

“Dissemination of Education for Knowledge, Science and Culture”

-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur

(An Empowered Autonomous Institute)



DEPARTMENT OF ZOOLOGY

M.Sc. Part – I

Semester-I & II

DRAFT SYLLABUS

As per NEP-2020

To be implemented from Academic Year 2026-27

Vivekanand College, Kolhapur
(An Empowered Autonomous Institute)
Department of Zoology
Departmental Teaching and Evaluation Scheme
Two - Years PG Programme
(As per NEP-2020 Guidelines Phase 2.0)
M. Sc. I Semester I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC41ZOO11	Molecular Cell Biology	4	-	60	40	-	100	4
2	DSC-II	DSC41ZOO12	Applied Entomology	4	-	60	40	-	100	4
3	DSE- I	DSE41ZOO11	General Sericulture & Mulberry Cultivation	4	-	60	40	-	100	4
		DSE41ZOO12	Molecular Biology of the Gene							
4	RMD	RMD41ZOO11	Research Methodology	4	-	60	40	-	100	4
5	DSC-PR-I	DSC41ZOO19	Zoology Lab-I	-	12	-	-	150	150	6
Semester-I Total				16	12	240	160	150	550	22
Semester-II										
1	DSC-III	DSC41ZOO21	Physiological Chemistry	4	-	60	40	-	100	4
2	DSC-IV	DSC41ZOO22	Anatomy & Physiology	4	-	60	40	-	100	4
3	DSE- II	DSE41ZOO21	Silkworm Biology & Rearing Technology	4	-	60	40	-	100	4
		DSE41ZOO22	Developmental Biology							
4	DSC-PR-II	DSC41ZOO29	Zoology Lab-II	-	12	-	-	150	150	6
5	FPR/OJT-I	FPR41ZOO21	Field Project		4	-	-	100	100	4
		OJT41ZOO21	On Job Training							
Semester-II Total				12	16	180	120	250	550	22
Total (Semester I & II)				28	28	420	280	400	1100	44

Abbreviations: TH-Theory, PR-Practical, PRO- Project, ESE- End Semester Examination, CIE-Continuous Internal Examination
Note: Separate passing for each Head - ESE, CIE and Practicals

Semester -I

M. Sc. Part – I Semester -I Zoology

DSC-I: DSC41ZOO171: Molecular Cell Biology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, the student will have in depth knowledge of:

CO 1: Functioning of the nucleus and its importance.

CO 2: Structure and various functions of membrane, intracellular transport and sorting.

CO 3: Functioning of various cell organelles at molecular level.

CO 4: Cytoskeletal elements, Cell signalling and cell division.

Unit I: The Interphase Nucleus, Chromatin, and the Chromosome (15 Hrs.)

- a) The ultrastructure of interphase nucleus, nuclear envelope, and nuclear pore complex, Nuclear import and export, Nucleolus
- b) The DNA structure, Histone proteins, Packaging of DNA into chromatin
- c) Euchromatin and Heterochromatin, The C-value paradox
- d) Fine structure and classification of chromosomes

Unit II: Membrane transport, protein sorting and vesicular trafficking (15 Hrs.)

- a) Biomembrane structure and functions.
- b) Transport of Ions and Small Molecules across the membrane.
- c) Transcellular transport.
- d) Cell-cell junctions and their significance.
- e) Protein sorting and vesicular trafficking.

Unit III: Cellular Respiration and Degradation (15 Hrs.)

- a) Mitochondria: Biogenesis, membrane differences, structure, and functions.
- b) Lysosomes: Origin, structural polymorphism and functions.
- c) Peroxisomes: Biogenesis, ultrastructure and functions.
- d) Endosomes: Late and early endosomes, assembly structure, and functions.
- e) Proteasomes: Types, assembly structure and functions.

Unit IV: Cytoskeleton, Cell signaling and Cell division (15 Hrs.)

- a) Cytoskeletal elements: microtubules, microfilaments, intermediate filaments and associated motor proteins

- b) Cell signaling: Features of signal transduction, Molecular Mechanisms of Signal Transduction, Gated Ion Channels, Receptor Enzymes, G Protein-Coupled Receptors and Second Messengers, Regulation of Transcription by Steroid Hormones, Signaling by Mechanoreceptors, pain receptors, Taste receptors and olfactory receptors.
- c) Cell Division: Cell cycle regulation, cyclin dependent kinases and check point pathways, Extracellular and Intracellular Cues Regulating Entry into Meiosis.

