trachea and Lungs, Respiratory volumes, Respiratory Pigments, Diffusion of respiratory gases and Transport of O<sub>2</sub> and CO<sub>2</sub>

### **UNIT IV: Circulatory System**

Structure and Working of Mammalian Heart

Blood groups, Rh factor Blood and its components, Blood clotting Mechanism Cardiac cycle

### **UNIT V: Skeletal system**

Ultra-structure of Skeletal Muscle, chemical basis of muscle contraction.

### **UNIT VI: Excretory System**

Kidney: structure and function, Mechanism of urine formation, Counter – Current theory,



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Ornithine – Arginine cycle

### **UNIT VII: Reproductive System**

Histology of male and female reproductive organs, physiology of reproduction in male and female, Accessory Reproductive organs, Methods of Contraception, Reproductive Hormone.

**UNIT VIII: Endocrine system:** Basics of Endocrine glands (Pituitary, Pineal, Thyroid, Pancreas Adrenal, Thymus, and Gonads). Classification of hormone  
Mode of hormone action. (TSH/Adrenaline)

### **UNIT IX: Nervous System**

Ultrastructure of Neuron, Physiology of nerve conduction, Reflex Action,

### **Reference Books:**

1. Guyton, A.C. & Hall, J.E. (2006). Text book of Medical Physiology. XI Edition. Her court Asia PTE Ltd. /W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S.(2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons.
3. Victor P. Eroschenko. (2008). Di Fiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. &Wilkins.
4. Arey, L.B.(1974). Human Histology. IV Edition. W.B. Saunders.
5. De Fiore Atlas of Human histology. Physiology Vandor



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL07ZOO	ANIMAL PHYSIOLOGY-Lab	1

### PRACTICALS:

1. Recording of simple muscle twitch with electrical stimulation (or virtual).
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells.
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.
5. Microtome: Preparation of permanent slide of mammalian tissues.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ08ZOO	COMPARATIVE ANATOMY	3

### **UNIT I: Integumentary System**

Structure Function and Derivatives of integument

### **UNIT II: Skeletal System**

An Over view of Axial and Appendicular Skeleton, Jawsuspensorium

### **UNIT III: Digestive System**

Alimentary Canal and associated gland, Dentition

### **UNIT IV: Respiratory System**

Skin, Gills, Lungs, Air Sacs and accessory respiratory organs

### **UNIT V: Circulatory System**

Evolution of Heart and Aortic arches, General plan of Circulation

### **UNIT VI: Urinogenital System**

Succession of Kidney, Evolution of Urinogenital duct

### **UNIT VII: Nervous system**

Comparative account of brain, Autonomic Nervous System, Spinal Cord, Cranial Nerves in Mammals



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### UNIT VIII: Sense Organ

Brief account of Visual and Auditory receptor

#### Reference Books:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw –Hill Companies.
3. Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills
4. Hilderbr and, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
5. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL08ZOO	COMPARATIVE ANATOMY-Lab	1

### PRACTICALS:

1. Study of placoid, cycloid and ctenoid scales through permanent slides/ photographs.
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit.
3. Carapace and plastron of turtle/ tortoise.
4. Mammalian skulls: One herbivorous and one carnivorous animal.
5. Dissection of rat to study arterial and urogenital system (subject to permission digital mode)
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video
7. Recording (may be included if dissection not permitted).
8. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER V

Subject Code	Subject title	Credit
MJ09ZOO	Molecular Biology	3

#### **UNIT I: DNA- Chemistry of nucleic acids (DNA & RNA):**

N-bases, Pentose sugar, Nucleosides & Nucleotides, Watson - model of DNA, Types of DNA (A, B & Z), Base pairing, Major & minor grooves of DNA, uninterrupted genes.

#### **UNIT II: DNA synthesis in E. coli:**

Semi-conservative DNA replication, Replication fork, DNA polymerases, Phases- initiation, elongation and termination. Errors in DNA and their repair (base excision repair & nucleotide excision pair)

#### **UNIT III: Transcription in E. coli:**

Consensus sequences, Promoter (-35 & -10 elements), RNA polymerase, Phases- initiation, elongation and termination. RNA processing of mRNA.

#### **UNIT IV: RNA:**

Chemistry of RNA, types of RNA (mRNA, rRNA, tRNA, snoRNA), Structure of mRNA & tRNA (clover-leaf model), Basics of RNA edit, RNAi.

#### **UNIT V: Genetic codes:**

History of genetic codes, Features of genetic codes, Wobble hypothesis. Central dogma.

#### **UNIT VI: Translation in E. coli:**

Translation factors, charging of tRNAs, Phases- initiation, elongation and termination.



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### **UNIT VII: Gene recombination:**

Homologous recombination.

### **UNIT VIII: Operon concept:**

Operon and its types, Lac operon – inducible, constitutive & non-inducible.

### **UNIT IX: Basics of the genetics of cancer:**

Proto-oncogenes, Gene regulation of the cell cycle. Gene therapy, Stem cell therapy, BLAST

### **Reference Books:**

1. Lehninger Principles of biochemistry: Cox & Nelson, MacMillan & Freeman, USA
2. Molecular biology of Gene: Watson et al., Pearson Publication, USA
3. Strickberger's Genetics, Prinitis Hall of India (PHI), Delhi
4. Principles of Genetics: Snustad & Simmons, John Wiley & Sons, USA
5. Modern Genetics Analysis: Integrating Genes and Genomes, Griffith et al., W. H. Freeman & Company, USA
6. Genetics: Russell & Benjamin, Cummings Publishing Company, USA.
7. Genetics: PK Gupta, Rastogi Publication, NewDelhi.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL09ZOO	Molecular Biology	1

### PRACTICALS:

1. Study of polytene chromosomes from Chironomus / drosophilalarvae.
2. Preparation of liquid culture medium (LB) and raise culture of E.coli.
3. Estimation of the growth kinetics of E. coli by turbidity method.
4. Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking.
5. Demonstration of antibiotic sensitivity/ resistance of E.coli to antibiotic pressure and interpretation of results.
6. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A<sub>260</sub> measurement).
7. Quantitative estimation of RNA using Orcinol reaction.
8. Study and interpretation of electron micrographs/ photo graph showing
  - i. DNA replication
  - ii. Transcription
  - iii. Split genes



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ10ZOO	GENETICS	3

### **UNIT I: Genetics**

Pre- Mendelian genetics, Mendel's life, Symbols, and terminologies, Laws of dominance, segregation & independent assortment, Back cross & test cross, Multiple alleles, and Incomplete Dominance.

