

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE
OF ARTS, SCIENCE & COMMERCE,
BARAMATI.
AUTONOMOUS INSTITUTE**



Scheme of Course Structure (CBCS)
Faculty of Science
Department of Zoology
Class: T.Y.B.Sc.
Evaluation Pattern: 40 (IA) + 60 (EA)
Total Credits: 48

Semester	Paper Code	Title of Paper	Credits
Semester V	ZOO 3501	ANIMAL SYSTEMATICS & DIVERSITY-V	3
	ZOO 3502	MAMMALIAN HISTOLOGY	3
	ZOO 3503	BIOCHEMISTRY	3
	ZOO 3504	ENVIRONMENTAL BIOLOGY & TOXICOLOGY	3
	ZOO 3505	PARASITOLOGY	3
	ZOO 3506	A] CELL BIOLOGY or B] GENERAL PATHOLOGY	3
	ZOO 3507	ZOOLOGY PRACTICAL-V (Related to ZOO 3501, 3502)	2
	ZOO 3508	ZOOLOGY PRACTICAL-VI (Related to ZOO 3503, 3504)	2
	ZOO 3509	ZOOLOGY PRACTICAL-VII (Related to ZOO 3505, 3506)	2
Semester VI	ZOO 3601	BIOLOGICAL TECHNIQUES	3
	ZOO 3602	MAMMALIAN PHYSIOLOGY & ENDOCRINOLOGY	3
	ZOO 3603	GENETICS & MOLECULAR BIOLOGY	3
	ZOO 3604	ORGANIC EVOLUTION	3
	ZOO 3605	GENERAL EMBRYOLOGY	3
	ZOO 3606	A] MEDICAL ENTOMOLOGY or B] PUBLIC HEALTH & HYGIENE	3
	ZOO 3607	ZOOLOGY PRACTICAL-VIII (Related to ZOO 3601, 3602, 3603)	2
	ZOO 3608	ZOOLOGY PRACTICAL-IX (Related to ZOO 3604, 3605, 3606)	2
	ZOO 3609	Minor Research Project (Compulsory)	2

IA* – Internal Assessment

EA* – External Assessment

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SEMESTER-V

तुळजाराम चतुरचंद महाविद्यालय, बारामती

Paper Code: ZOO 3501

Paper: I

Title of Paper: Animal Systematics and Diversity – V

Credits: 3

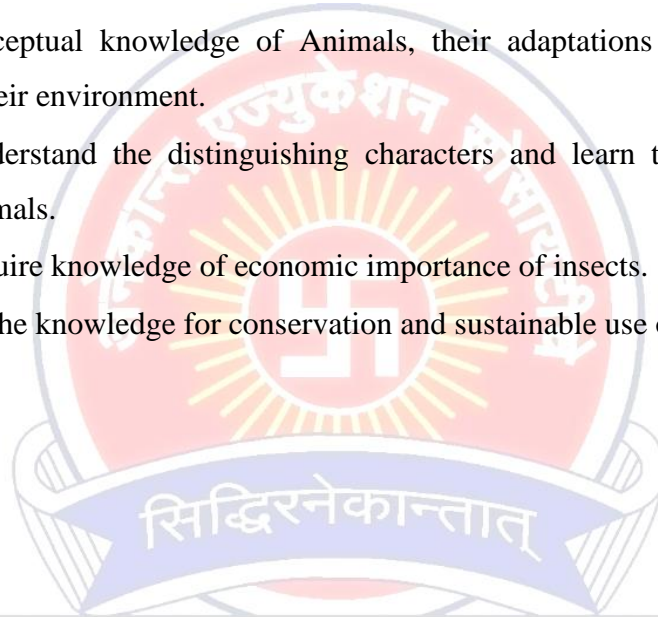
No. of Lectures: 48

A. Learning objectives:

- To learn basic classification and characteristics of Non- chordates.
- To learn about evolution and development of systems and animals.
- To make the students aware about conservation and sustainable use of Biodiversity.
- To emphasize on the habitat diversity of animals.

B. Learning outcomes:

- Imparts conceptual knowledge of Animals, their adaptations and associations in relation to their environment.
- Students understand the distinguishing characters and learn to identify the Non-chordate animals.
- Students acquire knowledge of economic importance of insects.
- Contributes the knowledge for conservation and sustainable use of Biodiversity



तुळजाराम चतुरचंद महाविद्यालय, बारामती

Paper Code: ZOO 3501

Paper: I

Title of Paper: Animal Systematics and Diversity – V

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Study of <i>Pila globosa</i> with reference to the following:		14
	1.1	Systematic position, habit, habitat and external characters	
	1.2	Body wall & pallial complex	
	1.3	Functional anatomy: digestive, respiratory, circulatory, excretory, reproductive, nervous system & sense organs	
2	Study of the following groups with reference to:		08
	2.1	Porifera: Sponge's regeneration & reproduction	
	2.2	Coelenterata: polymorphism and importance of coral reefs	
	2.3	Annelida: Metamerism	
3	Study of <i>Calotes versicolor</i> with reference to the following:		16
	3.1	Systematic position, habit, habitat and External characters.	
	3.2	Functional Anatomy - Digestive, Circulatory, Excretory, Reproductive, Nervous system and Sense organs.	
	Comparative study of following topics in vertebrates		
4	4.1	Heart: Structure of heart of <i>Scoliodon</i> , Frog, Calotes, Pigeon & Rat	06
	4.2	Kidney: Evolution of Archinephros, Pronephros, Mesonephros, Metanephros	
	4.3	Brain: Morphological variation in the different regions of the brain of <i>Scoliodon</i> , Frog, Calotes, Pigeon and Rat/Rabbit	
5	Study of following groups with reference to:		04
	5.1	Pisces: Parental Care	
	5.2	Mammals: Dentition	

Reference Books

1. Living Invertebrates, 1987: Pearse, Buchsbaum, Blackwell Scientific Publication, California.
2. A Text book of Zoology Invertebrates, Vol. I 1992, 7th Edn. Parker and Haswell edited by Marshall William, C B S publishers and distributors, New Delhi.
3. Invertebrate Zoology, 1992; S. N. Prasad, Vikas Publishing House, New Delhi.
4. Life of Invertebrates, 1992; S.N. Prasad, Vikas Publishing House, New Delhi.
5. Invertebrate Zoology, 1992 4th Edn., reprint, P.S. Dhama and J. K. Dhama, R. Chand and Co., New Delhi.
6. Modern text book of Zoology, Invertebrates 10th Edn., 2009, R.L. Kotpal, Rastogi publ., Meerut.
7. Invertebrates Structure and Function, 2nd Edn.1979, EJW Barrington, John Wiley and Sons Inc.
8. Invertebrates Zoology, 1994, 6th Edition, Ruppert, E. Edward, R. D. Barnes; Saunders college Publishing, USA.
9. Invertebrate Zoology,1991, P.A. Meglitsch & F. R. Schram, Oxford University Press;New York.
10. Invertebrate: A New synthesis, 1988, R.S.K. Barnes, P. Calow and P.J.W., OliveBlackwell Scientific, U.K.
11. An Introduction to Protochordata, 1990, H. S. Bhamrah and KavitaJuneja, Anmol publication, New Delhi.
12. The invertebrates: Protozoa through Ctenophora Vol.I, 1959, Hyman, Libbie Henrietta, McGraw-Hill Book Co., Inc. New York.
13. A text book of Zoology, Vol.II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi.
14. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.
15. Chordate Zoology, 1982, P. S. Dhama and J. K. Dhama, R. Chand and Co., New Delhi.
16. The life of Vertebrates, 3rd edn.1993, J. Z. Young, Oxford University Press, USA.
17. The Phylum Chordata: Biology of Vertebrates and their Kin, 1987, H. H. Newman, Distributor Satish book enterprise, Agra.
18. A text book of Zoology, 1984, R. D. Vidyarthi, S. Chand and Co., New Delhi.
19. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr,9thEdn., 2001,McGraw Hill, Boston, USA
20. Practical Zoology Invertebrates, 11th revised Edn., 2014, S. S. Lal, Rastogi publ.,Meerut.
21. Vertebrate Practical Zoology, 11th revised Edition, 2014, S. S. Lal, Rastogi publ.,Meerut.
22. Practical Zoology, 2004, Vijay Laxmi Sharma, Paragon International Publishers.
23. The anatomy of Garden Lizard, 1974, S.Y. Paranjape, Pune University Publication, Pune.
24. Chordate Zoology, 2009 reprint, E. L. Jordan, S. Chand and Co., New Delhi.
25. Text book of Zoology, Vertebrates, Vol. II, T.J. Parker and W.A. Haswell, edited by Marshall and Williams, CBS Publications, New Delhi.

Paper Code: ZOO 3502

Paper: II

Title of Paper: MAMMALIAN HISTOLOGY

Credits: 3

No. of Lectures: 48

Learning objectives:

- To familiarize the learners with the cellular architecture of the various organs in the body.
- To make the learners understand the need and importance of different types of tissues in the vital organs and their functions.
- To make learners understand the Ovarian Follicles, Corpus luteum, Corpus albicans & Structure of an Ovum.
- To familiarize the learners with the histology of endocrine glands.

Learning outcome:

- Learners will be able to understand the histology of mammals and its functions.
- Learners would appreciate the well planned organization of tissues and cells in the organ systems.
- Learner will be able to understand the Ovarian Follicles, Corpus luteum, Corpus albicans & Structure of an Ovum.
- Learners become aware about the Histological Structures of various Endocrine Organs, Cell types & Hormones Secreted by them, their functions in the Mammalian systems.
- Course helps to inculcate the research aptitude among the students.