Suggested Readings:

1. Molecular Biology of the Cell (7th Ed.) by Bruce Alberts, Rebecca Heald, Alexander Johnson, David Morgan, Martin Raff, Keith Roberts, Peter Walter, John Wilson, Tim Hunt, New York: Garland Science; 2022
2. Molecular Cell Biology, 9th Ed. Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Kelsey C. Martin; Michael Yaffe; Angelika Amon, W H Freeman & Co. New York, US.
3. The cell: A molecular approach – Cooper
4. Molecular cell biology – Gerald carp

M. Sc. Part – I Semester -I Zoology

DSC-II: DSC41ZOO12: Applied Entomology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, Students will be able to

CO1: Demonstrate morphology and anatomy of insects.

CO2: Recognise various types of insect pests.

CO3: Work in Sericulture, apiculture and lac culture.

CO4: Appreciate the forensic entomology and nutritional entomology.

Unit I: (15 Hrs.)

- a) Study of generalized insect: Grasshopper (Morphology and Anatomy, brief Account).
- b) Types of Insect pests: Definition with suitable examples.
- c) Types of Forest pests: Defoliators, Sapsuckers, Borers of trees, spike disease of Sandal, Soil insects damaging forest trees, control methods of forest pests.

Unit II: (15 Hrs.)

- a) Stored grain pests: Rice weevil, Rice moth, Khapra beetle, Pulse beetle, Rust red floor beetle, Angoumois grain moth.
- b) Veterinary entomology: Farm animal pests- Horse fly, Blowfly, Stable fly, Louse fly, Warble fly, Screw worm, Cattle louse, bird louse, Flea

Unit III: (15 Hrs.)

Sericulture: History of Sericulture, Life cycles of Mulberry and Non-mulberry Silkworms, Rearing technology of mulberry silkworm, Diseases and pests of Mulberry silkworm, Moriculture and cultural practices, Diseases and pests of Mulberry.

Unit IV: (15 Hrs.)

- a) Apiculture: The honey bees, Social organization of honey bees, Life history of honey bees, Methods of bee keeping.
- b) Lac culture: Lac insect- Taxonomy, distribution and life history, Host plants and lac insects, Strains of lac insect and their propagation, Cultivation practices, Lac extraction and uses.
- c) Forensic entomology: History, Corpse associated arthropod classes, Role of arthropods in forensic entomology, Examples.

- d) Nutritional entomology: Advantages of eating insects (Entomophagy), Examples of insects generally consumed, Nutritional value, Entomophagy as a source of income.

Suggested Readings:

1. Ambrose, D.P. (2015). The Insects. Structure, Function and Biodiversity. Kalyani publishers, New Delhi. 626pp.
2. Herms W. B. (1961). Medical Entomology. The Macmillan Company, New York And Brett-Macmillan Limited, Galt, Ontario. pp. 616.
3. Srivastava K. P. (1996). A Textbook of Applied Entomology, Volume- II. Kalyani Publishers, New Delhi. pp. 487.
4. David B. V. and Ramamurthy V. V. ((2015). Elements of Economic Entomology. Brillion Publishing, New Delhi. pp. 398.
5. Shukla G. S. and Upadhayay V. B. (2011) Economic Zoology. Rastogi Publications, Meerut, India. pp. 487.
6. Tembhare, D. B (2013). Modern Entomology. Himalaya Publishing House, India. pp 502.

M. Sc. Part – I Semester -I Zoology

DSE-I: DSE41ZOO11: General Sericulture & Mulberry Cultivation

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Appreciate the scope of sericulture and its distribution

CO2: Illustrates various aspects of soil requirement for mulberry cultivation.

CO3: Demonstrate various methods of mulberry cultivation and its management

CO4: Identify and manage various mulberry pest and diseases.

Unit-I: History and scope of Sericulture

(15 Hrs.)

General account of global production of mulberry and non-mulberry silk, Silk route, Geographical distribution of mulberry and non-mulberry sericulture, Scope of sericulture in India

Unit-II: Soil science and requirements for mulberry

(15 Hrs.)

Classification of different types of soil, Physical and chemical properties of soils, Soil testing and Management, Selection and preparation of land for mulberry cultivation Agro climatic zones and agro-climatic conditions for mulberry cultivation, Site suitability for mulberry garden establishment

Unit-III: Mulberry cultivation practices and management

(15 Hrs.)