### **UNIT II: Linkage:**

Coupling & repulsion hypothesis, Morgan's view of linkage, kinds of linkage, Chromosomal theory of linkage, Human chromosomal maps.

### **UNIT III: Crossing over or Gene recombination:**

Somatic & germinal crossing over, kinds of crossing over, Theories of the mechanism of crossing over.

### **UNIT IV: Eukaryotic Chromosomes:**

Structure & chemical composition of chromosomes. Karyotype, Ideogram, Human karyotype, Lamp brush chromosome

### **UNIT V: Sex determination:**

Genic balance theory, Chromosomal theory &, Types of sex determination, Environmental sex determination, Role of SRY gene in sex determination, and developing gonads.

### **UNIT VI: Sex-linked inheritance:**

Sex chromosomes, X-linked genes (colour blindness & haemophilia in humans), Y-linked inheritance, Sex – limited & Sex influenced traits.

### **UNIT VII: Pedigree analysis:**

Penetrance & expressivity, Symbols, Pedigree analysis of dominance inheritance (poly dactyly in man), Recessive inheritance (cysticfibrosis), and sex-linked inheritance (colour blindness).

### **UNIT VIII: Mutation:**

Historical background, Mutagens, Chromosomal mutation & gene mutation, Chromosomal aberrations in humans, Euploidy & aneuploidy



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### Reference Books:

- Strickberger's Genetics, Prentice Hall of India (PHI), Delhi
- Principles of Genetics: Snustad & Simmons, John Wiley & Sons, USA
- Modern Genetics Analysis: Integrating Genes and Genomes, Griffith et al
- W.H. Freeman & Company, USA



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL10ZOO	Genetics	1

### PRACTICALS:

1. To study the Mendelian laws and gene interactions
2. Chi- square analyses using seeds/ beads/ Drosophila.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on don data fromrosophila crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human in herited traits.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ11ZOO	<b>DEVELOPMENTAL BIOLOGY</b>	3

### UNIT I: Basic concept of Development

Basic concept of Development- Potency, Commitment, Specification, Induction, Competence.

1. Phase of Development: Embryo genesis, Organo genesis, Blasto genesis in seurchin & chick.
2. Period of Development: Embryonic period, Post embryonic period.
3. History of Embryology: Baer's law, theory of preformation, theory of epigenesis, mosaic theory.
4. Pattern & axes formation in amphibian.
5. Differential gene expression: cytoplasmic determinants and asymmetric cell division.

### UNIT II: Early Embryonic Development

Gametes: sperm or male gametes: types of sperms, Eggs or Female gametes: types of eggs

1. Gametogenesis: Spermato genesis, Oogenesis.
2. Egg membranes.
3. Fertilization (External seurchin and Internal Chick) & its mechanism.
4. Planes and patterns of cleavage.
5. Types of Blastula.
6. Fate Maps
7. Early development of frog and chick up to gastrulation.

### UNIT III: Late Embryonic Development

1. Extra embryonic membranes in birds.
2. Implantation of embryo in humans.
3. Placenta: Structure, types and functions of placenta.



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### **UNIT IV: Post embryonic Development Metamorphosis:**

Types of Metamorphosis. Metamorphosis in amphibians Hormonal control of metamorphosis in amphibians

1. Regeneration: Types of Regeneration
2. Epimorphosis
3. Morphall axis
4. Compensatory regeneration
5. Ageing: Concepts and Theories

### **UNIT V: Implications of Developmental Biology**

1. Teratogenesis: Teratogenic agents and their effect on embryonic development.
2. Invitro: fertilization (IVF)
3. Embryonic stem cells (Esc)
4. Amniocentesis.

### **Reference Books:**

1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky B.I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press.
3. Kalthoff (2008). Analysis of Biological Development ,II Edition, McGraw - Hill Publishers.
4. Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL11ZOO	<b>DEVELOPMENTAL BIOLOGY-Lab</b>	1

### **PRACTICALS:**

Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages).

1. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
2. Study of different types of placenta (photomicrograph/ slides)
3. Project report on chick embryo development.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER VI

Subject Code	Subject title	Credit
MJ12ZOO	Evolution	3

#### UNIT I: Introduction to Evolutionary Theories

1. Historical review of evolutionary concept:
2. Lamarckism, Darwinism, Modern synthetic theory

#### UNIT II: Evidence of Evolution

1. Geological time and scale
2. Fossil record (types of fossils, transitional forms,)
3. Adaptive Radiation, Homology and analogy
4. Evolution of horse.

#### UNIT III: Process of Evolutionary change

Sources of Variations:

1. Heritable variations and their role in evolution.
2. Concept of coevolution, parallel evolution.

#### UNIT IV: Principles of Population genetics

Population genetics.

1. Hardy Weinberglaw (statement and derivation of equation, application of law to human population)
2. Evolutionary forces upsetting H-Wequilibrium
3. Natural selection
4. Genetic Drift



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### **UNIT V: Species concept**

Product of Evolution:

1. Micro evolutionary changes (Inter population variations, clines, races)
2. Species concept
3. Isolating mechanism
4. Modes of speciation-allopatric, sympatric.
5. Macro evolution(Adaptive Radiation)

### **UNIT VI: Extinctions**

Background and Mass extinctions (causes and effects)

1. Detailed example of K-Extinctions

### **UNIT VII: Origin and Evolution of Man**

Unique homin in characteristics contrasted with primate characteristics.

1. Primate phylogeny from Dryopithecus leading to Homosapiens.

### **UNIT VIII: Phylogenetic trees**

#### **Multiple sequence alignment**

1. Construction of Phylogenetic trees.
2. Interpretation of phylogenetic trees.

#### **Reference Books:**

1. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
2. Barton, N.H., Briggs, D.E.G., Eisen, J.A., Goldstein, D.B. and Patel, N.H. (2007). Evolution. Cold Spring Harbor Laboratory Press.
3. Hall, B. K. and Hallgrímsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
4. Pevsner, J. (2009). Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL12ZOO	EVOLUTION-Lab	1

### PRACTICALS:

Study of fossil evidences from plaster cast models and pictures.

