

Date :- 29/06/2019

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc./M. Sc. in Zoology (Sem I & II)

Ref. :- Decision of the Academic Council at its meeting held on 28/06/2019.

The Syllabi of B. Sc./M. Sc. in Zoology (First and Second Semesters) as per CBCS-UG/PG Regulations, 2016 and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2019-20.

Copy of the Syllabi shall be downloaded from the College Website (www.kcesmjcollege.in)



Principal,

M. J. College, Jalgaon

HEAD
Dept. of the Zoology
M. College Jalgaon

To :

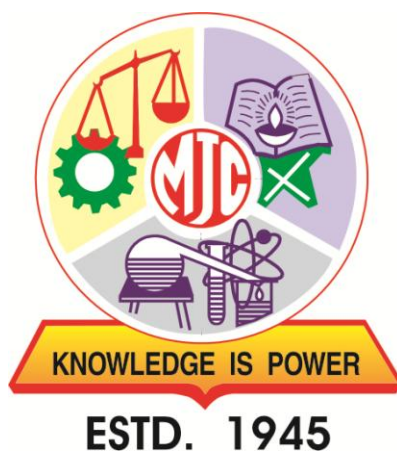
- 1) The Head of the Dept., M. J. College, Jalgaon.
- 2) The Director, School of Life Sciences, M. J. College, Jalgaon.
- 3) The office of the COE, M. J. College, Jalgaon.
- 4) The office of the Registrar, M. J. College, Jalgaon.
- 5) Office File.

Knowledge is Power

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon



SYLLABUS

ZOOLOGY

M. Sc. I

(Semester I and II)

Under Choice Based Credit System (CBCS)
[w. e. f. Academic Year: 2019-20]

KCE Society's Moolji Jaitha College, Jalgaon
Department of Zoology
ZOOLOGY POST GRADUATION SYLLABUS
2019-20

	COURSE CODE	COURSE TITLE	TOTAL CREDITS	Lecture
SEM-I				
1.	DSC-ZOO-101	Structural and Functional Organisation of Invertebrates	04	60
2.	DSC- ZOO-102	Dairy Science I	04	60
3.	DSC- ZOO-103	Practical's based on DSC-ZOO-101	04	8hrs
4.	DSC- ZOO-104	Practical's based on DSC-ZOO-102	04	8hrs
5.	DSE- ZOO-105	Cell and Molecular Biology	04	60
6.	SEC-ZOO-106	Zoology Laboratory management and safety	04	60
SEM- II				
1.	DSC -ZOO-201	Structural and Functional Organisation of Vertebrates	04	60
2.	DSC -ZOO-202	Dairy Science II	04	60
3.	DSC -ZOO-203	Practical's based on DSC -ZOO-201	04	8hrs
4.	DSC -ZOO -204	Practical's based on DSC -ZOO-202	04	8hrs
5.	DSE-ZOO-205	Animal Biotechnology	04	60
6.	GE-ZOO-206	Techniques in Biology	04	60
SEM-III				
1.	DSC-ZOO-301	Animal Physiology I / Fishery Science I / Entomology I	04	60
2.	DSC-ZOO-302	Inheritance Biology	04	60
3.	DSC-ZOO-303	Practical Based on DSC-ZOO-301	04	8hrs
4.	DSC-ZOO-304	Practical Based on DSC-ZOO-302	04	8hrs
5.	DSE-ZOO-305	Toxicology	04	60
6.	SEC-ZOO-306	Research Methodology	04	60
SEM-IV				
1.	DSC-ZOO-401	Animal Physiology II / Fishery Science II / Entomology II	04	60
2.	DSC-ZOO-402	Principles of Ecology, Evolution and Behaviour	04	60
3.	DSC-ZOO-403	Practical Based on DSC-ZOO-401 and DSC-ZOO-402	04	8hrs
4.	DSC-ZOO-404	Dissertation	04	8hrs
5.	DSE-ZOO-405	Insect Pest Management	04	60
6.	GE-ZOO-406	Biostatistics and Bioinformatics	04	60