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Paper Code: ZOO 3502

Paper: II

Title of Paper: MAMMALIAN HISTOLOGY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction		01
	1.1	Definition and scope of histology,	
	1.2	Application of histology in forensic science.	
2	Study of following tissues (location, structure, functions & histopathology):		08
	2.1	Epithelial: Simple, stratified & its types.	
	2.2	Connective: Proper, Areolar, Adipose, Ligament, Tendon, Cartilage.	
	2.3	Muscle: Striated, Smooth, Cardiac.	
	2.4	Nervous: Types of neurons, Medullated and non-medullated nerve fiber.	
3	Histological study of following organs:		31
	3.1	Skin (V.S.) (02)	
	3.2	Tooth (V.S.) (02)	
	3.3	Tongue (C.S.) with reference to mucosa papillae and taste buds (02)	
	3.4	Alimentary canal: Basic histological organization with reference to: Oesophagus (T.S.), stomach (T.S.), duodenum (T.S.) Ileum (T.S.) and rectum (T.S.) (08)	
	3.5	Glands associated with digestive system: (04) Salivary glands– C . S . of parotid, submandibular, sublingual liver and pancreas including both exocrine and endocrine components	
	3.6	Respiratory organs: Trachea (T.S.) & lung (C.S.) (02)	
	3.7	Blood vessels: Artery (T.S.), vein (T.S.) and capillaries (T.S.) (02)	
	3.8	Kidney (L.S.), Structure of nephron and juxtaglomerular complex (03)	
	3.9	Reproductive organs: (06) Testis (T.S.) with reference to Seminiferous Tubules and cells of Leydig Ovary (C.S.) - primary, secondary and Graafian follicle, corpus luteum and corpus albicans, Uterus and placenta.	
4	Histology of endocrine glands:		06
	4.1	Pituitary gland	
	4.2	Thyroid gland	
	4.3	Adrenal gland	
5	Introduction to Clinical Histopathology with special reference to cancer of: Colon, Lungs & Uterus		02

Reference Books

1. Inderbir Singh's Textbook of Human Histology (With Colour Atlas and Practical Guide), 2014, 7th Edn., Neelam Vasudeva and Sabita Mishra, Jaypee Brothers Medical Publishers, New Delhi, India.
2. Bailey's Text book of Histology, 1971, 16th edn. Wilfred M. Copenhaver, Richard P. Bung & Mary Bartell Bunge, The William & Wilkins Company, Baltimore.
3. Histology, 1987, 9th Edn., Arthur W. Ham, David H. Cormack, J. B. Lippincott Co. Philadelphia.
4. Essential Histology, 2001, 2nd Edition, David H. Cormack, Lippincott Williams & Wilkins, Philadelphia.
5. A text book of Histology, 2014, 5thedn. Krishna Garg, Indira Bahl & Mohini Kaul CBS publication & Distributors, Delhi.
6. Histology, 1977, 4th Edn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.
7. Histology of Mammals, 1983, M. V. Athawale and A. N. Latey, Narendra Prakashan, Pune.
8. Hand book of Basic Microtechnique, 1964, 3rd Edn., Peter Gray, McGrawHill Book Co. New York.
9. Hand Book of Histopathological & Histochemical Techniques, 1983, 3rd Edition reprint, Butterworth & Co. (Publishers) Ltd, UK.
10. Hand Book of Histological and Histochemical Techniques, 1991, 1st Edn. S. K. David, CBS publisher & Distributors, Delhi.



Paper Code: ZOO 3503

Paper: III

Title of Paper: BIOLOGICAL CHEMISTRY

Credits: 3

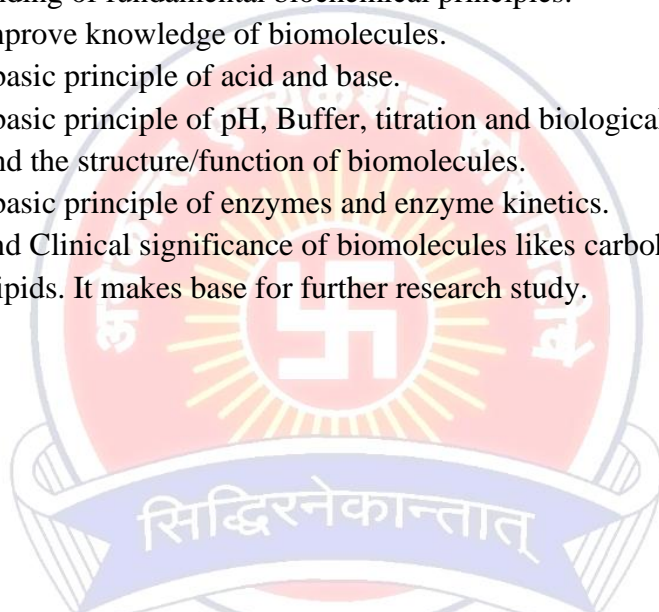
No. of Lectures: 48

Learning Objectives: -

- To understand the bonding interaction of biomolecules.
- To understand structures and functions of biomolecules.
- To understand the fundamental concepts of biocatalysts, and various classes of enzymes.
- To understand the basic concept of antigen and antibody.

Course Outcomes: -

- An understanding of fundamental biochemical principles.
- It helps to improve knowledge of biomolecules.
- Understand basic principle of acid and base.
- Understand basic principle of pH, Buffer, titration and biological buffer.
- An understand the structure/function of biomolecules.
- Understand basic principle of enzymes and enzyme kinetics.
- Biological and Clinical significance of biomolecules likes carbohydrates, amino acids, protein and lipids. It makes base for further research study.



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Paper Code: ZOO 3503

Paper: III

Title of Paper: BIOLOGICAL CHEMISTRY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Basic Biochemistry:		10
	1.1	Bond–Types: Ionic, covalent, non-covalent bonds (hydrogen, hydrophobic, electrostatic, Van der Waal forces) and their functions in biomolecules.	
	1.2	Structure of water molecule (liquid, ice and colloid)	
	1.3	Physico-chemical properties of water.	
	1.4	Concept of acid and base, pH, Sorenson's scale, derivation of Henderson–Hasselbalch equation and its applications.	
	1.5	Concept of Buffer-types of buffer, buffering capacity and buffers in biological system (Phosphate, bicarbonate)	
2	Carbohydrates:		08
	2.1	Definition and classification of carbohydrates	
	2.2	Isomerism in carbohydrates- Structural and stereoisomerism.	
	2.3	Stereochemical properties-enantiomers, anomers, epimerism, mutarotation, racemisation.	
	2.4	Biological significance of carbohydrates.	
3	Proteins:		08
	3.1	Essential and non-essential amino acids	
	3.2	Structure and classification of amino acids	
	3.3	Peptide bond, types of proteins, protein structures (primary, secondary, tertiary and quaternary structures with suitable example)	
	3.4	Bonds responsible for protein structures	
	3.5	Biological significance of proteins	
4	Enzymes:		10
	4.1	Classification and properties of enzymes.	
	4.2	Regulatory and non-regulatory enzymes.	
	4.3	Enzyme kinetics, MM equation and its importance and LB plot	
	4.4	Reversible and irreversible enzyme inhibition	
	4.5	Factors influencing enzyme activity (pH, temperature, substrate concentration, enzyme concentration)	
	4.6	Introduction of isoenzymes, allosteric enzymes, immobilized enzymes and ribozymes	
5	Lipids:		06
	5.1	Introduction, classification and chemistry	
	5.2	Clinical significance (obesity, atherosclerosis, myocardial infarction)	

	5.3	Biological significance of lipids	
6	Nucleic Acids:		06
	6.1	Introduction, definition, nitrogenous bases, pentose sugars, Nucleosides, Nucleotides.	
	6.2	DNA: Watson & Crick's model, Comparative study of forms of DNA: A, B, Z; Chargaff's rule.	
	6.3	RNA: Types & structure- mRNA, rRNA, tRNA, snRNA, snoRNA, miRNA, siRNA, piRNA (PiWi-interacting RNA).	

Reference books

1. Principles of Biochemistry, 1993, 2nd Edn, Lehninger A. L. Nelson D.L. & Cox M.M. CBH Publisher and distributors, Delhi.
2. Biochemistry, 1995 5th Edn. Zubay G. Wm, C. Brown Communications USA
3. Harpers Biochemistry, 1996, 26th Edn., Murray R.k., Granner D.K., Mayes P.A. & Rodwell V.W. Prentice Hall international USA.
4. Outline of biochemistry, 1995 5th Edn, Conn E.E., Stumph P.K. Bruening G & Doi R.H. John Wiley & Sons, USA
5. Principals of Biochemistry, 1993, 1st Edn., Pattabhiraman T.N., Gajanan Book publisher sand distributors Bangalore.
6. Clinical Biochemistry, 1994, B. P. Godkar, Bhalini Publishing house, Mumbai.
7. Biochemistry, 1995 5th Edn, Stryer Sanfrancisco, W. H. Freeman & Co.
8. Biochemistry, 1990, 8th Edn., D. Voet & J. Voet, John Willey, New York.
9. Fundamentals of Biochemistry, Jain, J.L., Jain, S. and Jain, N., S. Chand and Company Ltd. (2005).
10. Roitt I., Brostoff J., Male D., Immunology, Mosby Elsevier (2004).
11. Khan F.H. The Elements of Immunology, Pearson Education (2009)
12. Owen J. A., Punt J., Strandfod S.A, Jones P.P., Kuby- Immunology W.H. Freeman & Company (2013).

