

d"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

B.Sc. Part - II
Semester-III & IV

SYLLABUS

As per NEP-2020

To be implemented from Academic Year 2025-26

Departmental Teaching and Evaluation scheme
Second Year Semester-III & IV

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	SEE	CIE	PR	Marks	
Semester-III										
Major										
1	DSC-V	2DSC03ZOO31	Animal Physiology	2	-	40	10	-	50	2
2	DSC-VI	2DSC03ZOO32	Evolution	2	-	40	10	-	50	2
3	VSC-PR-II	2VSC03ZOO39	Sericulture	-	4	-	-	25	25	2
4	DSC-PR-III	2DSC03ZOO39	DSC-Zoology Lab-3	-	8	-	-	50	50	4
Minor										
1	MIN-V	2MIN03ZOO31	Biostatistics	2	-	40	10	-	50	2
2	MIN-VI	2MIN03ZOO32	Ethology	2	-	40	10	-	50	2
3	MIN-PR-III	2MIN03ZOO39	MIN-Zoology Lab-3	-	4	-	-	25	25	2
Open Elective										
1	OEC LFS-PR-III	2OEC03LFS32	Beekeeping and Honey Processing	-	4	-	-	25	25	2
Semester –III Total				8	20	160	40	125	325	18
Semester-IV										
Major										
1	DSC-VII	2DSC03ZOO41	Principles of Biochemistry	2	-	40	10	-	50	2
2	DSC-VIII	2DSC03ZOO42	Histology	2	-	40	10	-	50	2
3	VSC-PR-III	2VSC03ZOO49	Pisciculture	-	4	-	-	25	25	2
4	DSC-PR-IV	2DSC03ZOO49	DSC-Zoology Lab-4	-	8	-	-	50	50	4
Minor										
1	MIN-VII	2MIN03ZOO41	Tools and Techniques in Biology	2	-	40	10	-	50	2
2	MIN-VIII	2MIN03ZOO42	Insect Pest Management	2	-	40	10	-	50	2
3	MIN-PR-IV	2MIN03ZOO49	MIN-Zoology Lab-4	-	4	-	-	25	25	2
Open Elective										
1	OEC LFS-PR-IV	2OEC03LFS42	Aquarium Management	-	4	-	-	25	25	2
Semester –IV Total				8	20	160	40	125	325	18

B. Sc. Part –II Major
Semester –III Paper- V
Animal Physiology (2DSC03ZOO31)

Theory: 30 Hours

Credits- 02

Course Outcomes: After the completion of the course the student will be able to -

CO1: Remember the basic terms in human anatomy & physiology

CO2: Explain the working of different systems in the body

CO3: Compare the functioning of various systems in the body

CO4: Interpret the mechanism of working of organs-systems in the body

CO5: Acquire knowledge for higher studies and research area

Unit I

15Hrs

Digestion

Brief account of the alimentary canal and digestive glands, Physiology of digestion and absorption of carbohydrates, proteins, and lipids in alimentary canal

Respiration

Brief account of the respiratory system, Pulmonary ventilation, Respiratory volumes and capacities, Transport of oxygen and carbon dioxide in the blood, Haldane effect, Bohr's effect, Chloride shift

Excretion

Brief account of the excretory system, Ultrastructure of the nephron, Mechanism of Urine formation, Counter-current Mechanism

Unit II

15Hrs

Cardiovascular system

Composition of blood, Structure of Heart, Origin and conduction of heartbeat, Cardiac cycle, ECG

Nerve

Structure of a neuron, Neurotransmitter, Synapse-Electrical and chemical synapse, Origin of action potential and its propagation in nerve fibres

Muscle

Types of muscle, Ultra-structure of skeletal muscle, Mechanism of muscle contraction

Suggested readings:

1. Rastogi, S.C. (2007). Essentials of Animal Physiology, New Age International Publishers
2. Widmaier, E.P, Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, 9th Edition, McGraw Hill publication.
3. Nagabhushanam, (2008). Textbook of Animal Physiology, Oxford and IBH publication
4. Tortora G.J and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc
5. Guyton, A.C. and Hall, J. E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
6. Singh, H.R. & Neeraj Kumar (2017). Animal Physiology and Biochemistry, Vishal Publishing Co.

B. Sc. Part –II
Semester – III Paper- VI
Evolution (2DSC03ZOO32)

Theory: 30 Hours**Credits- 02**

Course outcomes: After the completion of the course the student will be able to -

CO1: Remember the basic concepts of evolution

CO2: Understand the evolution of the universe and life

CO3: Apply the knowledge of evolutionary biology to understand the phylogeny of evolution

CO4: Correlate the human evolution with different types of evolutionary theories

CO5: Develop skills and concepts to understand all aspects of evolutionary Biology.