1. Study of homology and analogy from suitable specimens/ pictures.
2. Study and verification of Hardy – Weinberg Law by chi – square analysis.
3. Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies.
4. Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to the age and sex.
5. Construction of phylogenetic tree with the help of bioinformatics tools (Clustal X and Phylip) and its interpretation.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ13ZOO	Insecta	3

### UNIT I: Introduction

1. General features of insects
2. Distribution and success of Insect on earth

### UNIT II: Insect Taxonomy

1. Basics of insects classification: Classification of insects up to orders (Orthoptera, Coleoptera, Dictyoptera, Lepidoptera)

### UNIT III: General Morphology of Insects

1. External features of a typical insect
2. Structure & Type of antennae
3. Structure & Types of Mouthparts w.r.t feeding habits Type of legs adapted to diverse habitat

### UNIT IV: Physiology of Insects

1. Reproductive system
2. Endocrine system
3. Nervous system
4. Sensory receptors – vision and sound receptors

### UNIT V: Insect Animal Interaction

1. Social economic insects (honey bees and termites) – Social organization & Social behaviour.
2. Insects as a vector – Mechanical and biological vectors
3. (Muscadomestica, Anopheles & Culex)



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### **UNIT VI: Insect Plant Interaction**

1. Role of allochemicals & pheromones in host plant mediation.
2. Host plant selection by phytophagous insects
3. Insect as plant pests & concept integrated pest management (IPM)

### **UNIT VII: Developmental Biology of Insects**

1. Developmental biology of Insects – oogenesis & spermatogenesis.
2. Structure of egg and sperm
3. Fertilization, Growth, types of Metamorphosis and its hormonal regulation

### **Reference Books:**

1. A general textbook of entomology. Imms. A. D. Chapman & Hall, UK
2. The insects: Structure and functions. Chapman. R.F. Cambridge University Press, U
3. Principles of insect morphology. Snodgrass. R.F. Cornell University Press, USA. Introduction to the study of insects. Norro. D.J. Triplehorn. C.A. and Johanson. N.F. Saunders. College Publication, USA.
4. Developmental Biology. Gilbert. Sinauer Associates, Inc., Publishers. Sunderland, Massachusetts  
U.S.A



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## B.Sc. Zoology

<b>Subject Code</b>	<b>Subject title</b>	<b>Credit</b>
MJL13ZOO	<b>Insecta -Lab</b>	1

### **PRACTICALS:**

1. Study of one specimen from each insect order
3. Study of different kinds of antennae, legs and mouth parts of insects
4. Study of head and sclerites of any one insect
5. Study of insect wings and their venation.
6. Study of insect spiracles
7. Methodology of collection, preservation and identification of insects.
8. Morphological studies of various castes of Apis, Camponotus and Odontotermes
9. Study of any three insect pests and their damages
10. Study of any three beneficial insects and their products



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ14ZOO	Sericulture	3

### Unit-I

History of Sericulture.

### Unit-II

Types of Silkworms, Distribution in India and other countries.

### Unit-III

Production of mulberry and non-mulberry silk in India and other countries. Comp. Production efficiencies.

### Unit-IV

Sericulture organization in India – Administrative set up – Research and training set up – Seed production – Cocoon production and Marketing of cocoon and silk – Reeling and Weaving sectors – Exports and imports –Tariff protection.

### Unit- V

Sericulture Research in India and its impact and also research being carried out in the universities.



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## B.Sc. Zoology

<b>Subject Code</b>	<b>Subject title</b>	<b>Credit</b>
MJL14ZOO	<b>Sericulture-Lab</b>	1

- 1.Estimation of Hatching and Brushing Percentage of Silkworm Eggs
- 2.Estimation of Moisture Content of Mulberry Leaves for Chawki Rearing
- 3.Determination of Mulberry Leaf Driage in the Rearing Bed –
- 4.Estimation of Silkworm Larval Density in the Rearing Bed and Silkworm Population During Chawki Rearing
- 5.Estimation of Larval Density and Shoot Quantity Required for Late Age Rearing (Shoot Feeding Method) for 100 dfls



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ15ZOO	Nanobiotechnology	3

1. Introduction of Nanobiotechnology and its applications. Various types of nanomaterial utilized in agriculture
2. Nanoparticles in agricultural and food diagnostics: Enzyme Biosensors and Diagnostics – DNABased Biosensors and Diagnostics, Radiofrequency Identification.
3. Nanotechnology in food production: Food and new ways of food production -Efficient fractionation of crops, Efficient product structuring -Optimizing Nutritional Values - Applications of Nanotechnology in Foods: Sensing, Engineering Food Ingredients to Improve Bioavailability - Nanocrystalline Food Ingredients – Nano-emulsions – Nano Engineered Protein Fibrils as Ingredient Building Blocks.
4. Nanotechnology in food packaging: Reasons to Package Food Products. Smart nanomaterials for packaging.
5. Sequence alignment and its evolutionary basis: Simple alignment and multiple sequence alignment - searching the database for sequence similarity – search programmes with special reference to FASTA, BLAST, CLUSTAL W. Application of bioinformatics in phylogenetic analysis.

### Reference Books:

1. Xiong, Essential Bioinformatics. Cambridge University Press.
2. Marketa J Zvelebil, Understanding Bioinformatics. Garland Science.
3. Shui Quing Ye, Bioinformatics: A practical Approach.
4. Anna Tramontano, Introduction to Bioinformatics
5. David W Mount, Bioinformatics. CBS



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## B.Sc. Zoology

6. Mani K and Vijayaraj N, Bioinformatics. KalaikathirAchchagam.
7. Augen Jeff, Bioinformatics in the post genomic era. Addison Wesley.
8. The 2018-2023 World Outlook for Nanobiotechnology Paperback – December 18, 2017, Icon group international.
9. Arunava Goswami and Samrat Roy Choudhury, Nanobiotechnology, Basic and Applied Aspects.
10. Clive Jarvis, Nanobiotechnology: An Introduction.
11. H B Singh, S Mishra, L F Fraceto, R D D Lima; Emerging Trends in Agri-Nanotechnology.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

<b>Subject Code</b>	<b>Subject title</b>	<b>Credit</b>
MJL15ZOO	Nanobiotechnology - Lab	1

1. Search and Sequence retrieve from genbank database.
2. Alignment of sequence by using tools: Clustal X, Clustal W, Mega and Bioedit.
3. Phylogenetic tree analysis by using Mega software.
4. Primer designing by using online tools.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER VII

Subject Code	Subject title	Credit
MJ16ZOO	Fish and Fisheries	3

#### Unit 1

##### **Introduction and Classification:**

General description of fish; Account of systematic classification of fishes (upto classes); Classification based on feeding habit, habitat and manner of reproduction.