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Paper Code: ZOO 3504

Paper: IV

Title of Paper: ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

Credits: 3

No. of Lectures: 48

Learning objectives:

- To study the ecosystem and the importance of abiotic and biotic factors.
- To learn various kinds of pollution, their consequences and preventive measures.
- To study the natural resource and their conservation.
- To study the wildlife, threats to wildlife and its management.
- To understand the toxicants, toxicity and health hazards.

Learning Outcomes:

- Students understand the basic concepts in environmental biology.
- Students understand the components of ecosystems and their interactions.
- Students understand the types of ecosystems, reasons of their degradation, ways of their conservation.
- Students understand the types of pollution, their reasons and thereby control measures.
- Students acquire the knowledge of environmental monitoring, role of various bioindicators, etc.
- Students understand the basic concepts in toxicology like LC₅₀, LD₅₀.



Paper Code: ZOO 3504

Paper: IV

Title of Paper: ENVIRONMENTAL BIOLOGY AND TOXICOLOGY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Environmental Biology		02
	1.1	Introduction- Definition, basic concepts and scope	
2	The Ecosystem		08
	2.1	Definition, abiotic and biotic components and their interrelationship	
	2.2	Energy flow in ecosystem and flow models	
	2.3	Major Ecosystems: (a) natural ecosystem: e.g., fresh water, forest (b) artificial ecosystem: e.g., cropland	
	2.4	Food chain in ecosystem and food web	
	2.5	Ecological pyramids	
3	Environmental Pollution:		10
	3.1	3.1 Definition and types of pollution	
	3.2	Pollutants, types of pollutants (metallic, gaseous, acids, alkalis, biocides)	
	3.3	Air pollution: Definition, sources of air pollution and their effects	
	3.4	Air pollution and its relevance with the following 3.4.1 Acid rain 3.4.2 Greenhouse effect 3.4.3 Ozone layer depletion	
	3.5	Water pollution: definition, sources of water pollution and their effects on ecosystem. 3.5.1 Community waste with reference to following: I. Sewage II. Industrial wastes III. Agricultural wastes	
	3.6	Land / Soil pollution: definition, sources of land / soil pollution and their effects	
	3.7	Noise pollution: definition, sources of noise pollution and their effects and control measures	
4	Environment and Development		05
	4.1	Bioindicators and environmental monitoring	
	4.2	Environmental challenges in India: land degradation, Population explosion, urbanization & industrialization.	
5	Population ecology		02
	5.1	Demographics of populations	
	5.2	Population growth models	
	5.3	Regulation of population size	
6	Natural Resources and Conservation:		04
	6.1	Renewable and non-renewable resources	
	6.2	Soil conservation	
	6.3	Forest conservation	

	6.4	Energy sources: conventional and non-conventional	
7	Introduction to Carbon credit		02
	7.1	Emission allowances	
	7.2	Kyoto's flexible mechanisms	
	7.3	Emission market	
8	Wildlife Management:		05
	8.1	Definition, causes of wildlife depletion	
	8.2	Importance of wildlife management in India	
	8.3	Endangered species, vulnerable species, rare species and threatened species	
	8.4	Wild life conservation	
9	Toxicants and Toxicity:		06
	9.1	Definition of toxicology, scope and branches	
	9.2	Types of toxicants	
	9.3	Factors influencing toxicity (pH, temperature, reproductive status, age, physiological state)	
	9.4	Dose, LD ₅₀ , LC ₅₀	
10	Toxicants of Public Health and Hazards:		04
	10.1	Pesticides, heavy metals, fertilizers, food additives and radioactive substances	
	10.2	Toxin free farming, biofertilizers and bio-pesticides	

Reference Books

1. Ecology and environment, 2014, 12th revised Edition, P. D. Sharma, Rastogi Publ. Meerat.
2. Environmental Biology, 1996, P. S. Verma and V. K. Agrawal, S. Chand and Co. New Delhi.
3. Ecology, 2007, 1st Edn. Mohan P. Arora, Himalaya Publ. House, Delhi.
4. Fundamentals of ecology, 2009, 3rd Edn., M. C. Dash, Tata Mcgraw Hill, New Delhi.
5. Elements of ecology, 1967, George L. Clarke, John Wiley and Sons, New York.
6. Ecology of Natural resources, 1985, Francois Ramade, W. J. Duffin, John Wiley and Sons, New York.
7. Concepts of Ecology, 1996, E.J. Kormondy, Prentice Hall of India. New Delhi
8. Modern concept of Ecology, 1995, 8thEdn. H. D. Kumar, Vikas Publishing House, New Delhi

Paper Code: ZOO 3505

Paper: V

Title of Paper: PARASITOLOGY

Credits: 3

No. of Lectures: 48

Learning Objectives:

- To provide the students the knowledge of evolutionary, biological, epidemiological and ecological aspects of parasites with special reference to human host.
- To enable the learners to understand the pathogenesis, clinical presentations & complications of parasitic & zoonotic diseases.
- To enable the learners to reach the diagnosis and know the general outline of treatment & prophylaxis of parasitic infections.
- To provide the learners adequate knowledge about endemic, epidemic & pandemic concepts of parasites.

Learning Outcomes:

- Student gets the knowledge about various branches of Parasitology and the scope of subject in the career.
- Students become aware about various types of parasites and hosts and thereby try to remain free from parasites.
- Student understands the host-parasite relationship so that it can implement the strategies to control the parasite infection.
- Becomes aware about endoparasites. With this knowledge, it spreads the awareness in society about infection chances, preventive measures and treatment.
- Increases awareness about infections and control measures of ectoparasites like head louse, tick, mite, mosquitoes.
- Acquires in depth knowledge about zoonotic diseases like bird flu, rabies and toxoplasmosis. This knowledge helps it to spread the awareness about preventive measures and treatments of these diseases.
- Updates the knowledge about epidemic disease like typhoid, cholera and small pox. This knowledge helps it to spread the awareness about preventive measures and treatments of these diseases.

Paper Code: ZOO 3505

Paper: V

Title of Paper: PARASITOLOGY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction:		03
	1.1	Scope and branches of Parasitology, Symbiosis & its types: commensalisms, mutualism and parasitism.	
	1.2	Concept of: Parasite, Host, Vector (Vector types).	
2	Parasitism & Types of parasites:		04
	2.1	Properties of Parasite, Advantages & Hazards of parasitism.	
	2.2	Classification of parasites according to different criteria.	
3	Types of hosts:		03
	3.1	Classification according to different criteria, Intermediate and Definitive, paratenic, reservoir host.	
4	Host-Parasite relationship:		04
	4.1	Host specificity- definition & types.	
	4.2	Adaptations of Parasites, Effects of parasites on host.	
5	Study of the Protozoan parasites Habit, habitat, Life cycle, Mode of Infection, pathogenicity and control measures of –		09
	5.1	<i>Plasmodium vivax</i>	
	5.2	<i>Entamoeba histolytica</i>	
	5.3	<i>Trypanosoma spp</i>	
6	Study of the following helminth parasites Habit, habitat, Life cycle, Mode of Infection, pathogenicity and control measures of-		09
	6.1	<i>Ascaris lumbricoides</i>	
	6.2	<i>Taenia solium</i>	
	6.3	<i>Wuchereria bancrofti</i>	
7	Study of following Arthropod parasites: Morphology, life cycle, pathogenicity and control measures of:		09
	7.1	Head louse	
	7.2	Tick	
	7.3	Mite (<i>Sarcoptes scabiei</i>)	
8	Concept of Zoonosis and study of following zoonotic diseases:		03
	8.1	Viral, Bacterial, Fungal & Parasitic zoonoses. (01 example from each).	
9	Concept of epidemic diseases: Pathogen, Mode of infection, Symptoms, Treatment & Prophylaxis of		04
	9.1	Typhoid	
	9.2	Cholera	
	9.3	Plague	
	9.4	Corona (COVID-19)	

Reference Books

1. Comparative Protozoology: Ecology, Parasitology, Life history, 1988, Anderson, O.R. Springer Verlag, Berlin.
2. Parasites and parasitism, Cameron, 1958, T. W. M. Methuen, London
3. An Introduction to Parasitology, 1961, Chandler, A.C.& C. P. Read, Wiley, New York
4. Parasitology and Helminthology in relation to Clinical Medicine, 1980, Edn.12 Chatterjee, K.D., Chatterjee Medical publishers, Calcutta.
5. The biology of animal parasites, 1964, Cheng T.C., Saunders, Philadelphia.
6. Symbiosis, 1970, Cheng T.C., Pegasus, New York.
7. Parasitology -The biology of animal parasites, 1971, Noble E.R. & G. A. Noble, Lea and Febiger, Philadelphia U.S.A.
8. Modern Text-book of Parasitology, A. N. Latey.
9. Foundations of Parasitology, Larry Roberts & John Janovy, McGraw-Hill, New York.
10. Microbiology, Lansing M. Prescott, McGraw-Hill Companies, New York.
11. Essential Microbiology, Stuart Hogg, John Willey & Sons, Ltd.