Characteristic features of popular mulberry varieties of tropical and temperate regions

Propagation of Mulberry- Scope and significance of sexual and asexual propagation, Methods of mulberry propagation

Mulberry crop production- Planning for establishment of mulberry garden Concept and establishment of mulberry garden for chawki & late age worms,

Water management- Concept of irrigation, Methods of irrigation, Frequency of irrigation and importance

Entrepreneurship in mulberry sapling production, Kisan nursery

Unit-IV: Management of Mulberry Pests and Diseases

(15 Hrs.)

Pests: Lepidopteran pests, Coleopteran pests, Orthopteran pests, Dipterans pests, Hemipteran pests (Sap feeders), white fly. Diseases: Fungal diseases - Root rots, Powdery mildew disease. Leaf spot, Leaf rust etc. Bacterial diseases - Leaf blight diseases, Root knot diseases, Viral diseases - Mulberry leaf mosaic disease, Nematode diseases

Suggested Reading:

1. Anonymous (1972): FAO Manuals on Sericulture Vol. I – IV
2. Hanumappa (1978): Sericulture for Rural Development, Himalaya Publications, Delhi.
3. King, L.A. and Posse R.D. (1990): Baculovirus Expression System? Chapman and Hall, London.
4. Koshy, T.D. (1990): Exports and Development, Ashish Publications, New Delhi.

5. Singh, B.D.: Plant breeding, Kalyani Publishers, New Delhi.
6. Anonymous (1972): Hand Book of silk rearing, Agriculture techniques Manual I., Fuji Publication, Tokyo.
7. Jolly, M.S.: Appropriate Sericultural Techniques CSR and TI Mysore.
8. FAO, Volumes (1-4), Central Silk Board, Bangalore
9. Handbook on pest and disease control of mulberry and silkworm, Economic and Social Commission for Asia and Pacific, United Nations.

M. Sc. Part – I Semester -I Zoology

DSE-I: DSE41ZOO12: Molecular Biology of Gene

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, student will be able to

CO1: Understand the genetic mapping techniques and blotting techniques.

CO2: Understand the importance of satellite DNA, Transposable DNA, Organelle DNA in human genome.

CO3: Discuss the of concept of gene, gene structure and transcription, post transcriptional control of gene expression.

CO4: Understand the significance of recombinant DNA technology and genetic manipulations by Knockout, transgenesis techniques and genome editing tools and applications.

Unit - I: Molecular Genetic Technique

(15 Hrs.)

1. Chromosome as a carrier of genes
2. Linkage groups, genetics maps, crossing over and genetic recombination
3. Genetic recombination analysis in *Drosophila*
4. Hybridization techniques –Southern blotting, Northern blotting, In situ hybridization, DNA microarray

Unit - II: Genes, Genomics and Chromosome

(15 Hrs.)

1. Simple sequence DNA – satellite DNA
2. Transposable DNA elements
 - a) DNA Transposons
 - b) LTR Retrotransposons
 - c) Non LTR Retrotransposons (SINES and LINES)
3. Organelles DNA
 - a) Mitochondrial DNA
 - b) Chloroplast DNA
4. Genomics- Genome wide Analysis of Gene Structure and Expression
5. Morphology and Functional Elements of Eukaryotic Chromosomes
 - a) Chromosome number, size and shape at metaphase
 - b) Banding patterns
 - c) Chromosome painting and DNA sequencing

Unit - III:**(15 Hrs.)****1. Gene and its expression:**

- a) Concept of gene
- b) Transcriptional control of gene expression in prokaryote (Lac, trp - operon).

2. Transcriptional control of gene expression in eukaryotes:

- a) RNA polymerases and gene control.
- b) Regulatory sequences in protein coding gene.
- c) Activators & Repressors of Transcription.
- d) Regulation of transcription factor activity.
- e) Regulation of elongation and termination of transcription.
- f) Other eukaryotic transcription systems.

3. Post transcriptional gene control and nuclear transport:

- a) Processing of pre m-RNA.
- b) Regulation of pre m-RNA processing.
- c) Macromolecular transport across the nuclear envelope.
- d) Cytoplasmic mechanisms of post transcriptional control.

Unit - IV: Genetic engineering**(15 Hrs.)**

- a) Recombinant DNA technology
- b) Selection, screening and analysis of recombinants
- c) Knockout gene technique
- d) Production of transgenic mice
- e) CRISPR-Cas9 based genome editing 12

Suggested Readings:

1. Molecular Cell Biology by Lodish *et. al.*
2. Molecular Biology of the gene by Watson
3. Principles of Gene Manipulation by S. B. Primerose

M. Sc. Part – I Semester -I Zoology

RMD: RMD41ZOO11: Research Methodology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO 1: Understand various separation techniques.