UNIT-1**15 Hrs****Origin of Life and evidences of evolution**

Life's beginnings: Chemogeny, RNA World, Biogeny, Cognogeny, Geological time Scale

Introduction to evolutionary theories

Lamarckism, Weismann's theory of germplasm, Darwinism, Mutation theory, Neo-Darwinism

Processes of Evolutionary Change

Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection, Adaptive radiation-Darwin's finches

UNIT-2

15 Hrs

Evidences of Evolution

Fossils, Types of fossils, Process of fossilization, dating of fossils, comparative anatomy, vestigial Structures

Species concept

Biological species concept (Advantages and limitations); Isolating mechanisms, Modes of speciation (Allopatric, Sympatric, Peripatric and Parapatric)

Extinction

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

Suggested readings:

1. Ridley, M. (2004). Evolution, 3rd Edition, Willey Blackwell publishing.
2. Hall, B. K. and Hallgrimson, B. (2008). Evolution, 4th Edition, Jones and Barlett Publishers.
3. Campbell, N. A. and Reece, J. B. (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
4. Douglas, J. F. (2009). Evolution, 2nd Edition, Sinauer Associates. Inc., U. S.
5. Jonathan B. L, (2013). The Princeton Guide to Evolution, Princeton University Press.

B. Sc. Part –II
Semester – III Paper- V & VI
ZOOLOGY LAB (3): VSC03ZOO39 (Practical II)
Practicals based on
Sericulture (2VSC03ZOO39)

Credits- 02

Course Outcomes: after successful completion of the course will be able to:

- CO1: Identify the various types of silk moths and Silk Fibers.
 - CO2 Describe the various anatomical organs of silk Worm Larvae.
 - CO3: Apply the knowledge to handle the silk worm larvae and rearing technique.
 - CO4: Evaluate the quality of silk and identification of mulberry and silkworm diseases.
 - CO5: Develop skill in Sericulture technology and production of silk cocoon ornaments.
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Practicals

1. Types of silk moths classification and description
2. Life cycle of silk Worm *Bombyx mori* (L)
3. Life cycle of Vanya / Non-Mulberry Silkworm
4. Difference between male and female silk moths of *Bombyx mori*
5. Sex separation in larva, pupa and adult of silkworm
6. General anatomy of silkworm (Photographs/Images/dissections)
7. Identification of egg, larva, pupa and moths of different non-mulberry silk moths (Photographs/Images).
8. Dissection and display (Photographs/Images/ dissections):
 - a. Digestive system of larva.
 - b. Silk glands.
 - c. Reproductive system of male and female moths.
 - d. Mounting of larval mouth parts and spiracle.
 - e. Nervous system of silkworm larva.
9. Silkworm rearing techniques and its maintenance
10. Mulberry cultivation and its maintenance
11. Identification of different Mulberry Varieties / Species
12. Calculation of shell ratio and denier scale by using the formula
13. Identification of major Mulberry pests and diseases
14. Identification of major silkworm pests & diseases and their disposal
15. Study of sericulture equipments.
16. Visit to sericulture unit/ farm

Suggested Reading

1. Charsley, S.R. (1982). Culture and sericulture. Academic Press Inc., New York, U.S.A
2. Ganga, G., and Chetty J. S. (1991). An introduction to sericulture. Oxford & Ibh Publishing Company.
3. Manual-2 - Silkworm rearing. Agriculture Service Bulletin, Fao, Rome.
4. Madan Mohan Rao, M. (1999). Comprehensive sericulture manual. PS Publications, Hyderabad.
5. Morohoshi S. (2001). Development physiology of silkworms. Science Publishers, U.S.
6. Yataro T. (2001). Improvement of biological functions in the silkworm. Science Publishers

7. Amin Masood M. and Afifa S. K. (2000). Principles of temperate sericulture. Kalyani Publisher.
8. Govindan, R., Narayanaswamy T.K. and Devaiah M. C. (1998) Principles of silkworm pathology. Seri Scientific Publishers, Bangalore.
9. Govindan R., Ramakrishna N. and Sannappa B. (2004). Advances in disease and pest management in sericulture. Seri Scientific Publishers, Bangalore

B. Sc. Part –II
Semester – III Paper- V & VI
ZOOLOGY LAB (3): 2DSC03ZOO39 (Practical III)
Practicals based on
Animal Physiology (2DSC03ZOO31) and Evolution (2DSC03ZOO32)