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: DSC – ZOO - 101

Title of the Paper: Structural and functional organization of Invertebrates

Credits: 4

Lectures: 60

Unit	Topics	Lectures
1.	Organization and life: a) Homology and analogy in organization, b) Diversity of invertebrate, c) Phylogeny of invertebrates	06
2.	Organization of Coelom: a) Acoelomates, b) Pseudocoelomates c) Coelomates - Protostomia and Deuterostomia	05
3.	Locomotion: a) Locomotory organelles – Pseudopodia, flagella, Cilia b) Amoeboid, Flagellary and Ciliary movement in protozoa	06
4.	Nutrition and Digestion: a) Pattern of feeding and digestion in lower metazoan b) Filter feeding in polychaeta c) Filter feeding and digestion in mollusca d) Filter feeding and digestion in deuterostoma	08
5.	Respiration: a) Organs of respiration- Gills and lophophores b) Gills and lungs in Mollusca c) Gills and trachea in Arthropoda d) Respiratory pigments in invertebrates. e) Mechanism of respiration in gastropoda and insecta.	07
6.	Excretion: a) Organs and Mechanism of excretion - Coelom, Coelomoducts, Nephridia and Malpighian tubules, b) Osmoregulation in terrestrial and aquatic invertebrates.	06
7.	Nervous system: a) Trends in neural evolution. b) Primitive nervous system- Coelenterates and Echinodermata c) Advanced nervous system- Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (Cephalopoda).	06
8.	Invertebrate larvae: a) Larval forms of Crustacea, Mollusca and Echinodermata b) Significance of larval forms.	06
9.	Colonial and social life: a) Protozoan and colonies	06

	b) Social life in honey bee.	
10.	Animal architecture: Coral, silk cocoon, spider web, honey comb, termite mound, mollusk shell etc.	04
	Total	60

Reference Books

- Barrington E.J.W.: Invertebrates, Structure and function, homes Nelson and Sons Ltd., London
- Hyman L.H.: The Invertebrate Volume 1 to 8, MacGraw Hill Co. New York
- Kotpal R.L.: Protozoa to Echinodermata Series,

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: DSC – ZOO - 102

Title of the Paper: Dairy Science

Credits: 4

Lectures: 60

Unit	Topic	Lectures
1	<ul style="list-style-type: none">• Introduction to livestock farming in India• Taxonomic classification of livestock• Study of cow breeds.<ul style="list-style-type: none">○ Milch breeds – Sahiwal, Sindhi, Gir.○ Dual Purpose breeds – Haryana, Ongale, Tharparkar, Kankrej, Deoni.○ Draught breeds – Amritmahal, Kangayam, Khillar, Redkandhari, cross breeds,○ Exotic breeds – Holstein Friesians, Jersey, Brown Swiss.• Study of buffalo breeds.<ul style="list-style-type: none">○ Murrah, Nagpuri, Surti, Jaffarabadi, Mehsana.	10
2	<ul style="list-style-type: none">• Resources and infrastructure for livestock industry in India.• Production potential of Indian livestock and their role in national economy• Milk production and utilization, regional and seasonal variation.• Role of co-operatives in livestock development.• Role of livestock in manpower employment, socio-economic development.• Hygiene and sanitation; First-aid measures.	10
3	<ul style="list-style-type: none">• Milk:-Definition, Composition, Factors affecting composition - quality and quantity of milk• Food and Nutritive value of milk, Milk and public health• Physico-chemical properties of milk.• Microbiology of milk:-Introduction	10
4	<ul style="list-style-type: none">• Clean milk production; collection and buying of milk, Transportation of milk; Safe guarding of milk supply• Method of buying, Judging and grading of milk, Method of collection Cooling of milk	05
5	<ul style="list-style-type: none">• Collection, Transportation, receiving, Grading, Weighing and cooling of Milk.• Milk processing : Straining, Filtration, Clarification, Homogenization.• Pasteurization - LTLT, HTST, Vacreation, UHT, Uprization, Stassanization, sterilization.	10