CO 2: Know in detail spectroscopy and principles and types of microscopes and immunological techniques

CO 3: Appreciate and apply various concepts of biosystematics.

CO 4: Apply various statistical methods in research.

Unit I: Separation techniques:

(15 Hrs.)

- Centrifugation techniques.** Basic principles of sedimentation and centrifuges and their uses, differential centrifugation, density gradient centrifugation.
- Chromatographic techniques** – Chromatography theory & practices, Molecular Sieve chromatography, affinity chromatography, ion exchange chromatography, HPLC, GLC, Thin layer chromatography.
- Electrophoretic techniques** – General principles, support media, electrophoresis of proteins and nucleic acids, Isoelectric focusing.

Unit II:

(15 Hrs.)

- Spectroscopic techniques:** UV and Visible light Spectroscopy, Spectrofluorimetry.
- Microscopy:** Light microscope, phase contrast microscope, fluorescence microscope, Electron Microscope (SEM & TEM).
- Immunological techniques** -Immunoprecipitation, Labelling antibodies, immunoblotting, immunoassays, immunohisto/cytochemistry.

Unit III: Biosystematics

(15 Hrs.)

- Taxonomy:** Introduction to taxonomy, Stages and importance of taxonomy; Problems, Aim and Tasks of Taxonomy.
- Modern Trends in Taxonomy:** Morphological approach, immature stages and Embryological approach, Ecological, behavioural and Cytological approach, Biochemical and Numerical taxonomy.
- Kinds of Classification.**

Unit IV. Biostatistics in research

(15 Hrs.)

- a) Application of statistics in Biology.
- b) Measures of Central tendency: Arithmetic mean, mode and median.
- c) Measures of dispersion: Range, quartile deviation, mean deviation, Standard deviation, coefficient of variation.
- d) Probability and Probability distribution - Introduction, addition and multiplication theory; Binomial, Poisson and Normal distribution.
- e) Correlation and Regression
- f) Hypothesis testing and test - Student t-test, Chi- square test (χ^2), Analysis of Variance

Suggested Readings:

1. Principles and Techniques in Biochemistry and Molecular Biology by Wilson and Walker
2. Cell: A molecular approach By Cooper
3. Molecular Biology of the Cell by Lodish *et al.*
4. Fundamentals of Statistics- Gupta S. C., 2018
5. Basic Biostatistics and its applications- Datta A. K
6. Biostatistics and Biometry- Parihar and Parihar, 2018
7. An Introduction to statistical Methods, (23rd Edt.) by C. B. Gupta and Vijay Gupta, 2009.
8. Biostatistics by S. K. Pundir, 2022.
9. Introduction to Biostatistics by Larry Winner, Department of Statistics, University of Florida.
10. Camp, W.H. (1951): Biosystematics Britania 7: 113 – 127.
11. Huxley, J.S. (ed.) The New Systematics Oxford Univ. Press London 538 pp.
12. Jeffrey, C. (1977): Biological nomenclature Indian Ed. Oxford and IBH Pub. Co. New Delhi 72 pp.
13. Mayr, E. (1969): Principles of systematic in Zoology Mc. Graw Hill N.Y. 428 pp.
14. Mayr, E. and E.G. Linsley and R.L. Usinger (1953): Methods and Principles of systematic Zoology, Mc Graw Hill N.Y. 328 pp.

M. Sc. Part – I Semester -I Zoology

DSC- PR-I: DSC41ZOO19: DSC Zoology Lab-I

Practical Based on Paper Molecular Cell Biology (DSC41ZOO11), Applied Entomology (DSC41ZOO12), General Sericulture & Mulberry Cultivation (DSE41ZOO11)/ Molecular Biology of the Gene (DSE41ZOO12)

Credits: 06

Marks-150

Section A: Practical Based on Paper Molecular Cell Biology (DSC41ZOO11)

1. Demonstration of extracellular material
 - a. Collagen
 - b. Elastin
2. Demonstration of Glycosaminoglycans in the extracellular material using
 - a. AB-1
 - b. AB-2.5
 - c. PAS
3. Demonstration of Nucleus by
 - i) Basic Dyes: TB, HE, Methylene blue.
 - ii) Feulgen reaction: Effect of temperature,
4. Lysosome demonstration (Acid phosphatase and any other method)
5. Golgi bodies demonstration (Cajal Method)
6. Demonstration of mitochondria
7. Effect of tonicity of solutions on plasma membrane –
 - a) Isotonic, Hypotonic, Hypertonic
 - b) Fragility test of RBC & Osmotic Resistance.
8. Any other practical set by concern teacher.