Credits-04

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1. To prepare hemin crystals from a given blood sample/own blood
 2. To detect ABO blood groups in human blood.
 3. To determine the bleeding time of own blood
 4. To determine the clotting time of own blood.
 5. To determine Erythrocyte Sedimentary Rate (E.S.R)
 6. To Estimate of Hb by Sahli's haemometer
 7. To Count the total RBCs of own blood
 8. To Count the total WBCs of own blood
 9. To study Differential WBCs of own blood
 10. To Measure human blood pressure
 11. To Interpret the ECG.
 12. Measurement of lung capacity
 13. Study of dialyzer unit
 14. Study of permanent slides of duodenum, liver, pancreas, salivary gland
 15. Study of permanent slides of spinal cord, lung, kidney, blood vessels (artery& vein)
 16. Study of fossil evidences from plaster cast models and pictures
 17. Study of homology and analogy from suitable specimens/ pictures
 18. Study of Phylogeny of human evolution
 19. Study of Phylogeny of horse
 20. Study of Darwin's finches with diagrams/ cut-outs of beaks of different species
 21. Study of adaptive radiation in marsupial

22. Study of fossil animals- *Peripatus*, *Dipnoi* fish, *Archaeopteryx*
23. Selection of fruit fly in relation to diet
24. Example based on Hardy-Weinberg law
25. Submission of project report / posters
26. Visit to Pathology lab/ museum/natural history museum/ educational institutes

B. Sc. Part –II Minor
Semester – III Paper- V
Biostatistics (2MIN03ZOO31)

Theory: 30 Hours

Credits- 02

Course Outcomes: After the completion of the course the student will be able to -

- CO1: Recall the fundamental importance of statistics in the field of biology.
- CO2: Understand the scope and sampling methods in biostatistics.
- CO3: Distinguish between different types of data and random sampling techniques.
- CO4: Summarize the key concepts of various diagrammatic representation methods.
- CO5: Application of statistical methods and prepare a report on given statistical data and its analysis

Unit I

15Hrs

Introduction to Biostatistics

Biostatistics Definition, Classification of Data, Types and methods of data collection procedures, Different types of scales- nominal, ordinal, ratio and interval, Scope & Importance

Frequency distribution

Principles of frequency distribution, Graphical presentation of data (Line diagram, Bar diagram; Pie chart, Histogram- equal and unequal classes, Polygon and frequency curve, Ogive curve)

Unit II

15Hrs

Tabulation

Definition, Requirements of a good table, Parts of the table; Types of tabulation and its applications

Measures of central tendency

Mean, Median, Mode, Measures of dispersion - Range, Standard deviation, Mean deviation

Correlation

Types of Correlation, Regression, similarities and dissimilarities of correlation and regression.

Suggested Readings

1. Benjamin B (1969). Demographic Analysis, George, Allen and Unwin. Chiang, C L John Wiley (1968). Introduction to Stochastic Processes in Biostatistics.
2. Griffin, D.J.Finney (1971). Statistical method in Bioassay Pub 3rd edition
3. Selvin, S., (1991). Statistical Analysis of epidemiological data, New York University Press.
4. Milton, J.S. & Tsokos, J.O. (1992). Statistical Methods in the Biological and Health Sciences (2nd edition) McGraw Hill
5. Campbell, R.C., (1998). Statistics for Biologists, Cambridge University Press.
6. Pagana, M. and Gavreau, K. (2000). Principles of Biostatistics, Duxberry Press, USA
7. Z. Govidarajulu (2000). Statistical techniques in Bioassay Pub.S.Kargar
8. Daniel, W.W. (2012). Biostatistics: A Foundation for Analysis in Health Sciences (10th edition) John Wiley.
9. Zar. J.H. (2013). Biostatistical Analysis (5th edition) Pearson.
10. Rohtagi V.K. and. Saleh A. K. M. E (2015). An Introduction to Probability Theory and Mathematical Statistics, 3rd Edition, Wiley.

**B. Sc. Part –II Minor
Semester – III Paper-VI
Ethology (2MIN03ZOO32)**

Theory: 30 Hours

Credits- 02

Course outcomes: After the completion of the course the student will be able to -

CO 1: Remember the basic concepts of evolution

CO2: Understand the basics of animal behaviour

CO3: Apply the knowledge of animal behaviour

CO4: Compare different types of animal behaviour

CO5: Develop skills and concepts to understand all aspects of animal behaviour

UNIT- I

15 Hrs

Animal Behaviour concept and classification:

Introduction, Ethology as a branch of biology, Animal psychology, classification of behavioral patterns, Analysis of behaviour, innate behaviour

Communication: Introduction, chemical, visual, audio, olfactory, electric, touch; Species specificity of songs; Communication in bees and ants

Ecological Aspects of Behaviour:

Introduction, habitat selection, food selection, optimal forage theory, anti-predation defenses, aggression, homing, territoriality

UNIT-II

15 Hrs

Social Behaviour:

Introduction, aggression, aggregations- schooling in fishes, flocking in birds; herding in mammals, group selection, kin selection, social organization in insects and primates

Reproductive Behaviour:

Introduction, mating systems, courtship, sexual selection

Biological rhythms: Introduction, Circadian and Circa-annual rhythms, Orientations and navigation, Migration of fishes and birds

Suggested readings

1. Campbell, N. A. and Reece, J. B. (2011). Biology. IX Edition. Pearson, Benjamin, Cummings.
2. David McFarland, (2009). Animal Behaviour-Psychobiology, Ethology and Evolution, eBook, Longman Publishing.
3. Manning, A. and Dawkins, M. S. (1998). An Introduction to Animal Behaviour, 5th Edition Cambridge, University Press, UK.
4. John Alcock, (2009). Animal Behaviour, Sinauer Associate Inc., U.S.
5. Paul W. Sherman and John Alcock, (2011). Exploring Animal Behaviour, 5th Edition Sinauer Associate Inc., Massachusetts.

B. Sc. Part –II Minor
Semester – III Paper- V & VI
ZOOLOGY LAB (3): 2MIN03ZOO39 (Practical III)
Practicals based on
Biostatistics (2MIN03ZOO31) and Ethology (2MIN03ZOO32)

Credits-02

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1. Calculate the mean using given data (Any two examples)
 2. Calculate the median using the given data (Any two examples)
 3. Calculate the mode using the given data (Any two examples)
 4. Calculate the standard deviation using the given data.
 5. Draw a line/ Bar diagram using the given data.
 6. Draw a Histogram by using given data (equal unequal distribution)
 7. Draw a Polygon using given data.
 8. Draw frequency curve/ Ogive curve using given data.
 9. Drawing graphs and tables on a computer using given data.
 10. Examples based on regression (Any two examples)
 11. Examples based on correlation (Any two examples)
 12. To study the locomotory behaviour in - a) Earthworm b) Garden snail
 13. To study chemical communication in ant
 14. To study simple reflex behaviour in Cockroach
 15. To study the reaction of terrestrial woodlice to light and humidity
 16. To study the aggression and courtship behaviour in crickets
 17. To study the chemoreception in the adult fly
 18. To study the courtship behaviour in fruit fly

B. Sc. Part – III Semester -VI ZOOLOGY
OEC LFS-PR-III: 2OEC03LFS32: OEC Zoology Lab-III
Practicals Based on Bee Keeping and Honey processing

Credits 2

Marks: 25

(Four lectures of 60 minutes per week per batch)

Course outcomes: After the completion of the course the student will be able to -

1. Identify species and morphological characteristics of Honey Bees
2. Describe the structure of bee hive and explain the role of various bee caste
3. Demonstrate techniques of hive inspection and handling of bees
4. Evaluate quality of honey and assess factors affecting honey production

5. Design a basic model of a bee farm and develop plans for honey extraction.

1. Study of different species of honeybees
2. Identification of different castes of honeybees
3. Study of different stages of life cycle of honeybees
4. Identification of Queen cells, Drone cells & Brood cells
5. Study of honey and pollen storage structures in hive
6. Methods of multiplication of Bee colonies
7. Steps for strengthening of colonies- Requeening technique
8. Identification and study of beekeeping tools and equipments
9. Extraction of Honey using Honey extractor
10. Demonstration of processing, filtration and bottling of honey
11. Determination of moisture content and quality testing of honey
12. Identification and management of bee diseases and pest.
13. Methods and measures to transport bee colonies
14. Propagation of floral calendar
15. Visit to apiculture unit and report submission

Suggested Reading

1. Singh S. (1962). Beekeeping in India, Indian Council of Agricultural Research, New Delhi.
2. Mishra, R. C. (1995). Honeybees and their Management in India. Indian Council of Agricultural Research, New Delhi.ayashree K.V., Tharadevi C.S Arumugam (2000).Text book of Apiculture Saras Publication.
3. Hooper T., Clive De B., Thomas M. (2014). The Beginner's Bee Book. Stenlake Publishing, Ayrshire. David Cramp (2012). The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
4. Cramp D., (2009). A Practical Manual of Beekeeping: How to Keep Bees and Develop Your Full Potential as an Apiarist. Spring Hill, London.
5. Hooper T., (2010). Guide to Bees and Honey: The World's Best Selling Guide ekeeping. Northern Bee Books. Oxford.
6. Roger A. M., Kim F., (1998). Honey Bee Pests, Predators and Diseases. Wicwas Pr; 3rd edition.

7. Jabde P. V., (1993). Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac Culture, Agricultural Pests and their Controls. Discovery Publishing House, New Delhi.