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Paper Code: ZOO 3506

Paper: VI

Title of Paper: (A) CELL BIOLOGY

Credits: 3

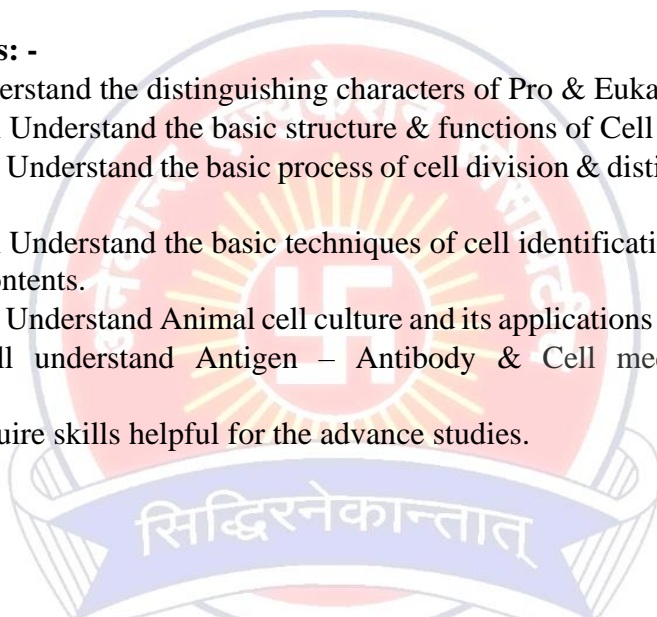
No. of Lectures: 48

Learning Objectives: -

- Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
- To understand the different kinds of cell membrane model & transport system.
- To understand how cellular organelles are used to generate and utilize energy in cells.
- To understand the basic application of stem cell therapies.
- To understand the concept of Immunology.

Learning Outcomes: -

- Students understand the distinguishing characters of Pro & Eukaryotic Cells.
- Students will Understand the basic structure & functions of Cell & organelles.
- Students will Understand the basic process of cell division & distinguish between its types.
- Students will Understand the basic techniques of cell identification & separation of cellular contents.
- Students will Understand Animal cell culture and its applications in the medicine.
- Students will understand Antigen – Antibody & Cell mediated Immune responses.
- Students acquire skills helpful for the advance studies.



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Paper Code: ZOO 3506

Paper: VI

Title of Paper: (A) CELL BIOLOGY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction to Cell biology:		01
	1.1	Definition and scope	
	1.2	Prokaryotic and eukaryotic cell: size, shape & structure	
2	Plasma membrane:		06
	2.1	Models: Lipid membrane concept, Sand-witch model, Unit membrane concept and Fluid Mosaic Model.	
	2.2	Membrane transport: Passive and Active Exocytosis and Endocytosis (Phagocytosis and Pinocytosis)	
3	Study of following cell organelles with respect to structure and functions in brief		04
	3.1	Endoplasmic reticulum	
	3.2	Golgi complex	
	3.3	Lysosomes	
	3.4	Mitochondria	
4	Nucleus:		05
	4.1	Ultrastructure of nuclear membrane and pore complex	
	4.2	Nucleolus: general organization, chemical composition and functions	
	4.3	Nuclear sap / nuclear matrix	
	4.4	Nucleocytoplasmic interactions	
5	Cytoskeleton:		03
	5.1	Microfilaments: location, ultrastructure, biochemical composition and functions	
	5.2	Intermediate Filament: location, ultrastructure, biochemical composition and functions	
	5.3	Microtubules: location, ultrastructure, biochemical composition and functions	
6	Cell cycle and cell division:		06
	6.1	Various phases of cell cycle, mitosis, meiosis & role of centriole in the cell division, Check points of cell cycle	
7	Cellular ageing and cell death:		04
	7.1	Concept of ageing theories:	
	7.2	Intracellular changes: free radicals	
	7.3	Extra cellular changes	
	7.4	Cell death:	
	7.5	Apoptosis: definition & significance	
	7.6	Necrosis: definition and examples	
8	Animal Cell Culture Techniques & Applications		07
	8.1	Animal cell culture: Introduction, principle and applications.	

	8.2	Stem Cells: Introduction to stem cells i) Potency of stem cells: Totipotency, Pluripotency, Multipotency, Unipotency ii) Sources of stem cells-Embryo, Fetal, Adult, Bone marrow iii) Stem cell therapy	
9	Introduction to Immunology		12
	9.1	Historical Perspectives	
	9.2	Types of immunity: Innate, Acquired	
	9.3	Study of antigen	
	9.4	Study of Antibodies & their types.	
9.5	Vaccination regime in India		

Reference Books

1. Cell and molecular biology, 2010, 8th Edn., De Robertis EDP and De Robertis EMF Jr., Lippincott Williams & Wilkins, Philadelphia
2. Molecular Cell biology, 2013, 1st Edn., C. B. Powar, Himalaya Publi. House.
3. Cell and molecular biology, 1968, Dupraw E. J., Academic Press, New York.
4. Molecular Cell biology, 1986, Avers C.J. Addison Wesley Pub. Co., New York & London.
5. Cell and Molecular biology, 2013, 7th Edn., Gerald Karp, John Wiley and Sons, USA.
6. Cell biology, 1993, David E. Sadava, Johnes and Bartlett Publi., London.
7. Cell Structure and Function, 1991, 3rd Edn, A.G. Loewy & Siekevitz, Saunder college Publi., Philadelphia
8. Becker's World of the Cell, 2012, 8th Edition, Jeff Hardin, Gregory Paul Bertoni, Lewis J. Kleinsmith, Benjamin Cummings, UK
9. The Cell: A molecular approach, 2013, 6th Edn., Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, USA
10. Molecular Biology of the Cell, 2007, 5th Edn., Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Taylor & Francis, UK
11. Morgan, S.I. Animal Cell culture 1993 Bio. Scientific Publishers Ltd Oxford.
12. Freshney, R.I. Culture of Animal Cells: A manual of Basic Technique, 1994, John Wiley Sons Inc. Pub. USA.
13. Immunology, Kubly, by Kindt, Goldsby, Osborne, Sixth Edition.
14. Immunobiology, The Immune system in Health and Disease, Seventh Edition by Janeway, Travers et al, Garland Publishing, 2008.
15. Cell & Molecular Biology, 2018, Dr. P. S. Lohar, MJP Publishers.

Paper Code: ZOO 3506

Paper: VI

Title of Paper: (B) GENERAL PATHOLOGY

Credits: 3

No. of Lectures: 48

Learning Objectives:

1. To enable the student to understand the basic nature of disease processes from the standpoint of causation, epidemiology, natural history, and the structural and functional abnormalities that result.
2. To enable the student to classify diseases of various body systems and how they manifest clinically and histo-pathologically.
3. To enable the student to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases.
4. To enable the student to apply knowledge of pathology's role in the diagnosis, staging, and management of disease.
5. To enable the student to utilize high quality peer-reviewed literature to maintain currency in the management of pathologic conditions.

Learning Outcomes:

1. Students will be able to identify the fundamental causes and mechanisms of disease, and the associated alterations in the structure and function of cells, tissues, organs and systems.
2. Students will describe basic mechanisms of cellular pathology, including cell injury, necrosis, and cellular adaptations.
3. Students will be able to describe the etiology and classification of inflammatory responses, and the mechanisms involved in healing and repair.
4. Students will be able to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases.
5. Students will be able to apply knowledge of pathology's role in the diagnosis, staging, and management of disease.
6. Students will be able to utilize high quality peer-reviewed literature to maintain currency in the management of pathologic conditions.

Paper Code: ZOO 3506

Paper: VI

Title of Paper: (B) GENERAL PATHOLOGY

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction:		04
	1.1	Definition, scope and basic branches	
	1.2	Applied pathology- biopsy and surgery	
	1.3	Autopsy- post mortem changes	
2	Clinical pathology		04
	2.1	Definition and scope	
	2.2	Gastric analysis	
	2.3	Urine examination	
	2.4	Importance of CSF examination	
	2.5	Liver function test	
	2.6	Renal function test	
3	Diseases:		04
	3.1	Definition and causes	
	3.2	Infectious diseases: aetiology and infectious agents	
4	Retrogressive changes		04
	4.1	Definition, cloudy (changes) swelling, degeneration, fatty degeneration, mucoid degeneration and amyloid degeneration	
5	Necrosis		03
	5.1	Definition and causes	
	5.2	Nuclear and cytoplasmic changes	
	5.3	Types of necrosis	
6	Gangrene		03
	6.1	Definition and causes	
	6.2	Types: dry, moist and gas gangrene	
7	Circulatory disturbances		08
	7.1	Hyperemia: active and passive (causes and effects)	
	7.2	Ischaemia: causes and effects	
	7.3	Hemorrhage: causes, effects and hemorrhagic effects	
	7.4	Thrombosis: thrombus formation, its causes & effects	
	7.5	Embolism: Definition, sources, types and effects	
8	Inflammation		05
	8.1	Definition and causes, cardinals of inflammation (signs), vascular phenomenon and cellular response	
	8.2	Acute and chronic inflammation	
9	Repair		04
	9.1	Process of Repair	
	9.2	Types: by regeneration, by connective tissue proliferation	
	9.3	Healing: primary and secondary	
10	Neoplasia		04

	10.1	Definition, causes & types of tumours- benign & malignant	
	10.2	Leukemia: acute and chronic.	
11	Disorders of pigmentations		02
	11.1	Brief idea about normal process of pigmentation, melanosis and jaundice	
12	Disorders of mineral metabolism		03
	12.1	Mechanism of calcification, pathological calcification (dystrophic and metastatic) causes and its effects. Gout aetiology and pathogenesis	

Reference Books

1. A text book of Pathology, 2009, 15th Rev Edn., Dey N. C. and Dey T. K. Sinha Debashish, New central book agency, Kolkota.
2. General pathology and pathology of systems, 2008, 6th Edn., Bhende Y. M. and Deodhar S.G.; Popular Prakashan Ltd, India.
3. Robins Basic Pathology, 2012, 9th Edn., Vinay Kumar, Abul K. Abbas, Jon C. Aster, Saunders, Philadelphia.
4. Textbook of Pathology, 2014, 7th Edition, Harsh Mohan, Jaypee Brothers Medical Publishers (P) Ltd.
5. Essentials in Hematology & Clinical Pathology, 2012, 1st Edition, Ramadas Nayak, Sharada Rai, Astha Gupta.
6. Concise Book On Medical Laboratory Technology, 2005 reprint, 1st Edn., C. R. Maiti, New Central Book Agency (p) Ltd, Kolkata, India.