Section B: Practical Based on Paper Economic Entomology (DSC41ZOO12)

1. Study of generalized insect. Identification economic importance of following insect pests (6-8 pests from each category)
2. Pests of stored gains.
3. Household pests.
4. Pests of medical importance.
5. Pests of veterinary importance.
6. Forest pests.
7. Types of silk moths.
8. Rearing appliances of mulberry silk worm and demonstration.

9. Study of forensic insects
10. Study of nutritional insects.
11. Life cycle and types of honey bees.
12. Lac insect economic importance.
13. Field visit for demonstration of pest damage.
14. Field visit for collection of insects.
15. Any other practical set by concern teacher.

Section C: Practical Based on (As per the elective chosen by a student)

1. Practical Based on General Sericulture & Mulberry Cultivation (DSE41ZOO11)

1. Demonstration of mulberry cultivation.
2. Preparation of mulberry saplings
3. Demonstration of pruning and application of chemical fertilizers
4. Preparation of herbarium of mulberry and non-mulberry host plants.
5. Study of anatomy of leaf, stem and petiole
6. Collection and preservation of mulberry pests
7. Study root and foliar diseases of mulberry
8. Any other practical set by the concerned teacher.

2. Practical Based on Paper Molecular Biology of Gene (DSE41ZOO12)

1. Isolation of DNA
2. Isolation of RNA
3. Estimation of DNA
4. Estimation of RNA
5. Separation of DNA by Agarose gel electrophoresis
6. Separation of RNA by Agarose gel electrophoresis.
7. Spectrophotometric analysis of nucleotides.
8. Spectrophotometric analysis of amino acids.
9. Isolation of Histones
10. Estimation of Histones.
11. Demonstration of Histones.
12. Estimation of phosphate from isolated nucleic acids.
13. Separation of proteins by SDS-PAGE
14. Western blotting
15. Northern blotting

16. Southern blotting.
17. Isolation of plasmids.
18. Any other practical set by concerned teacher.

Semester -II

M. Sc. Part – I Semester -II Zoology

DSC-III: DSC41ZOO21: Physiological Chemistry

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Understand the basic principles of Physics and Chemistry applicable in biology.

CO2: Understand the Metabolism of carbohydrates and its energetics.

CO3: Understand the chemistry of amino acids, proteins and nucleic acids.

CO4: Understand metabolism of lipids and their physiological significance.

Unit I: Chemical foundations of Biology

(15 Hrs.)

- a) Structure of atom
- b) Types of bonds, Van der Waal's electrostatic forces of attraction, hydrophobic interactions.
- c) Chemical structure and properties of water, pH, pKa, buffers,
- d) Thermodynamics in biological system: Enthalpy, Entropy and Gibb's free energy.

Unit II: Carbohydrate metabolism

(15 Hrs.)

- a) Structure, classification and functions of carbohydrates,
- b) Glycolysis, regulation and energetics,
- c) TCA cycle, regulation and energetics,
- d) Electron transfer system structure and mechanism of action, oxidative phosphorylation and ATP generation,
- e) Glycogenesis, glycogenolysis and gluconeogenesis
- f) Pentose phosphate pathway and its significance

Unit III: Amino acids, Proteins and nucleic acids

(15 Hrs.)

- a) Amino acids: Classification of amino acids, biosynthesis and Oxidation of amino acids.
- b) Proteins: Protein structure and functions: Primary, secondary, tertiary and quaternary structure
- c) Nucleic acids: Structure of nucleotides. Structure of DNA and RNA, De novo and salvage pathway of synthesis of nucleotides

Unit IV: Lipid metabolism

(15 Hrs.)

- a) Lipids- structure, classification and functions, Steroidal hormones: structure and functions.
- b) Catabolism of fatty acid – Beta oxidation, Carnitine shuttle, Significance of beta oxidation. Bioenergetics of Beta oxidation

- c) Biosynthesis of saturated and unsaturated fatty acids.
- d) Biosynthesis of triglycerides,
- e) Biosynthesis of membrane phospholipids.
- f) Biosynthesis of cholesterol
- g) Biosynthesis of prostaglandins and leukotriene Lipoprotein metabolism

Suggested Readings:

1. Lehninger-Principles of Biochemistry: Nelson and Cox
2. Biochemistry:, Tymoczko, Berg, Stryer
3. Review of physiological chemistry: H. Harper

M. Sc. Part – I Semester -II Zoology

DSC-IV: DSC41ZOO22: Anatomy & Physiology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Learn about anatomy of digestive system and nutrition.