**B. Sc. Part –II Major
Semester – IV Paper- VII
Principles of Biochemistry (2DSC03ZOO41)**

Theory: 30 Hours

Credits- 02

Course Outcomes: After the completion of the course the student will be able to -

- CO1: Recall the functional significance of biomolecules
- CO2: Understand the biochemistry of carbohydrates, protein and lipids and their metabolism
- CO3: Apply comprehensive knowledge of the metabolism
- CO4: Compare the biochemistry of carbohydrates, protein and lipids and their metabolism
- CO5: Design and implement experimental procedures using relevant techniques in biochemistry

Unit I

15Hrs

Carbohydrate Metabolism

Structure, classification and function of Carbohydrate, Glycolysis, Krebs cycle, Electron transport chain, Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis

Lipid Metabolism

Structure, classification, properties, types and functions of lipids, Biosynthesis of fatty acids and cholesterol, β oxidation of palmitic acid

Unit II

15Hrs

Protein metabolism

Amino acids- Structure, Essential and non-essential amino acids, Protein Structure (Primary, Secondary, Tertiary and Quaternary), Transamination, Deamination and Urea Cycle

Enzymes

Definition, Properties, Nomenclature and classification of enzymes, Mechanism of action of enzymes (Induced fit model & Lock and key model), Factors affecting enzyme activity, Inhibition and Regulation of enzyme action.

Suggested Reading

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman

and Co.

3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill
4. Jain and Jain, Fundamental of Biochemistry
5. Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York) (2013). Lehninger: Principles of Biochemistry.
6. Devlin, T.M., John Wiley & Sons, Inc. (New Jersey) (2011). Textbook of Biochemistry with Clinical Correlations.
7. Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York) (2012). Biochemistry 7th ed.

**B. Sc. Part –II Major
Semester – IV Paper- VIII
Histology (2DEC03ZOO42)**

Theory: 30 Hours

Credits- 02

Course Outcomes: After the completion of the course the student will be able to -

- CO1: Identify the different types of tissue
- CO2: Understand the complexity of various tissues in an organ.
- CO3: Demonstrate the structure & functions of various tissues and organs
- CO4: Compare various tissues, glands and organs related to diseases.
- CO5: Acquired skill, evaluate structure and functions of organs in animals

Unit -I

15 Hrs

1. Introduction: Definition and Scope of Histology.
2. Definitions and Types of Tissues: Epithelial tissue, Connective tissue, Nervous tissue, Muscular tissue.
3. Histological study of the alimentary canal: Oesophagus, Stomach, Duodenum, Rectum, Liver, Salivary gland
4. Histological study of the respiratory system- lungs and trachea
5. Histological study of excretory organs: Kidney, Juxtaglomerular complex.

Unit -II

15 Hrs

1. Histological study of the reproductive organ: testes and Ovary

2. Histology of endocrine glands – Hypothalamus, pineal, pituitary, thyroid, parathyroid, Thymus, pancreas, adrenal
3. Histology of Circulatory system – Heart, Arteries, Vein and capillary
4. Histology of Bone, Cartilage, Ligament

Suggested readings:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
2. Frederic R. Bailey (1971). Text Book of Histology, revised by W.M.Copenhaver; The Williams & Wilkins Company. The Williams and Wilkins Company.
3. Garg Krishna, Bahl Indira & Kaul Mohini (2014). A Text Book of Histology, 5th Edn. CBS Publication & Distributors, Delhi.
4. Deshmukh Shivaji (2023). A Textbook of Histology; Dominant publishers & distributors
5. Ramesh Mathur (2002). A Textbook of Histology; Anmol publication.
6. Gunasegaran J. P. (2010). A Textbook of Histology and A Practical Guide; Publisher Elsevier; Second edition.
7. Khanna D. R. (2009). A Textbook of Histology; Sonali publication.
8. Ghose K. C. & Manna B. (1999). Practical Zoology; Second Edition; New Central Book Agency Pvt. Ltd., Kolkata; 1999.

**B. Sc. Part –II Major
Semester – III Paper- V & VI
ZOOLOGY LAB (3): 2VSC03ZOO49 (Practical III)
Practicals based on
Pisciculture (2VSC03ZOO39)**

Credits-02

Course Outcomes: After successful completion of the course will be able to:

- CO1: Recall the various types of fin fishes
- CO2: Understand the various organs of fish
- CO3: Acquaint with the handling of fish
- CO4: Analyze the pond water and soil quality
- CO5: Develop skills in fish technology and production of fish by-products

Practicals

1. To study the anatomy of the fin fishes

2. To study the digestive and reproductive system of fin fishes
3. Mounting of placoid and cycloid scales
4. To study the induced breeding in fishes
5. Identification of commercially important fin fishes
6. Identification of commercially important shell fishes
7. Estimation of carbonate and bicarbonate in water samples
8. Estimation of chloride from water samples
9. Estimation of ammonia from water samples
10. Methods of quality assessment to examine the freshness of fish.
11. Maintenance of collected fishes/ Preservation techniques
12. Method of Transportation of Fish Seeds
13. Study of Fish by-products
14. Modern Crafts and Gears.
15. Estimation of muscle protein in fish by Biuret method.
16. Visit to fish market.