	<ul style="list-style-type: none"> • Packing and storage of milk. 	
6	<ul style="list-style-type: none"> • Introduction to milk products technology. • Dairy products and entrepreneurial opportunities. • Classification of milk products (Definition, Composition, Methods of production and yield of) <ul style="list-style-type: none"> ○ Concentrated indigenous dairy products: Peda, Burfi, Rabdi, Basundi and Gulabjamun. ○ Fermented indigenous dairy product: Chakka, Shrikhand and Shrikhand wadi. ○ Frozen indigenous dairy product: Kulfi, Malai ka Barf. ○ Fat rich indigenous dairy product: Butter and Ghee. ○ Special milk: Methods of production of Milk Shake, Flavored milk, Toned milk, Fortified milk, Recombined milk and Soya milk. 	10
7	<ul style="list-style-type: none"> • Role of dairy industry as on entrepreneur for development of small scale industry. • Food Safety and Quality Management; Marketing of milk products: scope and limitations. 	05
	Total	60

Reference Books

- A text Book of Animal Husbandry by- G.C. Banerjee
- Advances in Dairy animal Productions by- Mudgal
- Animal Husbandry and Dairy Science by – Jagdish Prasad
- Animal Husbandry and Rural Development by- Kar
- Dairy Microbiology - K.C. Mahanta
- Dictionary of Dairying - Davis & Leonard Hill
- Fundamentals of Animal Hygiene and Epidemiology by- Thypliyal
- Handbook of Animal Husbandry by – ICAR
- Indigenous milk products - ICAR pub
- Market Milk Industry - C.L. Rhodhouse & J.L. Henderson
- Milk Testing - J.G. Davis
- Standard Methods for Examination of Dairy Products - Gary H. Richardson

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: DSC – ZOO - 103

Title of the Paper: Practical corresponding to DSC-ZOO-101

Credits: 4

Lectures: 60

Practical	Title	Type
1.	Study of Grasshopper/Cockroach so as to expose its – Digestive system, Nervous System, Reproductive system (Male and Female)	D*
2.	Study of Nephridia and Spermatheca of earthworm, Mouthparts, Spiracles, Cornea and Wings of Grasshopper/Cockroach	D*
3.	Classification of Invertebrates - up to Class (one example from each class) Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Hemichordata	D*
4.	Classification of any one Invertebrate in local area using taxonomical keys.	D*
5.	Organization and life: Study of Homology and analogy in organization.	D*
6.	Study of Organization of Coelom.	D*
7.	Study of Organs of Respiration: Gills, lophophores, Lungs, trachea.	D*
8.	Study of Excretory organ in Terrestrial and Aquatic Invertebrates.	D*
9.	Study of primitive and advanced Nervous system.	D*
10.	Study of larval forms of Crustacea, Mollusca and Echinodermata.	D*
11.	Colonial and social life of Protozoa and Honeybee respectively.	D*
12.	Study of Animal architecture forms with respect to Coral, silk cocoon, spider web, honey hive, termite mound, mollusk shell etc.	D*

D = Demonstration *(with the help of models /charts / pictures / simulation)