CO2: Understand various concepts of respiratory physiology.

CO3: Understand various aspects of circulatory physiology.

CO4: Illustrate anatomy and physiology of excretory and endocrine organs.

Unit I: Physiology of Digestive System:

(15 Hrs.)

- a) Anatomy and physiology of gastrointestinal tract, Salivary gland, Pancreas and Liver.
- b) Digestion and absorption in gastrointestinal tract
- c) Balanced diet, obesity and starvation.
- d) Vitamins and their role in nutrition.

Unit II: Physiology of Respiration:

(15 Hrs.)

- a) Anatomy and physiology, respiratory tract and pulmonary ventilation.
- b) Pulmonary air volumes and capacities.
- c) Exchange of Oxygen and carbon dioxide.
- d) Control of respiration.

Unit III: Physiology of Circulation:

(15 Hrs.)

- a) Blood, Composition of blood, blood coagulation.
- b) Blood groups and blood transfusion.
- c) Anatomy and physiology Heart and blood vessels, Heart blood supply.
- d) Conduction system and pace maker.
- e) Electrocardiogram, Cardiac Cycle and heart sound.

Unit IV: Physiology of Excretion and Endocrine System:

(15 Hrs.)

- a) Anatomy and physiology of the kidneys, nephron and mechanism of urine formation.
- b) Urinary bladder, process of micturition, Hemodialysis and Artificial kidney.
- c) Anatomy and physiology of Pituitary gland and Adrenal gland.
- d) Anatomy and physiology of Thyroid and Parathyroid gland.

Suggested Readings:

1. Human Physiology – by A.C. Guyton. Saunders Company London, Toronto.
2. Shepherd G.M. Neuro Biology, New York Oxford University Press 1987.
3. Hurst J.W et al (eds) The Heart 7th ed. New York McGraw- Hill Book Co. 1990.
4. Hand Book of Physiology Vols. Circulation. Renkin, E.M. & Micbel, C.C. (eds) American Physiological Society, 1984.
5. Gayton A.C. et al. Circulation Overall regulation Annu Re. Physiol. 34: 13 1972.
6. Guyton A.C. 1980 Arterial pressure & Hypertension Philadelphia, W.B. Saunders Co- Cartiar output & its regulation 1973.
7. Kaplan N.M. et al 1989- The Kidney in Hypertension (Perspectives in hypertension vol.2) New York. Raven Press.
8. Guyton A.C. et al 1975 Dynamics & Control of the Body fluids Philadelphia, W.B. Saunders, Co., 1975.
9. Brenner B.M. & Rector, F.C. (Jr) 1986. The kidney 3rd ed. Philadelphia, W.B. Saunders Co., 1986.
10. Brooks V.B. 1986. The neural Basis of motor control New York, Oxford University press.
11. Johnson L.R. et al Physiology of the gastrointestinal tract 1987 New York Raven press.
12. Thompson J.C. et al (eds) Gastrointestinal Endocrinology. New York McGraw Hill book co., 1987.
13. Setchell K.D.R. et al eds 1988. The Bile Acids New York Plenum Pub. Corp.
14. Guthrie H.A. 1988. Introductory Nutrition 7th ed. St. Lonis C.V. Mosby Co.,
15. Felig P et al (eds) 1987. Endocrinology & Metabolism New Your Mac Graw- Hill Book Co.,
16. DeGroot L.J. et al 1989. Endocrinology 2nd ed. Philadelphia, W.B. Saunders Co. 1989.
17. Kannan, C.R. 1988. The adrenal gland New York Plenum Pub. Corp.

M. Sc. Part – I Semester -II Zoology

DSE-II: DSE41ZOO21: Silkworm Biology & Rearing Technology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Understand biology of various silkworms.

CO2: Illustrate anatomy and physiology of silkworm.

CO3: Appreciate rearing and management of silkworms.

CO4: Understand various silkworm diseases and their management.

Unit - I: Silkworm Biology

(15 Hrs.)

Classification and Geographical distribution of Silkworm races Life cycle of mulberry silkworm Life cycle of non-mulberry silkworms Eri, Muga and Tasar

Unit - II: Anatomy and Physiology of mulberry silkworm

(15 Hrs.)