Suggested reading-

1. Pillay T. V. R. (1993). Aquaculture: Principles and Practices. Fishing News Books. Black Well Scientific Publications.
2. Mathew Landau. (1995). Introduction to aquaculture. Daya Publishing House, New Delhi.
3. MPEDA. (1991). Hand Book on Shrimp Farming, Kochi, India.
4. Jhingran V. G. (1982). Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi.
5. Chakrabarti N. M. (1998). Biology, Culture and production of Indian major carps. Narendra Publishing House, New Delhi. 27
6. Coche A. G. and Muir J. F. (1996). Pond construction and fresh water fish culture – pond farm structures and layouts- simple methods for aquaculture. FAO. Daya Publishing House, New Delhi.
7. Upadhyay A. S. (1995). A hand book on design, construction and equipments in coastal aquaculture (Shrimp Farming). Daya Publishing House, New Delhi.
8. Wheaton, F. W. (1985). Aquaculture Engineering. MPEDA, Cochin.
9. MPEDA 1990. Aquaculture engineering and water quality management. Cochin, India.

B. Sc. Part –II Semester - IV

Paper- VII & VIII ZOOLOGY LAB (4): DSC03ZOO49 (Practical IV)

Practical based on

Principles of Biochemistry (2DSC03ZOO41) and Histology (2DSC03ZOO42)

Credits-04

1. Estimation of glucose by using DNSA methods
2. Separation of amino acids by paper chromatography
3. Identification of Lipids by TLC
4. Qualitative tests to identify proteins and lipids in a given sample
5. Qualitative tests to identify lipids in a given sample
6. Qualitative tests to identify carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose, and Starch)
7. Estimation of total protein in given solutions by Lowry's method/Biuret method.
8. Effect of pH on Salivary Amylase
9. Effect of Temperatures on Salivary Amylase
10. Detection of abnormal urine constituents from a given sample
11. Estimation of glycogen from liver tissue
12. Study of the different types of tissues with the help of permanent slides/photographs - epithelial tissue, connective tissue, muscular tissue, and nervous tissue.
13. Preparation of temporary mounts of striated & smooth muscle fibre.
14. Study of human blood smear to observe different types of blood cells.
15. Study of histological slides of (TS/LS) – bone and cartilage
16. Study of histological slides of (TS/LS) -Oesophagus, Stomach, Duodenum, Rectum, liver, salivary gland.
17. Study of histological slides of (TS/LS) -Brain, spinal cord, kidney, lungs, trachea
18. Study of histological slides of endocrine glands (TS/LS): Pituitary, pancreas, adrenal, thyroid
19. To study types of fixative used in histology
20. To study types of stains
21. Demonstration of histological staining techniques-HE techniques

B. Sc. Part –II Minor
Semester – IV Paper- VII
Tools and Techniques in Biology (2MIN03Z0041)

Theory: 30 Hours

Credits- 02

Course Outcomes: After the completion of the course the student will be able to -

CO1: Recall the various techniques used in biology.

CO2: Understand the functional significance of Biotechniques.

CO3: Gain hands-on experience in techniques used in biology & their applications.

CO4: Apply the techniques for research applications.

CO5: Acquire the required laboratory skills to perform, interpret and analyze widely used Biotechniques.

Unit I

15 Hrs

Microscopy and Microtomy

Basics of Microscopy- Definition, Magnification and Resolving Power, Principle and Application of Microscopy- Light (bright-field, dark-field and phase contrast), Fluorescence Microscope, Electron Microscope (SEM and TEM).

Elements of Microtomy: Pre-microtomy process, microtomy process, Postmicrotomy process, Rotary Microtome, Types of Stain, Methods of staining and mounting.

Unit II

15 Hrs

Separation techniques

Centrifugation- Basic principle, working and applications of Density gradient centrifugation and Differential centrifugation

Chromatography - Basic principle of chromatography; Types of chromatography techniques and their applications- Paper and Thin Layer Chromatography (TLC)

Electrophoresis - Basic principle of electrophoresis, types (Agarose and SDS-PAGE), and their applications

Suggested Readings-

1. Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*.
2. Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology – Principles and applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009).

An Introduction to Genetic Analysis. 9th Edition. Freeman and Co., N.Y., USA.

4. Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics*. V Edition, John Wiley and Sons Inc.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). *Recombinant DNA Genes and Genomes- A Short Course*. III Edition, Freeman and Co., N.Y., USA.
6. Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics*. 6th Edition,
7. Singh B. D. (2010). *Biotechnology Expanding Horizons*. Kalyani Publishers

**B. Sc. Part –II Minor
Semester – IV Paper- VIII
Insect Pest Management (2MIN03ZOO42)**

Theory: 30 Hours

Credits- 02

Course Outcomes: After completion of the course, students will be able to:

- CO1: Recall the various insects in nature and damage caused by them
- CO2: Understand the life cycles of insect pests
- CO3: Identify nature of damage and seasonal incidence of insect pests
- CO4: Interpret the importance of biocontrol agents.
- CO5: Develop effective management of insect pest by using different methods

Unit I

15Hrs

Introduction to Insects and Pest: General characters and morphology of the Insect.

Economic importance of insects- A. Beneficial insects (Pollinators of crops, Predators pests, Parasites of pests, Productive insects (Silkworm, Honey bee, Lac insect) B. Injurious insects (House hold pests, Stored grain pests, Medicinal Pests, Veterinary pests)

Identification, Characteristics, Life cycle, Damage and Control of following insect pests.

House hold pests: Cockroach, Clothes Moth, Furniture beetle, Silverfish, Wasp.

Stored grain pests: Rice weevil, Rice moth, Pulse beetle, Rust red flour beetle.

Unit –II:

15Hrs

Identification, Characteristics, Life cycle, Damage and Control of following insect pests.

Medicinal Pests: Mosquitoes, Bedbug, Sandfly, Human lice, Tse-Tse fly

Veterinary pests: Sandfly, Horsefly, Blowfly, Stable fly, Rat flea

Integrated Pest Management (IPM): Need, its tools and limitations. Natural Control, Applied

control, Biopesticides- Definition, types and Advantages

Suggested readings-

1. K. P. Srivastava (2021). Text of applied Entomology Vol I & II; Kalyani Publishers
2. G. S. Dhaliwal and R. Arora (2003). Principles of insect Pest Management; Kalyani Publishers
3. Jawaid Ahsan and Subhas Prasad Sinha (2010). A Hand Book On Economic Zoology S. Chand (G/L) & Company
4. Dinesh Kumar, Naznee Deshmukh and Ashok K. Rathoure (2015). Applied and Economic Zoology; Daya Publishing House
5. S. Pradhan (2016). Agricultural Entomology and Pest Controlby. Indian Council of Agricultural Research
6. Larry P. Pedigo, Marlin E. Rice, and Rayda K. Krell (2021). Entomology and Pest Management Waveland Press, Inc.; 7th edition
7. Yogendra Kumar Mishra, Anand Kumar Panday and Amit Kumar Sharma (2021). Insect Pest Management: Concept and Approaches; AkiNik Publications
8. Vinita Jaiswal and Kamal Kumar Jaiswal (2022). Economic Zoology; Prentice Hall India Pvt., Limited
9. Ramesh Arora , Balwinder Singh & A.K. Dhawan (2023). Theory and practice of integrated pest management; Imprint Scientific Publishers

B. Sc. Part –II Semester - IV

Paper- VII & VIII ZOOLOGY LAB (4): 2MIN03ZOO49 (Practical IV)

Practical based on

Tools and Techniques in Biology (2MIN03Z0041) and Insect Pest Management (2MIN03ZOO42)

Credits-02

1. Introduction to microscope
2. Cleaning and maintenance of microscope.
3. Demonstration of different types of Microscope (Simple, Compound, Stereozoom, fluorescence)
4. Demonstration of microtomy processes

5. Separation of molecules by density gradient centrifugation
6. Separation of amino acids using paper chromatography
7. Separation of amino acids using thin layer chromatography
8. To study the Principles and application of the following Instruments.
 - a) Incubator
 - b) Spectrophotometer
 - c) Colorimeter
 - d) Cooling Centrifuge
 - e) Rotary microtome
 - f) Oven
9. Demonstration of DNA separation by agarose gel electrophoresis.
10. Study of morphology of insect (Cockroach/Grasshopper)
11. Study of different types of mouth parts in insect
12. Technique of collection and preservation of insect pests
 - a. Wet preservation
 - b. Dry preservation
13. Study of following insect pests with reference to classification, life cycle, marks of identification, nature of damage and management.
 - a. Jowar – Stem borer
 - b. Sugarcane – White grub
 - c. Gram – Pod borer
 - d. Mango – Jassids
14. Study of following stored grain pests with reference to scientific name, life cycle, marks of identification, nature of damage and management.
 - a. Rice weevil
 - b. Pulse beetle
15. Study of beneficial insects and mites belongs to predators and parasitoid (Any two)
16. Collection, preservation and submission of insect pests (Any two)
17. Identification of Insect using key
18. Field / Institution / College Visit and submission of report with photographs

B. Sc. Part – III Semester -VI ZOOLOGY
OEC LFS-PR-IV: 2OEC03LFS42: OEC Zoology Lab-IV
Practicals Based on Aquarium Management