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: DSC – ZOO - 104

Title of the Paper: Practical based on DSC-ZOO-102

Credits: 4

Lectures: 60

Practical	Title	Type
1.	Study of cow breeds: Milch breeds – Sahiwal, Sindhi, Gir and Dual Purpose breeds – Hariana, Ongale, Tharparkar, Kankrej, Deoni.	D*
2.	Study of cow breeds: Draught breeds – Amritmahal, Kangayam, Khillar, Redkandhari, cross breeds and Exotic breeds – Holstein Friesians, Jersey, Brown Swiss.	D*
3.	Study of buffalo breeds: Murrah, Nagpuri, Surti, Jaffarabadi, Mehsana.	D*
4.	Study of Common diseases.	D*
5.	Designing of standard Farm layouts.	D
6.	Detection of adulterants.	E
7.	Organoleptic and Temperature test for judging the quality of milk.	E
8.	COB, Alcohol and Sediment test for judging the quality of milk.	E
9.	Determination of Fat, SNF and TS, Specific gravity, Acidity and pH of milk.	E
10.	Preparation of Basundi and Kulfi.	E
11.	Preparation of Shrikhand and paneer.	E
12.	Study of Dairy equipments: Muffle furnace, Viscometer, Centrifugal cream Separator, Milk packing material, Scrapers, Capping unit.	D
13.	Student's visits: Dairy industry; Vet. hospital, Goat and Sheep, Buffalo, Poultry farm, Hatchery.	

D = Demonstration *(with the help of models /charts / pictures / simulation);

E = Experiment

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: SEC– ZOO - 105

Title of the Paper: Zoology Laboratory management and safety

Credits: 4

Lectures: 60

Aims and Objectives:

1. To study the proper laboratory technique
2. Become acquainted with the taxonomy and classification of animals
3. To study of preservation and labeling of specimens and maintain museum.
4. Biological specimen etiquette and disciplined observation of archive animal materials.
5. The students understand proper laboratory safety.
6. To aware the possible risks or hazards involved with laboratory work.
7. To study the safety guidelines

Units	Topics	Lectures
1.	Safety in laboratory: Standard Operating Procedure, Maintain Documentation, General safety measures, Preparation of Material Safety Data Sheet (MSDS) for Chemical hazards, Physical hazards, biological hazards, Spillage and waste disposal, First aid.	12
2.	Introduction to good laboratory practices: Units of measurement: Preparation of Reagents, chemicals, buffers. a) Use of safety symbols: meaning, types of hazards and precautions b) Calculations and related conversions of each: Metric system-length (meter to micrometer); weight (gram to microgram), Volumetric (Cubic measures) c) Temperature: Celsius, Fahrenheit, Kelvin d) Concentrations: Percent solutions, ppt, ppm, ppb dilutions, Normality, Molarity and Molality.	8
3.	Use, Care and Maintenance of common laboratory equipments: Microscope, pH meter, colorimeter/ spectrophotometer, analytical balance, centrifuge, electrophoresis apparatus, glassware; general safety measures; personal protection, category of chemicals (OECD or other accepted guidelines). Concept of validation and Verification.	10
4.	Basics of Zoology: Introductions, Taxonomic Classification of Non Chordates and Chordates, Animal preservation and Presentations, General laboratory ventilation, Bio-safety cabinet, Lab Safety. Quality control in laboratory practice.	12

5.	Animal House Legal aspects: CPCSEA guidelines, IAEC, rational use of animals, alternatives for animal Models. Preparation and maintenance of proper laboratory manuals. Accreditation requirements. Professional Training for animal handling.	6
6.	Maintenance of cell culture laboratory: Introduction, A few basic techniques, Bio-safety and types, Characteristics of Cells and culture aseptic work, Quality Control, Design and layout for a dedicated cell culture lab.	6
7.	Emergency Action Plan and Knowledge Certification Forms: Quality control and Disaster Management	6
	Total	60

Reference Books

1. Laboratory Safety Manual: November 2018, University of Washington, Environmental Health and Safety Department, | www.ehs.washington.edu
2. Guidelines for Good Clinical Laboratory Practices (GCLP): 2008, Indian Council of Medical Research New Delhi, Aravali Printers & Publishers.
3. Plummer: An Introduction to Practical Biochemistry (3rd Ed.), Tata-McGraw Hill, 1990.
4. Kotpal, R. L. The Birds, 4th edition, Rastogi Publications, Shivaji Road, Meerut, 1999.
5. D. B. Tembhare- Techniques in Life Sciences, Himalaya Publishing House.
6. T. Poddar, S. Mukhopadhyay, S. K. Das- An Advanced Laboratory Manual Of Zoology, MACMILLAN.
7. Keith Wilson, John Walker Principles and Techniques of Practical Biochemistry (Wilson, Principles and Techniques of Practical Biochemistry)