Digestive system, Circulatory system, Excretory system, Nervous system, Respiratory system, Reproductive system and Endocrine system Anatomy, silk gland structure and function

Unit - III: Rearing technology and management practices

(15 Hrs.)

Principles of silkworm rearing, Environmental conditions for silkworm rearing Rearing Equipments, Management of rearing house and disinfection Types of rearing houses, Types of silkworms and methods of commercial rearing Chawki Rearing concept, shoot feeding and shelves rearing technology

Unit - IV: Silkworm diseases and management

(15 Hrs.)

Protozoon diseases, Bacterial diseases, Viral diseases, Fungal diseases and their management practices Pests, Predators, Parasites of mulberry and non-mulberry silkworm and management

Suggested Reading Material:

1. Sarkar, D.C. (1988): Ericulture in India, CSB, Bangalore.
2. Annual report of Central Sericultural Research and Training Institute, Mysore.
3. Annual report of Central Sericultural Research and Training Institute, Bangalore.
4. Annual report of Central Tasar Research Institute, Ranchi.
5. Annual report of Central Muga Research Institute, Assam.
6. A Treatise on acid treatment of silkworm eggs, CSR and TI, Mysore.
7. Tips for successful silkworm cocoon crops, CSR and TI, Mysore.

8. Tips for successful bivoltine silkworm cocoon crops, CSR and TI, Mysore.
9. M.V. Samson, Chandrashekhariah, P. Gowde and Saheb B. (1995): Monograph on silkworm loose egg production, SSTC, CSB, Bangalore.
10. FAO, Volumes (1-4), Central Silk Board, Bangalore

M. Sc. Part – I Semester -II Zoology

DSE-II: DSE41ZOO22: Developmental Biology

Credits: 04

Theory: 60hrs.

Marks-100

Course Outcomes: Upon successful completion of this course, students will be able to,

CO1: Understand the fundamentals of basic concepts of development of animals

CO2: Appreciate the molecular basis of gametogenesis, fertilization and mechanism of blastulation.

CO3: Understand the process of gastrulation and neurulation

CO4: Appreciate animal development at molecular and genetic level.

Unit – I: An introduction to developmental biology: (15 Hrs.)

Introduction, features of animal development, eukaryotic heritage, development among the unicellular eukaryotes, control of developmental morphogenesis and differentiation, origin of sexual reproduction, colonial eukaryotes, the evolution of differentiation, developmental pattern among metazoans

Unit - II: Gametogenesis, fertilization and early embryonic development (15 Hrs.)

- a) Production of gametes,
- b) Cell surface molecules in sperm-egg recognition in animals,
- c) Process of fertilization, cleavage,
- d) Blastulation in sea urchin, Amphioxus, Zebra fish, frog, chick and mammal.
- e) Implantation in mammals

Unit – III: Gastrulation and Neurulation (15 Hrs.)

- a) Gastrulation and formation of germ layers in sea urchin, frog, birds, reptiles and mammals;
- b) Molecular mechanism of left –right axis formation- in amphibian, mammal and reptile
- c) Neurulation-body segmentation, Hox gene control development

Unit – IV: Morphogenesis and organogenesis in animals (15 Hrs.)

- a) Cell aggregation and differentiation in *Dictyostelium*- Life cycle of *Dictyostelium*, cell-cell signaling, cell adhesion molecules in *Dictyostelium*
- b) Axes and pattern formation in *Drosophila*-Development of fruit fly, maternal effect gene,
- c) Organogenesis – vulva formation in *Caenorhabditis elegans*-cell-cell interactions and chance in the determination of cell types
- d) Eye lens induction- Cascades of induction –reciprocal and sequential inductive events

Suggested Readings:

1. Developmental Biology By Gilbert
2. Molecular cell biology by Lodish, Berk, Matsudaira, Kaiser, Krieger (2004) published by W. H. Freeman & company, New York.
3. The Cell by Bruce Alberts, published by Garland publishing Inc. New York & London
4. Cell & Molecular Biology by Gerald Karp (2005) published by John Wiley & sons.
5. Cell & Molecular Biology by E.D.P. De Robertis

M. Sc. Part – I Semester -II Zoology

DSC- PR-II: DSC41ZOO29: DSC Zoology Lab-II

Practicals based on Physiological Biochemistry (DSC41ZOO21), Anatomy & Physiology (DSC41ZOO22), Silkworm Biology & Rearing Technology (DSE41ZOO21) / Developmental Biology (DSE41ZOO22)