Credits 2

Marks: 25

(Four lectures of 60 minutes per week per batch)

Course Outcomes: After the completion of the course the student will be able to -

CO1: Recall common fresh and marine water in ornamental fishes

CO2: Explain principle of aquarium design structure and selection of materials

CO3: Analyze water quality parameters and interpret their importance in fish health

CO4: Evaluate different aquarium maintenance techniques and its economics

CO5: Use skills to develop and manage for self-employment and business development

1. Identification of common fresh water ornamental fishes (guppy, molly, sword tail, gold fish, angel fish)
2. Identification of common fresh water ornamental fishes ((Clown Fish, Damsel, Butterfly Fish, Lion Fish)
3. Study of sexual dimorphism in common ornamental fishes (guppy, sword tail, gold fish)
4. Study of live-bearing aquarium fishes
5. Preparation and composition of formulated fish feeds
6. Preparation, design and construction of a home aquarium
7. To maintenance of water quality of aquarium -pH, hardness, salinity
8. To maintenance of water quality of aquarium -oxygen, carbon dioxide
9. To maintenance of water quality of aquarium -chlorine, ammonia, nitrites
10. Maintenance of water quality of aquarium –temperature
11. Study of common aquarium equipments
12. To study bacteria diseases of ornamental fishes.
13. To study Protozoan diseases of ornamental fishes and control measures
14. To study Fungal diseases of ornamental fishes and control measures
15. Visiting to any aquarium shop / ornamental fish farm

Suggested Readings:

1. Home Aquarium and Ornamental Fish Culture (2015), Jayashree K. V., Tharadevi C. S., and Arumugam N., Saras Publication, Tamil Nadu, India
2. Training Manual on Freshwater Ornamental Fish Breeding and Aquascaping Techniques (2019), Haridas, H. et al, ICAR-Central Island Agricultural Research Institute, Port Blair, India.

3. Helen E. R. (2009) fundamentals of Ornamental Fish Health Blackwell Publication.
4. Mandal S.SC. and Panday P.K. Biology of Indigenous Freshwater Ornamental Fishes of India, Narendra Publication house Delhi.
5. Diana L. W. (2013), Ecology of the Planted Aquarium: A Practical Manual and Scientific Treatise for the Home Aquarist, Echinodorus Publication

VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

B.Sc. Part- II (Zoology), Semester-III/IV Examination

Paper Name and No-

Day:

Time: 2 hours

Date:

Marks: 40

Instructions:

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary.

Nature of Question Paper (Major/ Minor)

Q.1. A) Multiple choice questions

(8)

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)

Q.2. Attempt any Two

(16)

i)

- ii)
- iii)

Q.3. Attempt any Four

(16)

- i)
- ii)
- iii)
- iv)
- v)
- vi)

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur

(AN EMPOWERED AUTONOMOUS INSTITUTE)

B.Sc. Part- II (Zoology) Semester- III/IV

Practical Based on

Animal Physiology (2DSC03ZOO31) and Evolution (2DSC03ZOO32)

Or

Principles of Biochemistry (2DSC03ZOO41) and Histology (2DSC03ZOO42)

Practical Examination

Practical Skeletal Question Paper

Total Marks: 50

Q.1. Major experiment-----	10Marks
Q.2. Major experiment-----	10Marks
Q.3. Minor experiment-----	05Marks
Q.4. Minor experiment-----	05Marks
Q.5. Spotting -----	10Marks
Q.6. Journal	05Marks
Q.7. Field study report	05Marks

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Vivekanand College, Kolhapur

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B.Sc. Part- II (Zoology) Semester- III/IV

Practical Based on

Biostatistics (2MIN03ZOO31) and Ethology (2MIN03ZOO32)

Or

**Tools and Techniques in Biology (2MIN03ZOO41) and Insect Pest Management
(2MIN03ZOO42)**

Practical Examination

Practical Skeletal Question Paper

Total Marks: 25

Q.1. Major experiment-----	08Marks
Q.2. Minor experiment-----	06Marks
Q.3. Spotting -----	05Marks
Q.4. Journal	03Marks
Q.5. Field study report	03Marks

Shri Swami Vivekanand Shikshan Sanstha's
Vivekanand College, Kolhapur

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B.Sc. Part- II (Zoology) Semester- III/IV

Practical Based on

Sericulture (2VSC03ZOO39) / Pisciculture (2VSC03ZOO49)

Practical Examination

Practical Skeletal Question Paper

Total Marks: 25

Q.1. Major experiment-----	08Marks
Q.2. Minor experiment-----	06Marks
Q.3. Spotting -----	05Marks
Q.4. Journal	03Marks
Q.5. Field study report	03Marks