तुळजाराम चतुरचंद महाविद्यालय, बारामती

Paper Code: ZOO 3507

Zoology Practical: V

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO-3507

Subject Title: ZOOLOGY PRACTICAL-V

Learning objectives

1. To learn the external characters, digestive and Nervous system of *Pila & Calotes*
2. To learn the scales, pecten and hyoid apparatus of *Calotes*.
3. To understand the Gemmules in sponges.
4. To understand the comparative study in vertebrates.
5. To make the students understand identification different types of tissues.
6. To make the students understand the method of temporary slide preparation of striated muscle fiber, stratified epithelial cells and medullated nerve fiber.
7. To introduce the students to different cells of human blood and their importance.

Learning outcomes

1. Outline the systematic position of *Pila & Calotes*.
2. The student will be able to label the organs and systems of *Pila* and *Calotes*.
3. The student will be able to understand asexual reproduction in sponges through gemmules.
4. Illustrate the morphological peculiarities of Heart, Kidney and Brain of vertebrates
5. Students are able to distinguish the permanent histological slides of different types of tissues.
6. 2. Students make a temporary slide preparation of striated muscle fiber, stratified epithelial cells and medullated nerve fiber.
7. 3. Students acquire the skill of making the blood smear and identifying different types of lymphocytes such as neutrophils, eosinophil, basophil and monocytes.

Paper Code: ZOO 3507

Zoology Practical: V

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO-3507

Subject Title: ZOOLOGY PRACTICAL-V
(Related to ZOO 3501, 3502)

Title of the Practical		Status
1	Study of external characters and digestive system of <i>Pila</i>	D
2	A. Study of Nervous system of <i>Pila</i> B. Temporary mounting of radula, osphradium & statocyst of <i>Pila</i>	D
3	Study of external characters and digestive system of <i>Calotes</i>	D
4	Study of nervous system of <i>Calotes</i>	D
5	A. Temporary mounting of scales, pecten and hyoid apparatus of <i>Calotes</i> B. Study of Gemmules in sponges	D
6	Comparative study of Scales in fishes: Placoid, Cycloid, and Ctenoid Heart: <i>Scoliodon</i> , Frog, <i>Calotes</i> , Pigeon and Rat Brain: <i>Scoliodon</i> , Frog, <i>Calotes</i> , Pigeon and Rat	D
7	Study tour to visit costal locality / Bio-diversity area / Hilly area / ponds/lakes / tanks / zoo / museum / science center- prepare tour report and submit at the time of examination	
8	Study of the different types of tissues with the help of permanent slides	D
9	Temporary mounting of tissues: A. Medullated Nerve fibre B. Striated muscle fibre C. Stratified epithelial cells	E
10	Study of permanent histological slides of skin, tooth, tongue, stomach, duodenum, ileum, liver, pancreas and any one salivary gland	D
11	Study of permanent histological slides of trachea, lung, kidney, testis, ovary, thyroid and adrenal gland.	D
12	Study of human blood smear to observe different cells	E

D: Demonstrating Practical

E: Experiment Performing Practical

Paper Code: ZOO 3508

Zoology Practical: VI

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3508

Subject Title: ZOOLOGY PRACTICAL-VI

(Practicals related to ZOO 3503, 3504)

Learning Objectives:

- To study the methods of collection, preservation and identification of planktons from freshwater
- To understand the importance and methods of water quality analysis
- To understand the importance and methods of soil analysis
- To study the methodologies of dissolved O₂ estimation from water samples.
- To study the methodologies of dissolved CO₂ estimation from water samples.
- To learn calculation of LC₅₀ and LD₅₀ from the data.
- To understand the working principle of pH meter using various solutions.
- To understand the effect of pH, temperature on enzyme activity.
- To know about how to prepare standard solutions while performing experiments.
- To detect carbohydrate, protein with suitable test.
- To estimate protein with Lowry's method.
- To study the separation of biomolecules with specific technique.

Learning outcomes:

- Students understand the methods of field collection, preservation and identification of planktons
- Students learn various water quality parameters, their measurement using analysis kit and importance.
- Student learn methods of estimating LC₅₀ and LD₅₀.
- It helps to student to understand about acidic, basic and neutral nature of chemicals.
- It helps to know about how the enzyme activity is dependent on different factors.
- Understand about application of different techniques in biomolecules separation.
- Understand about conversion and preparation of standard solutions.
- It helps to understand methods for estimation of protein, carbohydrates.

Paper Code: ZOO 3508

Zoology Practical: VI

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3508

Subject Title: ZOOLOGY PRACTICAL-VI

(Practicals related to ZOO 3503, 3504)

Title of the Practical		Status
1	Study of fresh water plankton (field collection, preservation and gross identification).	E
2	A visit to water body to study physicochemical properties of water. (TDS, Temperature, pH, turbidity, hardness, acidity & alkalinity) using analysis kit.	E
3	Study of physico-chemical properties of soil sample (using analysis kit)	E
4	Estimation of dissolved oxygen in water by Winkler's method.	E
5	Estimation of dissolved CO ₂ in water.	E
6	Hypothetical problem to determine LC ₅₀ and LD ₅₀ .	E
7	Study of principle and working of pH meter and measuring pH of three samples.	D
8	To study the effect of pH, temperature and inhibition on salivary amylase.	E
9	Detection of carbohydrates (monosaccharides, disaccharides and polysaccharides) with the help of suitable tests.	E
10	Study of preparation of standard acid and alkali and its standardization.	E
11	Estimation of proteins from suitable biological sample by Lowry's method.	E
12	Separation of amino acids / sugars / lipids by thin layer chromatography (TLC).	E

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Paper Code: ZOO 3509

Zoology Practical: VII

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO-3509

Subject Title: ZOOLOGY PRACTICAL-VII

(Practicals related to ZOO 3505, 3506)

Learning Objectives: -

- To Learn the detection of mitochondria with help of Janus Green B Stain.
- To study the of permanent slides of different stages of mitosis & meiosis.
- To Learn the temporary preparation of different mitotic stages from onion root tip cells.
- To Learn the effect of Colchicine on mitosis.
- To study the of temporary preparation of different meiotic stages from grasshopper testis / Tradescantia/ Onion floral bud.
- To study the viability of cell by using Trypan Blue dye.
- To study Splenectomy in rat.
- To understand the morphology and life cycle of *Plasmodium vivax* and *Entamoeba histolytica*, *Ascaris lumbricoides* and *Taenia solium*.
- To describe the morphology and pathogenicity of arthropods of human & animal health importance.
- To identify vector - host - pathogen relationships in arthropod-borne diseases.
- To expose the endoparasites from the host.
-

Learning Outcomes: -

- Students will learn how to detect mitochondria by using 'Janus Green B' Stain.
- Students will learn & identify the different stages of mitosis & meiosis by using readymade permanent slides.
- Students will learn how perform the temporary preparation of mitotic stages in onion root tip cells.
- Students will learn the role of Colchicine on mitosis (cell cycle).
- Students will learn the temporary preparation of different meiotic stages from grasshopper testis / Tradescantia/ Onion floral bud.
- Students will learn how perform the viability of cell by using Trypan Blue dye.
- Students will learn Splenectomy & its significance.
- Students learn the morphology & life cycle of protozoan & helminth parasites.
- Students become aware about the spreading of diseases by different arthropods.
- Students can identify the different vectors responsible for spreading of diseases.
- Students will learn the dissection, collection and mounting of endoparasites.

Paper Code: ZOO 3509

Zoology Practical: VII

Credits: 02

No. of Practicals: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3509

Subject Title: ZOOLOGY PRACTICAL-VII

(Practicals related to ZOO 3505, 3506)

Title of the Practical		Status
1	Study of Life cycle of <i>Plasmodium vivax</i> and <i>Entamoeba histolytica</i> (whole mounts of life stages), <i>Ascaris lumbricoides</i> and <i>Taenia solium</i> (whole mounts of life stages).	D
2	Study of morphology & pathogenicity of Head louse, Tick, & Mite.	D
3	Study of vectors by whole mountings of —mosquito, rat flea, house fly and bed bug.	E
4	To study rectal parasites of cockroach OR Intestinal Parasites of Hen / Fish.	E
5	Study of detection of mitochondria by Janus Green B.	E
6	Study of permanent slides of mitosis & meiosis.	D
7	To study the effect of Colchicine on mitosis.	E
8	Study of temporary preparation of different meiotic stages from grasshopper testes / Tradescantia/ Onion floral bud.	E
9	Cell Viability Test (Trypan Blue)	D
10	Study of antigen-antibody interaction by Ouchterlony Method.	D

OR (Optional for Practical no. 5 to 10 from Cell Biology)

ZOO-3506 B] General Pathology

Practicals:

5. Study of pathogenic agents and pathological conditions with the help of suitable microscopic slides **D**
- Mycobacterium tuberculae*
 - Mycobacterium leprae*
 - Vibrio cholerae*
 - Anthrax bacilli*
 - Pneumococci* sp.
 - Trypanosoma* sp.
6. Study of pathological conditions with the help of suitable microscopic slides **D**
- Normal and diseased cell (Lung)
 - Fatty degeneration (Liver)
 - Cloudy degeneration/Swelling (Kidney)
 - Dying cell –necrosis (Liver)
 - Lung lobar pneumonia
 - Ovarian cyst
 - Thyroid goitre
7. Study of following pathological slides or specimens **D**
- Carcinoma in situ eg. Human cervix
 - Malignant cell

- c) Organized thrombus
 - d) Ovary fibroid tumour/carcinoma
 - e) Carcinoma of colon-cauliflower growth
 - f) Carcinoma of stomach
 - g) Liver cirrhosis
 - h) Breast fibrocystic disease
8. To detect the normal and abnormal constituents of urine **E**
9. Study of Gastric juice analysis by Toffler's reagent (alcoholic solution of dimethylaminoazobenzol methyl orange indicator). **E**
10. Visit to medical college/hospital/pathological laboratory





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Scheme of Course Structure (CBCS)
Faculty of Science
Department of Zoology
Class: T.Y.B.Sc.
Evaluation Pattern: 40 (IA) + 60 (EA)
Total Credits: 48

Semester	Paper Code	Title of Paper	Credits
Semester VI	ZOO 3601	BIOLOGICAL TECHNIQUES	3
	ZOO 3602	MAMMALIAN PHYSIOLOGY & ENDOCRINOLOGY	3
	ZOO 3603	GENETICS & MOLECULAR BIOLOGY	3
	ZOO 3604	ORGANIC EVOLUTION	3
	ZOO 3605	GENERAL EMBRYOLOGY	3
	ZOO 3606	A] MEDICAL ENTOMOLOGY or B] PUBLIC HEALTH & HYGIENE	3
	ZOO 3607	ZOOLOGY PRACTICAL-VIII (Related to ZOO 3601, 3602, 3603)	2
	ZOO 3608	ZOOLOGY PRACTICAL-IX (Related to ZOO 3604, 3605, 3606)	2
	ZOO 3609	Minor Research Project (Compulsory)	2

IA* – Internal Assessment
EA* – External Assessment



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Paper Code: ZOO 3601

Paper: I

Title of Paper: Biological Techniques

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- To give students an introduction to the basic techniques used in research.
- To understand the techniques used in life sciences.
- To study the principles behind the working of various instruments.
- To emphasize the application of bioinformatics and biological databases for problem solving in real-life & research.
- To familiarize student with the use of a biological database and to enable them to apply these methods under various situations.

B. Learning outcomes:

After successful completion of this course, students are expected to:

- Understand basic principle of chromatography, Electrophoresis, centrifuge and spectroscopy
- Understand basic method of solutions preparation and different strength.
- Ability to use specific laboratory tools and techniques (e.g. effective use of microscopes and lab instruments, handling of microorganisms, making up solutions).
- Ability to use Hematological tools and techniques (Hemoglobin meter, haemocytometer, total count of WBCs and RBCs manually).
- Understand basic concept of histological technique and tissue slide preparation.
- Understand fixative, clearing agent, hydration and dehydration agent etc.
- Basic principle of tissue block making and problem in section cutting
- Understand staining methods.
- Basic technique of histochemistry and Immunohistochemistry.
- Understand the application of computer and biological databases in research.

Paper Code: ZOO 3601

Paper: I

Title of Paper: Biological Techniques

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction to biological techniques:		14
	1.1	Solution/strengths of chemicals: Percentage, normality, molarity, molality, ppm, ppb.	
	1.2	Separation techniques: principle and applications, techniques related to isolation, purification and characterization of biomolecules. 1.2.1 Chromatography- Paper and ion-exchange. 1.2.2 Electrophoresis- Agarose and Polyacrylamide. 1.2.3 Ultracentrifugation. 1.2.4 Colorimetry and spectroscopy.	
2	Haematological Techniques:		05
	2.1	Blood cell count –Total count of RBCs, WBCs and Differential count of WBCs and their significance.	
	2.2	Microscopy: Phase contrast and electron – their principle & working.	
3	Microtechnique:		07
	3.1	Procurement of tissues and precautions to be taken to avoid tissue damage during procurement.	
	3.2	Fixatives: Classification of fixatives and importance of fixation of tissues.	
	3.3	Methods of fixation.	
	3.4	Dehydration. 3.4.1. Clearing. 3.4.2. Impregnation, Embedding and block making.	
4	Microtomes and Knives:		04
	4.1	Types of microtomes.	
	4.2	Types of microtome knives.	
	4.3	Section cutting: Steps, Common faults in section cutting: reasons & remedies.	
	4.4	Mounting and spreading of ribbons.	
5	Stains and Staining:		06
	5.1	Classification of stains.	
	5.2	Principle, methods and types of staining.	
	5.3	General procedure for staining of sections.	

	5.4	Mounting and labeling of sections: Classification of mounting media, refractive indices of mounting media.	
6	Histochemical staining:		02
	6.1	Demonstration of Carbohydrates by PAS technique.	
	6.2	Demonstration of Nucleic acid by Feulgen Reaction.	
7	Biotechnology:		05
	7.1	Introduction to PCR, RT-PCR, Southern, Western and Northern Blotting.	
	7.2	Introduction to DNA Fingerprinting and its applications.	
8	Introduction to Bioinformatics:		05
	8.1	Computer applications in Biology.	
	8.2	Types of Biological Database.	
	8.3	BLAST- Sequence Search & alignment.	

Reference Books

1. Introduction of Medical Laboratory Technique, 1998, 7th Edn., Baker F. J., Silvertown R. E., Pallister C. J., Butterworth-Heinemann, UK
2. Hematology: Basic Principles and Practice, 2008, 5th Edn., Ronald Hoffman, Bruce Furie, Philip McGlave, Churchill Livingstone Elsevier, USA
3. Histological and Histochemical Methods, Theory and Practice, 2008, 4th Edn., John A. Kiernan, Scion Publishing Ltd, UK
4. Basic Separation Techniques in Biochemistry, 1998, Okotore R. O., New Age International, New Delhi.
5. Cytological techniques: The Principles Underlying Routine Methods, 1963, Baker J.R, Methuen & Co, London
6. Davenport H. A.: Histological and Histochemical techniques.
7. Handbook of basic Microtechnique, 1958, 2nd Edn., Gray P., McGraw-Hill, USA
8. The microscope and how to use it, 1970, George Stehli, Dover Publications Inc., New York.
9. Histopathological technique and Practical Histochemistry, 1976, 4th Edn, Lillie R.D McGraw-Hill, USA

10. Staining methods (Histological and Histochemical), 1960, Mc Manus J. F. A. And Mowry R.W., Paul B. Hoeber, Inc.; Harper & Brothers, NY
11. Notes on Microscopical Techniques for Zoologist, 1964, Pantin C. F.A.: Cambridge University Press
12. Elementary Microtechnique, 1973, 4th Edn., Peacock H.A., Edward Arnold Publ. Ltd., UK
13. Histochemistry, 1968, Pearse A.G.E., Vol. I & II., W.B. Saunders Company (WBS) of Philadelphia
14. Microscope and microscopic life, 1979, 2nd Edn., Peter Healey, Hamlyn, UK
15. Biological Instrumentation and methodology, 2008, 2nd Revised Edition, P.K. Bajpai, S. Chand and Co. Ltd., New Delhi
16. Bioinformation- A Biologist Guide to Biocomputing & Internet- Brown, S.M. Eaton Publication New York
17. Fundamental Concept of Bioinformation- Krane & Raymer, Persons Education, 2003
18. Introduction to Bioinformation – Attwood & Parry- Smith, Persons Education, 2003
19. Principles and Techniques of Biochemistry and Molecular Biology, Seventh edition Edited by KEITH WILSON AND JOHN WALKER
20. Biotechnology, 2018, Dr. P. S. Lohar, MJP Publishers.
21. Cell & Molecular Biology, 2018, Dr. P. S. Lohar, MJP Publishers.
22. BioInformatics, 2020, Dr. P. S. Lohar, MJP Publishers.

तुळजाराम चतुरचंद महाविद्यालय, बारामती

Paper Code: ZOO 3602

Paper: II

Title of Paper: Mammalian Physiology & Endocrinology

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- To familiarize students with the principles and basic facts of mammalian physiology and with some of the laboratory techniques and equipment used in the attainment of physiological data. The importance will be on mammalian.
- The course will focus on organ-system physiology, nutritive, circulatory, respiratory, excretory, muscular, nervous, reproductive and endocrine physiology.
- To introduce to the learner the details of endocrine glands and its disorders.

B. Learning outcomes:

Upon successful completion of this course, the students will be able to describe, identify, and/or explain:

- The various physiological organ-systems and their importance to the integrative functions of the human body.
- Understand Concept of energy requirements
- Various aspects of Digestive physiology.
- Circulatory system with medical conditions
- Understand Respiratory mechanism and gases transport.
- Eliminations of waste materials from the body.
- Develop understanding in Structure and functions of muscles
- Understand formation of gametes and function of endocrine glands.