Credits: 06

Marks-150

Section A: Physiological Biochemistry (DSC41ZOO21)

1. Estimation of glycogen.
2. Estimation of lipids & phospholipids.
3. Estimation of Vitamin C.
4. Estimation of Cholesterol.
5. To find saponification value for a given fat.
6. Preparation of phosphate buffer pH measurement.
7. To estimate free amino acids by Ninhydrin method.
8. To estimate protein content by Biuret method/ Lowry et.al./ Bradford method.
9. Estimation of glucose.
10. Estimation of casein from milk.
11. Estimation of Uric acid
12. Extraction of Starch.
13. Extraction of Glycogen.
14. Any other practical set by the concerned teacher

Section B: Practical Based on Paper Anatomy & Physiology (DSC41ZOO22)

1. Determination of Bleeding time
2. Determination of Clotting time
3. Estimation of Hemoglobin (Hb) concentration and oxygen carrying capacity
4. Enumeration of Red blood corpuscles (R.B.C)
5. Enumeration of white blood corpuscles (W.B.C)
6. Differential count of W.B.C.
7. Erythrocyte sedimentation rate (E.S.R)
8. Detections of digestive enzymes
9. Anatomy and histology of digestive and endocrine glands

10. To estimate amylase from saliva
11. To study normal constituents of urine
12. Measurement of breathing rate, heart beat and study of heart sound.
13. Any other practical set by the concerned teacher

Section C: Practical Based on As per the elective chosen by a student

1. Practical Based on Paper Silkworm Biology & Rearing Technology (DSE41ZOO21)

1. Morphology of egg, larva, pupa and adult of mulberry and non-mulberry silkworms
2. Dissection of Digestive system of silkworm
3. Dissection of Nervous system of silkworm
4. Dissection of Circulatory system of silkworm
5. Dissection of male reproductive system of silkworm
6. Dissection of female reproductive system of silkworm
7. Mounting of silk gland
8. Rearing of silkworm to study its life cycle.

2. Paper Developmental Biology (DSE41ZOO22)

1. Study of eye lens differentiation in chick embryo.
2. Study of nervous system development in chick embryo.
3. Study of Angiogenesis in chick embryo.
4. Study of Dorsal nerve root development in chick embryo
5. Effect of colchicine on development of dorsal nerve root in chick embryo
6. Demonstration of stem cells
7. Study of gastrulation in amphioxus and frog
8. Study of partial hepatectomy in mice.
9. Any other experiments / practical set by the Department.

Nature of Question Paper (End Semester Examination)

VIVEKANAND COLLEGE, KOLHAPUR (AN EMPOWERED AUTONOMOUS INSTITUTE)

M.Sc. I Sem: Examination.....

Course Code and Name:

Day:

Date: --/--/----

Time: 2hr 30min

Marks: 60

Instructions:

- 1) All the questions are compulsory.
 - 2) Figures to the right indicate full marks.
 - 3) Draw neat labelled diagrams wherever necessary.
 - 4) Use of log table/calculator is allowed.
-

Q.1. Choose the correct alternative (One Mark Each)

[12]

- i)
A) ----- B) ----- C) ----- D) -----
- ii)
A) ----- B) ----- C) ----- D) -----
- iii)
A) ----- B) ----- C) ----- D) -----
- iv)
A) ----- B) ----- C) ----- D) -----
- v)
A) ----- B) ----- C) ----- D) -----
- vi)
A) ----- B) ----- C) ----- D) -----
- vii)
A) ----- B) ----- C) ----- D) -----
- viii)
A) ----- B) ----- C) ----- D) -----
- ix)
A) ----- B) ----- C) ----- D) -----
- x)
A) ----- B) ----- C) ----- D) -----
- xi)
A) ----- B) ----- C) ----- D) -----
- xii)
A) ----- B) ----- C) ----- D) -----

Q.2. Attempt any THREE [FOUR Marks Each]

[12]

- i).....
- ii).....
- iii).....
- iv).....
- v).....

Q.3. Attempt any THREE [FOUR Marks Each]

[12]

- i).....
- ii).....
- iii).....
- iv).....
- v).....

Q.4. Attempt any TWO [SIX Mark Each]

[12]

- i).....
- ii).....
- iii).....

Q.5. Attempt any TWO [SIX Mark Each]

[12]

- i).....
- ii).....
- iii).....