#### Unit 2

##### **Morphology and Physiology:**

Types of fins and their modifications; Locomotion in fishes; Hydrodynamics; Types of Scales, Use of scales in classification and determination of age of fish; Gills and gas exchange; Swim Bladder: Types and role in Respiration, buoyancy; Osmoregulation in Elasmobranchs; Reproductive strategies (Special reference to Indian fishes); Electric organs; Bioluminescence; Mechanoreceptors; Schooling; Parental care; Migration

#### Unit 3

##### **Fisheries:**

Inland Fisheries; Marine Fisheries; Environmental factors influencing the seasonal variations in fish catches in the Arabian Sea and the Bay of Bengal; Fishing crafts and Gears; Depletion of fisheries resources; Application of remote sensing and GIS in fisheries; Fisheries law and regulations

#### Unit 4

**Aquaculture:** Sustainable Aquaculture; Extensive, semi- intensive and intensive culture of fish; Pen and cage culture; Polyculture; Composite fish culture; Brood stock management; Induced breeding of fish; Management of finfish hatcheries; Preparation and maintenance of fish aquarium; Preparation of compound diets for fish; Role of water quality in aquaculture; Fish diseases: Bacterial, viral and parasitic; Preservation and processing of harvested fish, Fishery by-products



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## B.Sc. Zoology

### Unit 5

#### **Fish in Research:**

Transgenic fish, Zebrafish as a model organism in research

#### **Suggested Books:**

1. Q Bone and R Moore, Biology of fishes, Talyour and Francis Group, CRC Press, U.K.
2. D.H. Evans and J.D. Claiborne, The Physiology of fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogdans and B.G. Kappor. The Senses of Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
3. C.B.L. Srivastava, Fish Biology, Narendra Publishing House • J.R. Norman, A history of Fishes, Hill and Wang Publishers
4. S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL16ZOO	Fish and Fisheries-Lab	1

1. Morphometric and meristic characters of fishes
2. Study of Petromyzon, Myxine, Pristis, Chimaera, Exocoetus,
3. Hippocampus, Gambusia, Labeo, Heteropneustes, Anabas
4. Study of different types of scales (through permanent slides/ photographs).
5. Study of crafts and gears used in Fisheries
6. Water quality criteria for Aquaculture; Assessment of pH, conductivity,
7. Total solids, Total dissolved solids
8. Study of air breathing organs in Channa, Heteropneustes, Anabas and Clarias
9. Demonstration of induced breeding in Fishes (video)
10. Demonstration of parental care in fishes (video)
11. Project Report on a visit to any fish farm/ pisciculture unit/ Zebrafish rearing Lab



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ17ZOO	General Microbiology	3

### **Unit 1: Introduction, history and scope of Microbiology;**

Contribution of Antony Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Ivanowsky, Waksman, Subba Rao, Sambhunath De; Position of microorganisms in the living world. 5 kingdom classification of Whittaker and 3 kingdom classification, comparison of the 3 domain of microorganisms- bacteria, archaea, eukarya; Bergey's manual and introduction to classification of bacteria.

### **Unit 2: Bacterial morphology**

Ultrastructure of bacterial cell, cell wall, plasma membrane, capsule, flagella, nucleoid, and reserve material. Differences between archaebacterial and eubacterial cell. General features of Rickettsia, Chlamydia, Mollicutes, Actinomycetes and Cynobacteria.

### **Unit 3: Techniques in microbiology I**

Principles of microscopy, construction and application of Compound Microscope (monocular and binocular), Bright field Microscopy, Dark field Microscopy, Phase Contrast Microscopy, Fluorescence Microscopy, Electron Microscopy- TEM and SEM

### **Unit 4: Techniques in microbiology II**

Principles, construction and application of centrifuge; bacteriological Incubator



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& Incubator Shaker; Laminar flow; Colourimeter & Spectrophotometer (UV Vis)

### **Unit 5: Sterilization techniques and control of microorganisms**

Definitions of terms- sterilization and disinfection; Sterilization by Physical methods- Use of moist heat- heat under pressure, autoclave, boiling, pasteurization, fractional sterilization, tyndallization; Use of dry heat- hot air oven, incineration; Filtration- Seitz filter, membrane filter, HEPA filter;

### **Unit 6: Isolation, cultivation and preservation of microorganisms**

Culture media and its types; Methods for enumeration & isolation of microorganisms using pour plate, spread plate technique, and streak plate;

### **Unit 7: Stains and staining techniques**

Staining techniques, principles, procedures and applications of Simple staining, negative staining; Differential staining- Gram's staining, acid fast staining,

### **Reference Books:**

1. Alexopoulos C.J. and Mims C.W., Introductory Mycology, New Age International, New Delhi.
2. Aneja K.R., Experiments in Microbiology, plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.
3. Atlas R.M., Microbiology- Fundamentals and applications, Macmillan Publishing Company, New York.
4. Benson Harold J., Microbiological Applications, WCB McGraw-Hill, New York.
5. Bold H.C. and Wynne M.J., Introduction to Algae, Prentice Hall of India Private Limited, New Delhi.



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## B.Sc. Zoology

6. Baveja C.P., Textbook of microbiology APC 6th edition.
7. Dubey R.C.. and Maheshwari D.K., Textbook of microbiology, S Chand Publications.
8. Pelczar M.J., Chan E.C.S and Kreig N.R., Microbiology, Mcgraw-Hill Book Company, New York.
9. Prescott Lansing M., Harley John P. and Klein Donald A., Microbiology, WCB Mcgraw-Hill, Newyork..



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL17ZOO	General Microbiology-Lab	1

### PRACTICALS:

- Good laboratory practice in Microbiology and safety measures.
- Cleaning and sterilization of glassware and equipments.
- Study of aseptic technique- preparation of cotton plug, wrapping of glassware, transfer of media and Inoculum.
- Study of instruments- Microscope, autoclave, hot air oven, laminar airflow, inoculation loop and needle, incubator, B.O.D incubator, centrifuge machine, pH meter, colony counter, seitz filter, membrane filter, colourimeter, spectro photometer.
- Preparation of different culture media- nutrient agar/nutrient broth for bacterial culture, PDA for fungal culture.
- Enumeration of bacteria using spread plate and pour plate techniques.
- Isolation of bacteria by pour plate, spread plate and streak plate method.\
- Staining of bacteria-
  1. Simple staining- methylene blue
  2. Gram's staining
  3. Acid fast staining
  4. Ziehl Neelsen staining
  5. Giemsa staining
  6. Structural staining- capsule, endospore.
  7. Staining of fungi using lactophenol and cotton blue.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ18ZOO	Water Relations, Growth and Development	3

### Unit-1

Water relations of plants: Unique physio-chemical properties of water, chemical potential, water potential. Apparent free space, bulk movement of water, soil plant atmosphere, continuum (SPAC), stomatal regulation of transpiration, hormonal and energy dependent hypothesis; Inorganic nutrition, physicochemical aspects of solute transport, diffusion and facilitated diffusion, passive and active transport; Nernst equation and Donnan's potential. Role of ATPase as a carrier, co-transport (symport) and counter transport (antiport). Ion channels, role of calmodulin. Importance of foliar nutrition and use of chelates.