सुखाराम चतुर्वेद महाविद्यालय, बारामती

Paper Code: ZOO 3602

Paper: II

Title of Paper: Mammalian Physiology & Endocrinology

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Nutrition and digestion		07
	1.1	Concepts of nutrition and energy requirements	
	1.2	Physiology of digestion: digestive enzymes and their actions- salivary, gastric and intestinal digestion. Role of liver and pancreas in digestion	
	1.3	Vitamins – Sources and associated disorders.	
2	Respiration:		05
	2.1	Definition, and mechanism of pulmonary and tissue respiration	
	2.2	Transport of Oxygen and carbon dioxide	
	2.3	Respiratory Quotient and BMR	
3	Circulation:		07
	3.1	Cardiac Cycle- systole, diastole and pacemakers	
	3.2	Cardiac output and blood pressure	
	3.3	Chemical and nervous regulation of heart.	
	3.4	Definitions and significance of electrocardiogram, colour doppler, angiography, angioplasty, angina pectoris, myocardial infarction and coronary bypass.	
4	Excretion:		05
	4.1	Physiology of Urine formation- ultrafiltration, reabsorption, tubular secretion	
	4.2	Counter-Current Multiplier theory for urine concentration	
	4.3	Role of ADH, and Renin-angiotensin system	
	4.4	Definitions and clinical significance of renal failure, renal calculi, dialysis.	
5	Muscles:		04
	5.1	Mechanism of muscle contraction by Sliding filament theory	
	5.2	Response of muscles to stimulation- simple muscle twitch, muscle fatigue, muscle tetanus, rigor mortis	
6	Nervous Excitation:		05
	6.1	Origin and conduction of nerve impulse, saltatory conduction	

	6.2	Synapse- ultrastructure and transmission of nerve impulse	
	6.3	Definitions/concepts: impulse, stimulation, conduction, response, EEG, epilepsy	
7	Reproduction:		08
	7.1	Hormonal control of male reproduction.	
	7.2	Physiology of female reproduction, hormonal control of estrous and menstrual cycle.	
	7.3	Hormonal control of pregnancy	
	7.4	Hormonal control of parturition and lactation	
8.	Endocrinology:		07
	8.1	Mechanism of hormone action. Functions of pituitary, thyroid, parathyroid, pancreas and adrenal gland hormones.	
	8.2	Endocrine disorders: gigantism, acromegaly, dwarfism, diabetes insipidus, diabetes mellitus, goiter, cretinism, myxedema, rickets, Addison Disease, Cushing's syndrome	

Reference Books

1. Textbook of Medical Physiology, Guyton A.C. & Hall J.E., 2006, 11th Edition, Hercourt Asia Pvt. Ltd. / W.B. Saunders Company.
2. Principles of Anatomy & Physiology, 2006, 11th Edition, Tortora G.J. & Grabowski S., John Wiley & sons, Inc.
3. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical applied agency, Kolkata.
4. Text book of Animal Physiology, 2008, 2nd Edn. Nagabhushanam, S. V. S. Rana, S. Kalavathy, Oxford University Press, India.
5. Animal Physiology: Adaptation and Environment, 1997, Schmidt-Nielsen, Knut, Cambridge University Press.
6. General and Comparative Physiology, 1983, 3rd Edn. Hoar W. S., Prentice Hall, UK.
7. Medical Physiology, 2006, Asis Das, Books and Allied Pvt. Ltd., Kolkata.
8. Endocrinology, 2005, Lohar P. S., M J P Publishers, Chennai.
9. Vander, Sherman, Luciano's Human Physiology: The Mechanisms of Body Function, 2003, 9th Edn. Eric P. Widmaier, Hershel Raff, Kevin T. Strang, Mc Graw Hill.
10. Endocrinology, 2018, Dr. P. S. Lohar, MJP Publishers.

Paper Code: ZOO 3603

Paper: III

Title of Paper: Genetics and Molecular Biology

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- To understand the importance of Mendelian genetics.
- To understand the Structure of DNA and RNA, DNA and RNA as genetic material.
- To understand the structure of chromosomes, and be able to categorize in euchromatin and heterochromatin.
- To describe the processes of replication and how DNA is stored.
- To understand the process of transcription, translation to regulate gene expression.
- To introduce a set of techniques to modify an organism's genome to produce improved or novel genes and organisms.

B. Learning outcomes:

- Students shall get an insight into the Structure of DNA and RNA, DNA and RNA as genetic material
- The course shall prepare learner to get insight into the Central Dogma of Molecular Biology
- Students understand the concepts like mutation, its types and mutagens.
- Students shall also understand related areas in relatively new fields of genetic engineering
- Students shall get acquainted with the vast array of techniques used to manipulate genes which can be applied in numerous fields like medicine, research, etc. for human benefit.

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Paper Code: ZOO 3603

Paper: III

Title of Paper: Genetics and Molecular Biology

Credits: 3

No. of Lectures: 48

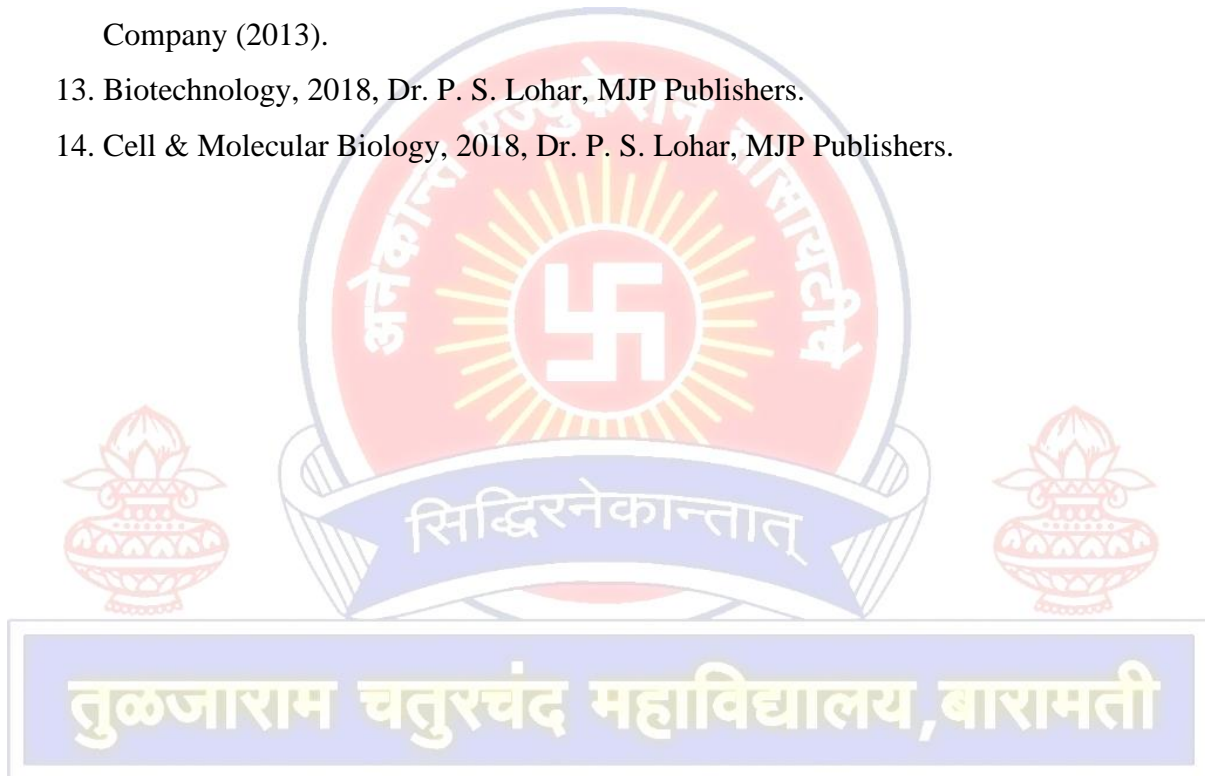
UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES	
1	Introduction to genetics:		01	
	1.1	Classical and Modern concept of Gene, Cistron, Muton, Recon, Replicon		
2	Gene Mutation:		06	
	2.1	Definition Types of mutations: spontaneous, induced, somatic, gametic, forward and reverse mutation Types of point mutation- deletion, insertion, Frameshift, substitution, transversion, transition		
	2.2	Mutagenic agents. a) UV radiation and ionising radiation b) Base analogs, alkylating and intercalating agents		
3	Population Genetics:		04	
	3.1	Basic Concepts in population genetics: Mendelian population, gene pool, gene frequency, chance mating (Panmictic mating) Hardy Weinberg law and its equilibrium		
4	4.1	Linkage and crossing over Types of Linkage, crossing over types of crossing over, mechanism and molecular basis of recombination (Holiday model)	05	
5	Molecular Biology:		05	
	5.1	DNA as genetic material- evidences (Griffith's, Avery et al and Hershey - Chase experiment), RNA as genetic material-TMV.		02
	5.2	Chromatin Structure- Heterochromatin (Example barr bodies) Euchromatin, histones, nucleosome arrangement, packaging of DNA		03
6	Central Dogma of Molecular Biology			

	6.1	DNA Replication- Semiconservative (Messelson and Stahl experiment) Basic Mechanism of replication in prokaryotes and eukaryotes	05
	6.2	Transcription –Basic mechanism of transcription in prokaryotes and eukaryotes, RNA polymerase enzyme in prokaryotes and eukaryotes Post transcriptional modification of RNA	06
	6.3	Translation – Genetic code, properties of genetic code, Wobble hypothesis, ribosome structure [prokaryotes and eukaryotes] Basic mechanism of Translation in <i>E. coli</i> and eukaryotic cells	06
7	7.1	Concept of operon - Lac operon, Trp operon,	03
	Genetic Engineering		
8	8.1	Tools in Genetic Engineering- Enzymes involved in Genetic Engineering: Introduction, nomenclature and types of restriction enzymes with examples	05
	8.2	Vectors for gene cloning- General properties ,types and advantages and disadvantages of cloning vectors - plasmid vectors(pBR322), phage vector (λ Phage), cosmid vector	
9	Introduction to Gene transfer technology		02