Class: First Year M.Sc. Zoology - I

Semester - I

Course Code: SEC– ZOO - 106

Title of the Paper: Cell and Molecular Biology

Credits: 4

Lectures: 60

Aims and Objectives:

1. To study modern tools and techniques used in plant system
2. To study the components and their functions
3. To study molecular biology in relation to genetic material, its inheritance, modification, replication and repair.
4. To study transcription, translation post translation modification and targeting sorting of protein to organelles.
5. To study gene regulation in prokaryotes and eukaryotes.

Units	Topics	Lectures
1	Cell Biology <ul style="list-style-type: none">• Structure, Function, oxidative Metabolism in the Mitochondrion, Role of Mitochondria in the formation of ATP• Translocation of Protons and the establishment of a proton-motive force, machinery for ATP formation – Peroxisomes.• Genome studies of Mitochondria.• Chloroplast structure and function: An overview of photosynthetic metabolism, components of cytoskeleton, Microtubules, Intermediate filaments – Microfilaments,• Protein trafficking, Cell- to -Cell Signaling: Hormones and Receptors, Intracellular signalling in Development and Disease,• Transport across Cell Membranes,• Protein Sorting: Organelle Biogenesis and Protein secretion	12
2	Cell Components <ul style="list-style-type: none">• Cell components and their functions (Prokaryotic/ Eukaryotic)• Dynamic structure, functions and biogenesis of cell wall and plasma membrane• New insights in structure and function of cytoplasmic cell organelles and biopolymers;• Nucleus: its components, chromatin structure in eukaryotes, condensation and packaging of DNA in prokaryotes	12

3	<p>DNA replication</p> <ul style="list-style-type: none"> • DNA Structure and Replication: DNA replication machinery in Prokaryotes and eukaryotes, Replication fork. • Enzyme of DNA Replication: DNA polymerase (I, II, III), primases, ligases, helicases, topoisomerases, gyrases and SSBP. • Models of DNA Replication: theta mode of replication, rolling circle model of replication, unidirectional replication, Bidirectional replication, replication of linear, Regulation of DNA replication and inhibitors of DNA replication. • Concept of Operon: Structure and regulation of lac, ara, his and tryptophan operons. Regulation of lytic and lysogenic pathway in lamda bacteriophage • Gene regulation in eukaryotes: DNA rearrangements, Chromatin modification, Cis-acting site, RNA Silencing 	12
4	<p>Transcription and Translation</p> <ul style="list-style-type: none"> • Types of RNA polymerase (prokaryotic and eukaryotic), Process of transcription • mRNA processing, editing: capping, adenylation, splicing, RNA transport • Transcriptional regulation: transcriptional bursting/pulsing, specificity factors, enhancers, repressors, activators and general transcription factors • Post-transcriptional modifications: RNA degradation, nuclear transport, mRNA localization, anti-sigma factors, RNAi (siRNA, miRNA and CRISPR mechanism) • Genetic code and its properties • Ribosome (structure and composition), Activation of tRNA, tRNA synthetase • Steps: Initiation: factors and their regulation, Elongation, Termination Inhibitors • Post translational modification of proteins and protein degradation • Translational regulation: Cytoplasmic polyadenylation, UTR sequence elements, RNA binding proteins, ribosomal regulation, non-sense mediated RNA decay, 5' decapping 	12
5	<p>DNA Damage and Repair</p> <ul style="list-style-type: none"> • DNA damage: deamination, oxidative damage, alkylation, pyrimidine dimmers, mechanical and chemical damage • DNA mutations: Spontaneous and inducible and mutagenic agents. • DNA repair pathways: Methyl directed mismatch repair, very short patch repair, nucleotide excision repair, base excision repair, recombination (Specific and Nonspecific), mismatch, SOS 	12
	Total	60

References

- Alberts B, Johnson A, Lewis J, Raff Martin, Roberts K and Walter P. (2007) Molecular Biology of the Cell. Garland Publ., NewYork.
- Bonifacino JS, Dasso M, Harford JB, Liipincott-Schwartz J and Yamada KM. (2004) Short Protocols in Cell Biology. John Wiley & Sons, NewJersey.
- Bregman AA (1987) Laboratory Investigations in Cell Biology. John Wiley & Sons,

New York.