### Unit-2

Photosynthesis: Energy pathway in photosynthesis, chloroplast as an energy transducing organelle; Composition and characterization of photosystems, I and II, electron flow through cyclic, non cyclic and pseudo cyclic photophosphorylation. Pathways of CO<sub>2</sub> fixation. Differences between C<sub>3</sub> and C<sub>4</sub> fixation and different kinds of C<sub>4</sub> pathways.

### Unit-3

CAM pathway: Occurrence, biological events and adaptive advantage; Photorespiration: Mechanism and regulation of photorespiration; Introductory studies on water stress and its tolerance mechanisms.

### Unit-4

Enzymes: Classification, mode of action, K<sub>m</sub> value; Industrial application, immobilized enzymes, their preparation and application; Enzyme regulation: Competitive and noncompetitive, allosteric enzymes.

### Unit-5

Chemical control of growth and morphogenesis; Hormonal effects on growth and development; Bioassay of plant growth regulators and mode of action with reference to auxins; Gibberellins, cytokinins, abscisic acid and ethylene; Phytochrome: Chemistry and photomorphogenic effects and role in flowering; Genetic study of secondary metabolites such as alkaloids (only types of wide occurrence.) Dormancy: Seed and bud dormancy; hormonal regulation



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL18ZOO	Water Relations, Growth and Development-Lab	1

### PRACTICALS

1. Study of physical and chemical characteristics of soil by rapid field test.
2. Determination of pH of water.
3. Determination of dissolved oxygen in water
4. Extraction of amylase and determination of its activity
5. Preparation of cleared whole mounts of floral parts of polypetalae, sympetalae and monocots for vasculature.
6. With the help hand section and dissection prepare longitudinal and transverse sections of flower. Examination of: a. Transmitting tissue/ canal in stigma and style. Use of paraffin method of microtechnique .
7. Acquaintance with ultratome: use of wood microtome and common and anatomy and histochemical methods.
8. Learning techniques of making temporary and permanent microscopic preparation.
9. Knowledge and use of photomicrography in anatomical studies.
10. Knowledge and use of the principles and working of electron microscope



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJ19ZOO	Fermentation and Bioprocess Technology	3

**Unit 1:** Concept of Fermentation, Different types of fermentations-Batch, Fed-batch and continuous fermentation, An overview of submerged and solid state fermentations. Factors affecting fermentation; Bioreactor- structure and applications of a laboratory bioreactor; Different types of bioreactors like - Stirred tank reactor, air-lift, packed bed, fluidized and bubble column- their structure and applications; Multiphase bioreactor system.

**Unit 2:** Sterilization (medium and air)-thermal death kinetics of microorganisms; aeration, agitation and heat transfer in bioprocess. Microbial substrates, Media formulation and optimization; Microbial growth and kinetics. Monitoring of Bioprocesses: On line data analysis for measurement and control of important physicochemical and biochemical parameters, Computer based data acquisition, Techno-economic feasibility of bioprocess.

**Unit 3:** Isolation and characterization of industrially important Microorganisms; Generation of mutant strains for fermentation. Different approaches for strain improvement for fermentation. Concept of primary and secondary metabolites, Yield coefficient and efficiency. An overview of important products like antibiotic, biofuel, enzymes, An overview of recombinant proteins.

**Unit 4:** Biological mixture-composition and separation of different components of biological mixture-filtration, centrifugation, sedimentation, flocculation; Cell disruption; separation of soluble products: liquid-liquid extraction, precipitation, chromatographic techniques, reverse osmosis, ultra and micro filtration; Purification of wild and recombinant proteins, Product polishing-drying; crystallization; storage and packaging. Recent advances and applications in the field.



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## B.Sc. Zoology

### Reference Books:

1. Bioprocess Engineering: Basic Concepts (2017) 3rd ed. Shuler, ML, and Kargi, F. Pearson Prentice Hall, ISBN: 0137062702.
2. Principles of Fermentation Technology (2016) 3rd ed. Stanbury P, Allan Whitaker, Stephen Hall. Imprint (Butterworth-Heinemann), ISBN: 9780080999531.
3. Biochemical Engineering Fundamentals (2013) 5th reprint J. E. Bailey and Ollis, D. F. McGraw Hill Education (India) Pvt Ltd., ISBN: 0070701237.
4. Bioprocess Engineering Principles (2013) 2nd ed. Doran, P.M, Academic Press, ISBN: 978-0-12-220851-5.
5. Bioreactors Analysis and Design (2011) Panda T, Tata McGraw Hill, ISBN: 978-0-07-070424-4.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL19ZOO	Fermentation and Bioprocess Technology-Lab	1

### PRACTICALS:

1. To study the structure and functions of a stirred tank bioreactor.
2. To study the production of metabolites in submerged and solid state fermentations
3. To determine Volumetric Oxygen Transfer Coefficient (kLa) in fermentation system by dynamic method/sulphite method.
4. Comparative studies on the kinetics of free and immobilized enzymes/cells.
5. To study the production of biofuel/enzyme using lignocellulosic biomass.
6. Comparative study of batch, fed-batch and continuous fermentations



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## B.Sc. Zoology

### SEMESTER VIII

Subject Code	Subject title	Credit
MJ20ZOO	Immunology	3

#### Overview of Immunology

History of immunology, Physical and physiological barriers, Innate and Acquired immunity, Organs and Cells of Immune system

#### Complement System

Complement System Proteins, Complement System Activation by Classical, Alternate and Lectin Pathway

#### Immunity

Humoral and Cell Mediated Immunity, Active And Passive Immunity

**Antigen & Immunogens**  
Antigen Characteristics, Types of Antigens, Adjuvants, Immunogenicity and Antigenicity, Cytokines,

**Immunoglobulins and MHC and their role**  
Classes of immunoglobulin, structure and function, Major Histocompatibility Complex: Types, Antigen Presentation through MHC class I and class II molecules

#### Hypersensitivity

Types of Hypersensitivity, Mechanism of hypersensitivities with examples

**Immune Response**  
Antibody dependent Cell mediated Cytotoxicity, Phagocytosis, Inflammation and Inflammatory response mechanism.

**Applications of Immunoglobulins**  
Applications of antibody in diagnosis and therapy; *In vitro* serological test



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## B.Sc. Zoology

methods: Antigen-Antibody Reactions: Agglutination and immunodiffusion;  
ELISA and RIA.