- Hawes C and Satiat-Jeunemaitre B (2001) *Plant Cell Biology: Practical Approach*. Oxford University Press, Oxford.
- Hirt RP and Horner DS (2004) *Organelles, Genomes and Eukaryote Phylogeny: An evolutionary synthesis in the age of genomics*. CRC Press.
- Karp G. (2008) *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.
- Lodisch H, Berk A, Kaiser CA, Krieger M, Scott MP, Bretscher A, Ploegh H and Matsudaire P (2008) *Molecular Cell Biology*. WH Freeman & Co., New York.
- Ruzin SE (1999) *Plant Micro-technique and Microscopy*. Oxford Univ. Press, Oxford.
- Wischnitzer S. (1989) *Introduction to Electron Microscopy*. Pergamon Press,

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: DSC – ZOO - 201

Title of the Paper: Structural and functional organization of Vertebrates

Credits: 4

Lectures: 60

Unit	Topic	Lectures
1.	Organization of Protochordates: a. Study of Urochordata with respect to Doliolum (Morphology and Anatomy) b. Study of Cephalochordata with respect to Amphioxus (Morphology and Anatomy).	6
2.	Origin and phylogeny of vertebrates.	3
3.	Cyclostomata: a. Affinities of cyclostomata b. Phylogenetic status of cyclostomata.	3
4.	Adaptive radiations in vertebrates	8
5.	Comparative account of circulatory system of vertebrates.	4
6.	Comparative account of urogenital system of vertebrates.	8
7.	Comparative study of nervous system of vertebrate	6
8.	Neuro-endocrine relationship of vertebrates	4
9.	Receptor organs in vertebrates: a. Olfactory b. Gustatory c. Photoreceptors (Eye) d. Statoacoustic organ (Ear)	8
10.	Study of endoskeleton of human and its functions	10
	Total	60

Reference Books

- Alexander, R. M.: The chordate. Cambridge University press Lodon.
- Ballairs- Reptiles (Hutchinson)
- Bourne, G. M.: The structure and function of nervous tissue. Academic Press, Newyork.
- Carter, G. S.: Structure and Habit in vertebrate evolutions. Sedgwich and Jackson London.
- Hyman : Comparative vertebrate Anatomy, University of Chicago Perss.

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: DSC – ZOO - 202

Title of the Paper: Biochemistry

Credits: 4

Lectures: 60

Unit	Topic	Lectures
1.	Basics of Biochemistry a. Covalent and Non-covalent bonds. b. Acids and bases- proton donors and acceptors; strong/weak acids/bases; ionization of water and the ion product; c. pH scale and the physiological pH range; dissociation constant -Ka and pKa; d. Henderson-Hasselbalch equation; buffer solutions; Normality and Molarity.	6
2.	Chemistry of biomolecules and their significance a. Carbohydrates-Classification; derivatives of monosaccharides – phosphate esters, acids and lactones; amino sugars; oligosaccharides; polysaccharides – storage and structural polysaccharides; b. Lipids - Definition, classification, structure of fatty acids, triacylglycerols, phospholipids and sphingolipids, Steroid hormones; lipids as constituents of biological membranes c. Amino acids - Structure, classification; non-protein amino acids, essential and non-essential amino acids; modified amino acids and function. d. Nucleic acids: Structure of bases, nucleosides and nucleotides; importance of nucleic acids.	15
3.	Enzymes: Introduction, Types, Nature, Mechanism, Classification, enzyme activity, factors influencing enzyme activity.	7
4.	Confirmation of nucleic acids: Confirmation of nucleic acids (A-, B-, Z-DNA), t-RNA, micro-RNA.	5

5.	Protein structure: a. Primary, secondary, tertiary and quaternary structures. b. Fibrous proteins and globular proteins- examples and biological significance. c. Conformation of protein - Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds. d. Stability of protein structures.	10
6.	Vitamins (Structural formula not expected) a. Definition, Classifications- Fat and Water soluble. b. Study of Fat soluble – A,D,E, and K with respect to sources, daily requirements. Study of Water soluble – B complex (B1,B2,B6 and B12) and with respect to sources, daily requirements. c. Principle role in metabolism and Deficiency diseases.	10
7.	Chemistry of Hormones a. Types: Amine, peptides and Steroids b. Properties of Hormones c. Mode of action of peptide hormones and steroid hormones.	7
	Total	60

Reference Books

- Lehninger, A.L.: Principles in Biochemistry, CBS publication, New Delhi
- Principles and techniques of practical Biochemistry, K. Wilson and J. Walkar, ISBN edition
- Biochemistry: Stryer
- Harper's Biochemistry: Robert Murray, D.K. Granner, Peter A. Mayer and Victor w. Rodwell. International 25th edition.
- Biochemistry: Zubay
- Biochemistry: Satyanarayan

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: DSC – ZOO - 203

Title of the Paper: Practicals corresponding to DSC-ZOO-201

Credits: 4

Lectures: 60

Practical	Title	Type
1.	Classification of vertebrates up to sub-class.	D*
2.	Study of phylogeny of vertebrates.	D*
3.	Study of Adaptive radiations in Mammals.	D*
4.	Study of Affinities of Cyclostomata.	D*
5.	Study of Axial and Appendicular skeleton of human.	D*
6.	Comparative study of structure of heart of vertebrate - Dogfish, Frog, Lizard, Pigeon, Rabbit.	D*
7.	Comparative study of urogenital system of vertebrate - Dogfish, Frog, Lizard, Pigeon, Rabbit.	D*
8.	Study of eye ball muscles of Dogfish/ Pecten from eye ball of hen.	D*
9.	On the basis of Identification Key Identify and Classify an organism.	D*
10.	Visit to Zoo/Sanctuary/Forest.	
11.	Visit to Zoological Survey of India (ZSI).	

D = Demonstration *(with the help of models /charts / pictures / simulation);

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: DSC – ZOO - 204

Title of the Paper: Practicals corresponding to DSC-ZOO-202

Credits: 4

Lectures: 60

Practical	Title	Type
1.	Determination of Protein, Barford reaction.	E
2.	Estimation of Nucleic acid, DNA/RNA.	E
3.	Determination of λ max for protein, amino acid at 280 nm and 260 nm.	E
4.	Estimation of Vit. 'C' from suitable source.	E
5.	Determination of pKa value of glycine.	E
6.	Preparation of buffer of given molarity and pH.	E
7.	Determination of Tryptic activity from any biological sample.	E

E = Experiment

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: GE-ZOO-205

Title of the Paper: Techniques in Biology

Credits: 4

Lectures: 60

Unit	Topic	Lectures
1.	Basic Techniques <ul style="list-style-type: none">• Basic techniques: Lab maintenance and sterilization techniques• Preservation of materials – types of fixatives, macerations, peeling, mounting.• Microtome: - types of microtome, serial sectioning.• Staining: - types and procedure of staining (double and multiple staining).• General principles of biophysical chemistry: -pH, pH meter, types of electrodes and working.• Thermodynamics, conductivity, buffer, turbidity.	12
2.	Advance Microscopy <ul style="list-style-type: none">• Microscopic techniques historical microscopy, principle of microscopy• Types and working of light microscope, electron microscope(SEM and TEM), dark field microscopy, fluorescence microscopy, phase contrast microscope, flow cytometry, confocal microscopy.• Micrometry: - metric units, principles and techniques. Properties of light-wavelengths and resolving power of microscope.	12
3.	Separation Techniques <ul style="list-style-type: none">• Centrifugation techniques: - principles and working of centrifuge• RPM, rotors and its types, types of centrifuge (high speed centrifuge, ultra- centrifuge, and gradient centrifuge)• Chromatographic techniques: - basic principles of chromatography• Rf value calculation, adsorption, absorption, solvents and solutes• Paper chromatography, column chromatography, gel filtration, ion exchange chromatography, HPLC, gas chromatography.• Electrophoresis: - gel electrophoresis (one and two dimensional)• SDS-PAGE, AGAROSE. Various methods and agents used in detection of bands.• Blotting techniques – southern blotting, northern blotting,	12