### Reference Books:

1. Kindt, Goldsby and Osborne. Kuby's Immunology. WH Freeman & Company,
2. Roitt I, Brostoff, J and Male D. Immunology, 6th edition, 2001, Mosby, London.
3. Ramesh SR, Immunology. Mc Graw Hill Publications.
4. Madhavee LP, A Textbook of Immunology, S Chand Publisher.
5. Reddy R, Textbook of Immunology, 3rd edition, AITBS Publisher.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
MJL20ZOO	Immunology-Lab	1

### PRACTICALS:

- ABO blood group determination.
- Differential Leukocyte Count.
- Total Leukocyte Count.
- Widal Test.
- Demonstration of lymphoid organs.
- Histological study of spleen, thymus and lymph nodes through slides/ photographs
- Preparation of stained blood film to study various types of blood cells.
- Demonstration of - i. ELISA& ii. Immunoelectrophoresis.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJ01ZOO	ENDOCRINOLOGY	3

### **UNIT I: Introduction to Endocrinology**

1. Definition and Classification of hormones.
2. Endocrine, paracrine and merocrine modes of hormone delivery
3. Feedback mechanisms

### **UNIT II: Epiphysis, Hypothalamo- hypophysial Axis.**

1. Structure of the pineal gland, secretions and their function in biological rhythms and reproduction.
2. Structure of hypothalamus, hypothalamic nuclei and their functions, Regulation of neuroendocrine glands.
3. Structure of pituitary gland, hormones of pituitary gland and their functions.
4. Hypothalamo- hypophysial portal system.
5. Hypothalamic control of adenohypophysis

### **UNIT III: Structure and functions of endocrine glands in Mammals.**

1. Structure, hormones, functions and regulation of endocrine glands:
2. Pituitary
3. Pineal
4. Thyroid
5. Parathyroid
6. Adrenal
7. pancreas
8. Testis
9. Ovary
10. Local endocrine gland



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### **UNIT IV: Mechanism of Hormone Action**

1. General mechanism of hormone action
2. Regulation of Hormone action: Hormone action at cellular level, Hormone receptors, Transduction and regulation of hormone action at molecular level, molecular mediators, genetic control of hormone action

### **UNIT V: Hormonal dysfunction and diseases**

1. Dwarfism and acromegaly
2. Goiter
3. Addison's disease
4. Diabetes mellitus

### **Reference Books :**

1. General Endocrinology C. Donnell Turner Pub- Saunders Toppan.
2. Endocrinology: An integrated Approach; Stephen Nussey and Saffron Whitehead.
3. Oxford: BIOS Scientific Publishers; 2001
4. Hadley, M.E. and Levine J.E.2007. Endocrinology, 6th Edition Pearson Prentice- Hall, Pearson Education Inc., New Jersey.
5. Vertebrate Endocrinology by David O. Norris



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## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJL01ZOO	ENDOCRINOLOGY-LAB	1

### PRACTICALS:

1. Handling, sexing, numbering and maintenance of rat.
2. Dissection and demonstration of endocrine glands in laboratory bred rat.
3. Study of vaginal smear preparation of rat.
4. Demonstration of following surgical operations in laboratory bred rat:
  - a. Orchidectomy
  - b. Ovariectomy
  - c. Tubectomy
5. Study of permanent histological slides of following endocrine glands in rat: Pituitary, thyroid, adrenal, endocrine pancreas, testis and ovary.
6. Estimation of plasma level of any hormone using ELISA.
7. Compensatory ovarian hypertrophy in vivo bioassay in laboratory bred rat.
8. Group discussion and seminar presentation on related topics.



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## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJ02ZOO	Industrial Microbiology	3

**Unit 1:** History & Multidisciplinary nature of Industrial microbiology. A typical Bio process: Introduction, advantages & limitations. Patents and intellectual property rights

**Unit 2:** Taxonomic diversity of industrially useful bacteria & fungi. Important characteristics of microbes used in Industrial Microbiology, Isolation techniques. Concept & examples of microorganisms classified as Generally Regarded as Safe (GRAS)

**Unit 3:** Exploitation of microorganism and their products, Screening, Strain development strategies, Immobilization methods.

**Unit 4:** Fermentation: Media, Raw material, Antifoaming agents, Buffers. Equipments, Fermenter design. Types of fermentation – Single, Batch, Continuous.

**Unit 5:** Down-stream processing steps: Detection and assay of the product, Recovery (intercellular and extracellular product). Purification (solvent extraction & chromatography)

**Unit 6 :** Production of Alcohol (industrial alcohol, wine, beer, whiskey), Organic acid (Citric acid), Antibiotic (Penicillin)

**Unit 7 :** Production of Vitamin (B12), Enzyme (Amylase), Amino acid (Glutamic acid), Hormones (Insulin), Vaccine (Hepatitis B).

**Unit 8 :** Biofuel (Methane), Production of Biofertilizers & Biopesticides, Biotransformation of steroids.



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## B.Sc. Zoology

### Reference Books:

1. Industrial Microbiology (2000) by AH Patel, Macmillan Publishers India
2. Biology of Industrial microorganism (1981) by Arnold L. Domain, Benjamin/ Cummings Pub. Co.
3. Industrial Microbiology by Prescott & Dunns, AVI Publishing Company Inc.
4. Industrial Microbiology by Casida LE, New age International (P) Ltd.

### Suggestive digital platforms web links

- <http://foodhaccp.com/foodsafetymicro/onlineindex.html>
- <http://www.cpe.rutgers.edu/courses/current/If0401wa.html>



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJL02ZOO	Industrial Microbiology-Lab	1

### PRACTICALS:

1. Study of Bioreactor & its essential parts
2. Necessity & procedure of writing SOPs for instruments used in large scale production
3. Isolation and microscopic observation of industrially important microorganism
4. Isolation and characterization of microorganism used in Dairy industry
5. Isolation and characterization of Yeast used in Bakery/distillery/winery
6. Isolation & identification of important microorganism of food microbiology
7. Determination of the quality of milk by MBRT
8. Bacteriological analysis of food products
9. Bacterial examination of milk – Alcohol test
10. Preservation methods



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJ03(ZOO)	Animal Biotechnology	3

### UNIT I

Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Genetransfer.

### UNIT II

Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology – Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.

### UNIT III

Animal propagation – Artificial insemination, Animal Clones. Conservation Biology – Embryo transfer techniques. Introduction to Stem Cell Technology and its applications.

### UNIT IV

Genetic modification in Medicine - gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.

### UNIT V

Stem cell therapies: Generation of induced pluripotent cells, and molecular

Mechanism of iPSCs reprogramming. Direct differentiation.

Stem cell technologies, Gene editing technologies- TALEN, CRISPR-Cas 9.

### Reference Books:

1. Lanza R, Gaerhart J, Hogan B, Melton R, Thomas D, Thomas J, and Wilmut S. Essentials of Stem Cell Biology. Elsevier!Inc.
2. Stillman B, Stewart D and Grodzicker T, Control and Regulation of Stem Cells.
3. Tursten Kursad, Stem Cell Biology and Regenerative Medicine, Humana Press



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
AMJL03ZOO	Animal Biotechnology-Lab	1

### PRACTICALS:

- Extraction of DNA and RNA.
- Polyacrylamide gel electrophoresis (PAGE).
- Agarose gel electrophoresis.
- Restriction endonuclease analysis of DNA.
- Isolation and purification of plasmid.
- Polymerase chain reaction.
- Cloning of gene.
- Expression of cloned gene.
- Purification of recombinant protein.
- Blotting.
- RFLP.
- RAPD

**OR**



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
RC01	<b>RESEARCH METHODOLOGY</b>	4

**1. Foundations of Research:** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of Research - Concept, Construct, Definition, Variable. Research Process.

**2. Problem Identification & Formulation** - Research Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis. Null Hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & Importance.

**3. Research Design:** Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

**4. Qualitative and Quantitative Research: Qualitative research** - Quantitative research - Concept of measurement, causality, generalization, replication. Merging the two approaches.

**5. Measurement: Concept of measurement-** what is measured? Problems in measurement in research- Validity and Reliability. Levels of measurement Nominal, Ordinal, Interval, Ratio.

**6. Sampling:** Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample- Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample Practical considerations in sampling and sample size.



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## B.Sc. Zoology

**7. Data Analysis:** Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis- Cross tabulations and Chisquare test including testing hypothesis of association.

**8. Interpretation of Data and Paper Writing-** Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

**9. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.**

**10. Use of tools I techniques for Research:** methods to search required information effectively, Reference Management Software like Zotero/ Mendeley, Software for paper formatting like LaTeX/ MS Office, Software for detection of Plagiarism

### **Reference Books :**

1. Business Research Methods- Donald Cooper & Pamela Schindler, TMGH, 9th editions.
2. Business Research Methods- Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology- C. R. Kothari
4. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
5. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
6. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
RC02	RESEARCH PROPOSAL	4

### Process of writing a research proposal.

That includes the following points :

1. TITLE.
2. INTRODUCTION
3. REVIEW OF LITERATURE (BACKGROUND AND RATIONALE)
4. RESEARCH QUESTION(S) ..
5. AIMS & OBJECTIVES
6. RESEARCH METHODOLOGY.
7. PLAN OF WORK
8. REFERENCE/BIBLIOGRAPHY.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
RC03	Research Report	4

A research report is a reliable source to recount details about a conducted research. It is most often considered to be a true testimony of all the work done to garner specificities of research.

Research reports present the results of formal investigations into the properties, behavior, structures, and principles of material and conceptual entities. Almost any physical phenomenon or concept may be investigated in a research framework. The following are some key differences between formal research, and other less structured kinds of inquiry.

1. **Problem definition:** the rigorous reduction of the inquiry to a narrow question with a quantifiable answer. The most significant preliminary phase of research writing is that of effective problem definition. This process is one of identifying an interesting question and narrowing the research inquiry to a manageable size.
2. **Research approach:** the structuring of the research according to a methodology associated with a specialized field of inquiry. Specialized fields have research methodologies that are followed in investigating problems. These range from general methods of interviewing and literature researching to highly specialized procedures for using materials and mechanical devices to establish appropriate conditions for generating data. Adapting a sound research methodology to the investigation of your problem is a major milestone in the conduct of your inquiry.
3. **Research report:** the presentation of the research and its results in a rigorously formatted document that follows a conventional structure. In presenting your research, you pull all its elements together into a focused, coherent document. Research reports contain a standard set of elements that include.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

MINOR (I/ III/ V/ VII)

### SEMESTER I

Subject Code	Subject title	Credit
MN01CHE	Zoology I	4

### GROUP I - NON CHORDATES

#### Kingdom Protista

1. General introduction and classification upto class
2. Locomotion in Protista
3. Reproduction and Nutrition in Protista

#### Phylum Porifera, Cnidaria, Ctenophora

1. General characters and classification upto class
2. Canal system in Porifera
3. Coral and coral Reef formation.
4. Alteration of Generation in cnidarian.
5. Evolutionary significance of ctenophore

#### Helminthes

1. General characters and classification of Platyhelminthes, Nematelminthes and Aschelminthes. upto class
2. Life cycle of Fasciola hepatica

#### Annelida

1. Segmentation in Annelids
2. Origin of coelom

#### Arthropoda

1. General characters, Classification upto class
2. vision in Arthropods, Appendages in Arthropods

#### Mollusca

1. General characteristic of Mollusca. Classification upto class
2. Torsion and Detorsion in Mollusca

#### Echinodermata



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## B.Sc. Zoology

1. General characters, classification upto class

2. Water vascular system in Echinodermata

### **GROUP II - CHORDATES**

Introduction to chordates and its origin general characters and outline classification

#### **Protochordates**

General characters of Hemichordates Urochordates and Cephalochordates.

#### **Agnatha**

General characters and classification of cyclostomes.

#### **Pisces**

1. General classification of chondrichthyes and Osteichthyes

2. Parental care in fishes

#### **Amphibia**

1. General Classes and classification of Amphibia

2. Parental care in Amphibians.

#### **Reptilia**

Poison apparatus and Biting mechanism in snakes.

#### **Aves**

General characters of Aves 2. Flight adaptations in birds 3. Flightless Birds, a brief idea.

#### **Mammalia**

General characters and classification up to classes, Dentition in mammals.