	and western blotting, south western blotting.	
4.	Spectroscopy <ul style="list-style-type: none"> • Spectroscopic techniques: - relation of wavelength and energy, principles and working of visible spectrophotometer, • U.V. spectrophotometer, I.R. spectrophotometer, flow cytometry, NMR and mass spectrometry, Atomic absorption spectrophotometer 	12
5.	Radio Activity and Immunological techniques <ul style="list-style-type: none"> • Radio labeling and radioactive techniques • Properties of different types of radioisotopes in biological system, radio degradation, half-life period, radio dating, radio labeling, auto radiography, dosimetry, safety guidance. • Rocket immunoelectrophoresis, and Ouchterlony double diffusion method 	12
	Total	60

Reference Books:

- De Roberti's and De Roberti's (2005) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
- Upadhyay, Upadhyay, Nath (2010)'Biophysical chemistry Principals and Techniques' Himalaya publication Mumbai.
- Jacquelyn G Black (2011) "Microbiology principles and exploration 6th edition 2005 john Wiley and sons USA.
- Sadasivam S., Manikam A. (2018) "Biochemical analysis" New age publication, New Delhi.

Class: First Year M.Sc. Zoology - I

Semester - II

Course Code: DSE-ZOO-206

Title of the Paper: Animal Biotechnology

Credits: 4

Lectures: 60

Unit	Topic	Lectures
1.	Animal Cell - Introduction of animal tissue culture and terminologies used in animal biotechnology, Principle, Merits and Demerits of Animal cell/tissue culture, Scope of Animal Tissue Culture	10
2.	Equipments, culture vessel and Media for Cell Culture: a. Specialized Equipments: CO ₂ Incubator. Inverted Microscope, Bio-safety cabinets, Liquid nitrogen, Freezers and Deep Freezers, culture vessel b. Media for culturing cells and tissues: natural and artificial media, Physico-Chemical properties of media.	10
3.	Preparation of culture Media and its Sterilization, Primary and established cell line cultures, Biology and characterization of the cultured cells.	10
4.	Measurement of cell viability and cytotoxicity, Measurement of growth parameters; cell separation, disaggregation of tissue and primary culture, maintenance of cell culture, Scaling-up of animal cell culture.	10
5.	<i>In vitro</i> culture of oocytes / embryos, Cell/embryo cryopreservation, Measurement of cell death, apoptosis, Cell cloning and micromanipulation, Stem Cells.	10
6.	Applications of biological products – Application of Recombinant DNA in manufacture of biological products, Glandular products-pituitary, adrenal, pancreatic (insulin production) and thyroid extracts, Human growth Hormone production, Interferon and interleukins, Immunological products, Vaccines general- killed, live vaccines, examples of various vaccines- Rabies, Hepatitis B, Measles, Influenza, Rubella.	10
	Total	60

Reference Books

- Culture of animal cells (3rd Edition) by Freshney R.I. Wiley-Liss.
- Genes VIII by Lewin. Pearson Education International, NJ, USA, 2004.
- Animal Cell Culture – Practical Approach Edited by John RW. Masters, Oxford.
- Cell Growth and Division: A Practical Approach edited by Basega R, IRL Press.
- Animal Cell Culture Techniques edited by Martin Clynes, Springer.
- Methods in Cell Biology Vol.57, Animal Cell Culture Methods edited by Mather JP and Barnes D, Academic Press.