#### **Practicals**

1. Good laboratory practice in Biotechnology and safety measures. Cleaning and sterilization of glassware and equipment's. Study of aseptic technique- preparation of cotton plug, wrapping of glassware, transfer of media and Inoculum.
2. Study of instruments- Microscope, autoclave, hot air oven, laminar airflow, inoculation loop and needle, incubator, B.O.D incubator, centrifuge machine, pH meter, colony counter, seitz filter, membrane, filter, colourimeter, spectro photometer.
3. Study of whole mount of Euglena, Amoeba and Paramecium; Binary fission and Conjugation in Paramecium. Sycon (including T.S. and L.S.), Obelia, Physalia Aurelia,



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## B.Sc. Zoology

Gorgonia, Metridium, Pennatula, Aphrodite, Nereis, Heteronereis, Pheretima, Hirudinaria, Sacculina, Cancer, Pila, Unio, Asterias, Antedon

4. Study of adult Fasciola hepatica, Taeniasolium and their life cycles (Slides/microphotographs)
5. Study of adult Ascari slumbricoides and their life stages (Slides/micro-photographs)
6. Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta.
7. Study of Museum specimen: Petromyzon, Myxine, Scoliodon, Heteropneustes, Labeo, Exocoetus, Hippocampus, Tetrodon, Bufo, Hyla, Alytes, Salamandra, Uromastix, Draco, Vipera, Naja, Hydrophis, Columba, Bat
8. Types of beaks and claws

### Reference Books

1. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Singh, S. Keshari S. and Abhishek, K.S. (2016). Medical Zoology and Parasitology, Jharkhand Jharokha, Classical Publishing Company.
6. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
7. Pough H. Vertebrate life, VIII Edition, Pearson International.
8. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
9. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### SEMESTER III

Subject Code	Subject title	Credit
MN03(CHE)	Zoology II	3

**Biochemistry:** - Details of Carbohydrates, protein and lipids. Their Structure and classification. Metabolism of carbohydrates, protein and lipids. Introduction of Enzymes, Nomenclature and classification of enzymes. Enzyme kinetics. Regulation of Enzyme action Coenzymes and Isoenzymes. Enzyme inhibition and Km equation Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

**Cell Biology:** - A general concept of prokaryotic and eukaryotic cells, Cell theory, General structure of different cell organelles including Mitochondria, Golgi complex. Endoplasmic Reticulum, Nucleus, Chromosome, Ribosome, Golgi apparatus, and Lysosome Cytoskeleton- Composition and function. Microtubules and microfilaments. Cell membrane structure: Chemical composition of Plasma membrane of Erythrocyte, Active and Passive transport, (Diffusion and osmosis) ATPase Pump and Exchange. Cell Adhesion molecules. A brief introduction to cell cycle, its various phases, Mitosis and Meiosis, Cell division, Checkpoints, and its regulation. Cell signaling, Regulation of signaling pathways.

**Biostatistics:** - Types of data: Primary and secondary data. Mean, Median, Mode, Standard Deviation, Standard error, Chi square test, t-test, f-test, ANOVA, Correlation, and Regression Analysis. Basics of statistics software – MS-EXCEL, BLAST, and R

**Animal Physiology:** - Tissue - Structure and classification, Bone and Cartilage. Digestive System, Gastrointestinal tract and its associated glands. Respiratory System - Histology of trachea and Lungs, Respiratory volumes, Respiratory Pigments, Diffusion of respiratory gases and Transport of O<sub>2</sub> and CO<sub>2</sub>. Circulatory System - Structure and Working of Mammalian Heart Blood groups, Rh factor Blood and its components, Blood clotting Mechanism Cardiac cycle .Skeletal system - Ultra-structure of Skeletal Muscle, chemical basis of muscle contraction. Excretory System - Kidney: structure and function, Mechanism of urine formation, Counter-Current theory, Ornithine-Arginine cycle. Reproductive System - Histology of male and female reproductive organs. Physiology of reproduction in male and female, Accessory Reproductive



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

organs, Reproductive Hormone. Endocrine system: - Basics of Endocrine glands. Classification of hormone. Mode of hormone action. Nervous System Ultrastructure of Neuron, Physiology of nerve conduction, Reflex Action.

### Practicals

1. Quantitative test of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Demonstration of proteins separation by SDS-PAGE.
4. Student's t – test dependent and independent, hand calculation and calculation using MS-Excel
5. Comparative general anatomy of digestive, respiratory, muscular, cardio vascular and reproductive system of (Virtual demonstration).
6. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibers and nerve cells.
7. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.
8. Preparation of permanent slide of mammalian tissues.
9. Hematology: Blood group determination, hemoglobin estimation, bleeding and clotting time, Morphology of different blood cells and their count.

### Reference Books

1. Raziuddin, M., Mishra P.K. 2014, A Handbook of Environmental Studies, Akanaksha Publications, Ranchi.
2. Mukherjee, B. 2011: Fundamentals of Environmental Biology. Silverline Publications, Allahabad.
3. Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.
4. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
5. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

6. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
7. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.
8. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29--64). Zed Books.
9. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
10. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
11. Krebs Ecology
11. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
12. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons.
13. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
14. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.
15. DeFiore Atlas of Human histology. Physiology Vandor 6. Ganong's Physiology



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MN05ZOO	ANIMAL DIVERSITY	3

### **UNIT I: Kingdom Protista**

General characters and classification upto classes; Locomotory Organelles and locomotion in Protozoa

### **UNIT II: Phylum Porifera**

General characters and classification up to classes; Canal System in Sycon 3

### **UNIT III: Phylum Cnidaria**

General characters and classification up to classes; Polymorphism in Hydrozoa

### **UNIT IV: Phylum Platyhelminthes**

General characters and classification upto classes; Life history of Taeniasolium

### **UNIT V: Phylum Nemathelminthes**

General characters and classification up to classes; Life history of Ascarislumbricoides and its parasitic adaptations

### **UNIT VI: Phylum Annelida**

General characters and classification upto classes; Metamerismin Annelida

### **UNIT VII: Phylum Arthropoda**

General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

### **UNIT VIII: Phylum Mollusca**

General characters and classification up to classes; Torsion in gastropods

### **UNIT IX: Phylum Echinodermata**

General characters and classification up to classes; Water-vascular system in Asteroidea

### **UNIT X: Protochordates**

General features and Phylogeny of Protochordata

### **UNIT XI: Agnatha**

General features of Agnatha and classification of cyclostomes up to classes



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MNL05ZOO	ANIMAL DIVERSITY-Lab	1

### Study of the following specimens:

1. Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taeniasolium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ur eotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis.
2. Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

### Study of the following permanent slides:

1. T.S. and L.S. of Sycon
2. Study of life history stages of Taenia
3. T.S. of Male and female Ascaris
4. Key for Identification of poisonous and non-poisonous snakes



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MN07ZOO	Biomolecules	3

### Unit 1 : Biomolecules

Types and significance of chemical bonds; Structure and properties of water; pH and buffers. Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides. Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quarternary; Protein denaturation and biological roles of proteins. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA. Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.

### Unit 2: Enzymes

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

### Reference Books:

- Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
- Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition
- Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.



# RKDF UNIVERSITY RANCHI

## B.Sc. Zoology

Subject Code	Subject title	Credit
MNL07ZOO	Biomolecules-Lab	1

### PRACTICALS:

- Study of cell and its organelles with the help of electron micrographs.
- Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.
- Study the phenomenon of plasmolysis and deplasmolysis
- Study the effect of organic solvent and temperature on membrane permeability

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