Reference books

1. Principles of Biochemistry, 1993, 2nd Edn, Lehninger A. L. Nelson D.L. & Cox M.M. CBH Publisher and distributors, Delhi.
2. Biochemistry, 1995 5th Edn. Zubly G. Wm, C.Brown Communications USA.
3. Harpers Biochemistry ,1996 ,26 th Edn., Murray R.k., Granner D.K. ,Mayes P.A. &Rodwell V.W. Prentice Hall international USA.
4. Outline of biochemistry, 1995 5th Edn, Conn E.E., Stumph P.K. Bruening G &Doi R.H.John Wiley & Sons, USA

5. Principals of Biochemistry, 1993, 1st Edn., Pattabhiraman T.N., Gajanan Book publishers and distributors Bangalore.
6. Clinical Biochemistry, 1994, B. P. Godkar, Bhalini Publishing house, Mumbai.
7. Biochemistry, 1995 5th Edn, Stryer Sanfrancisco, W. H. Freeman & Co.
8. Biochemistry, 1990, 8th Edn., D.Voet & J. Voet, JohnWiley, New York.
9. Fundamentals of Biochemistry, Jain, J.L., Jain, S. and Jain, N., S. Chand and Company Ltd. (2005).
10. Roitt I., Brostoff J., Male D., Immunology, Mosby Elsevier (2004).
11. Khan F.H. The Elements of Immunology, Pearson Education (2009)
12. Owen J. A., Punt J., Strandfod S.A, Jones P.P., Kuby- Immunology W.H. Freeman & Company (2013).
13. Biotechnology, 2018, Dr. P. S. Lohar, MJP Publishers.
14. Cell & Molecular Biology, 2018, Dr. P. S. Lohar, MJP Publishers.



Paper Code: ZOO 3604

Paper: IV

Title of Paper: Organic Evolution

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- Students will be able to explain how life might have originated on this planet.
- Students will understand Darwin's theory and how the principles of natural selection can lead to speciation.
- Students will be able to give examples of adaptation and of both allopatric and sympatric speciation.
- Students will be able to contrast alternate models for macroevolution and describe the major patterns in the fossil record.
- Students will be able to relate broad patterns in the fossil record to major geological events and the evolution of man.

B. Learning outcomes:

- Students get the basic knowledge of origin and evolution of life, origin of eukaryotic cell origin of mitochondria, plastids as symbionts.
- Students become aware about Theories of organic evolution Such as Lamarckism, Darwinism and Neo Darwinism, Mutation Theory and Modern Synthetic theory.
- Students will get the knowledge of pre-zygotic and post-zygotic isolation mechanisms.
- Students will understand the process of speciation and the factors influencing speciation.
- Students learn the basic co-evolutionary mechanism.
- Students become aware of Geological Time Scale and the evolution of man.

Paper Code: ZOO 3604

Paper: IV

Title of Paper: Organic Evolution

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction:		03
	1.1	Origin of life	
	1.2	Origin of eukaryotic cell (origin of mitochondria, plastids and symbionts.)	
2	Evidences In Favor of Organic Evolution		07
	2.1	Evidences from: anatomy, embryology, geographical distribution, palaeontology, physiology, biochemistry, genetics, and molecular biology.	
3	Theories of Organic Evolution:		06
	3.1	Lamarckism.	
	3.2	Darwinism and Neo-Darwinism.	
	3.3	Mutation Theory	
	3.4	Modern Synthetic theory.	
4	Isolation:		03
	4.1	Isolating mechanism.	
	4.2	Classification of isolating mechanism	
	4.3	Pre-zygotic and post-zygotic isolating mechanism.	
5	Speciation:		06
	5.1	Types of speciation (Allopatric and Sympatric)	
	5.2	Mechanism of speciation.	
	5.3	Patterns of speciation	
	5.4	Factors influencing speciation.	
6	Coevolution:		04
	6.1	Introduction to coevolution	
	6.2	Competition and character displacement	
	6.3	Predator-prey interactions	
	6.4	Host-pathogen interaction	
7	Human Induced Evolution:		03
	7.1	Human-induced evolution as natural experiments	
	7.2	Antagonistic effects of human-induced selection on behaviour, life history and population dynamics	
	7.3	Pollution and multi-stressor environments of urbanized areas	
	7.4	The impact of anthropogenic climate change - shifts on species distributions and connectivity	
	7.5	Evolutionary applications in the Anthropocene	

8	Geological Time Scale:		04
	8.1	Terminologies, eras, periods and epochs	
	8.2	Notable changes in geographical time	
9	Animal Distribution:		02
	9.1	Methods of distribution.	
	9.2	Classification of animal distribution.	
	9.3	Patterns of animal distribution.	
	9.4	Factors affecting distribution	
10	Antiquity of Man:		06
	10.1	Evolution of anthropoids including man (Kenya pithecus to <i>Homo sapiens</i>)	
11	Zoo-Geographical Realms:		04
	11.1	Geographical regions and fauna	

Reference Books

1. Organic Evolution, Richard Swann Lull, Light and Life Publishers.
2. Introduction to Evolution, Paul Amos Moody, Kalyani Publishers, New Delhi.
3. Organic Evolution, 1991 T.S. Gopalkrishnan, IttaSambashivarab Publ. House
4. Evolution, 1996 P.K. Gupta Rastogi Publ., Meerut.
5. Evolutionary Biology, 1990, Mohan P.Arora, Himalaya Publi.House,Delhi.
6. Evolution, 1968, E. O. Dodson, Reinhold Publ. Crop., New York.
7. The major features of evolution, 1953, Simpson G.G. Columbia, New York.
8. The origin of species, 1959, Charles Darwin, New American Library, New York.

तुळजाराम चतुरचंद महाविद्यालय, बारामती

Paper Code: ZOO 3605

Paper: V

Title of Paper: General Embryology

Credits: 3

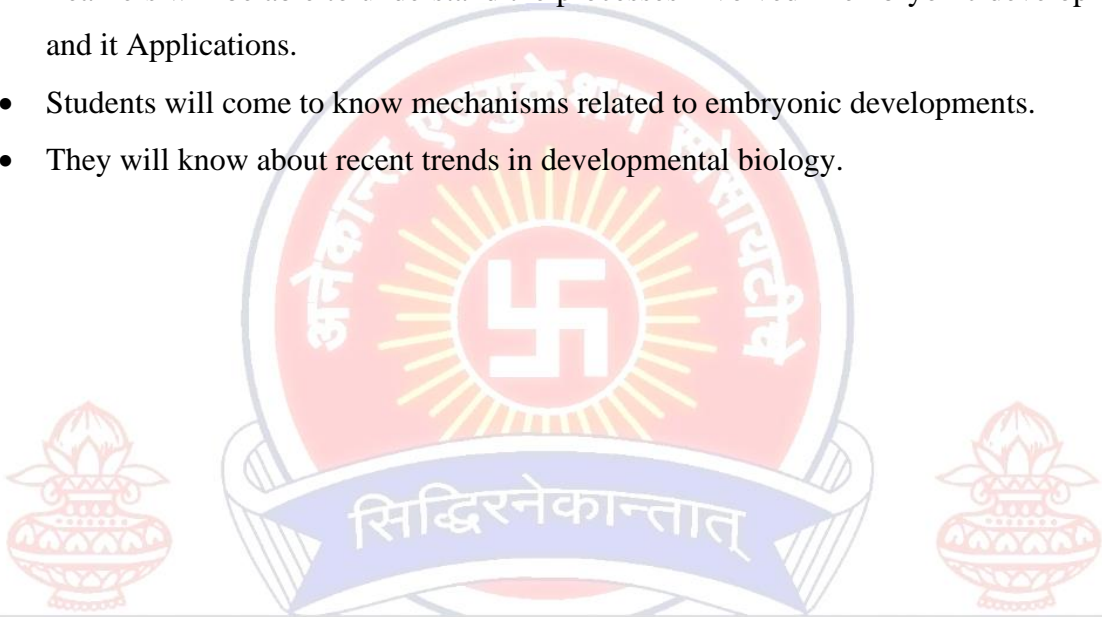
No. of Lectures: 48

A. Learning objectives:

- To introduce the learners to the basics of embryology with reference to chick as a model.
- To make the students aware about the mechanisms related to embryonic development.
- To understand the signalling pathways and intercellular communication during development

B. Learning outcomes:

- Learners will be able to understand the processes involved in embryonic development and its Applications.
- Students will come to know mechanisms related to embryonic developments.
- They will know about recent trends in developmental biology.



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Paper Code: ZOO 3605

Paper: V

Title of Paper: General Embryology

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction to embryology:		04
	1.1	Definition and scope.	
	1.2	Theories of Developmental biology: Preformation, pangenesis, epigenesis, axial gradient and germ plasm.	
2	Concepts in Developmental Biology:		02
	2.1	Growth, differentiation, dedifferentiation, cell determination, cell communication, morphogenesis, induction and regeneration.	
3	Gametogenesis:		08
	3.1	Spermatogenesis: phases & spermiogenesis (nuclear and cytoplasmic changes), Ultra structure of typical sperm. (Entire, T.S. through head, middle piece and tail).	
	3.2	Oogenesis phases: growth phase- pre-vitellogenesis, vitellogenesis and post-vitellogenesis, Oocyte maturation: role of MPF (maturation promotion factor). Ovum: general structure. Egg membranes: primary, secondary and tertiary.	
	3.3	Types of eggs.	
4	Fertilization:		9
	4.1	Concept and types.	
	4.2	Attraction of gametes: sperm activation, chemotaxis (fertilizin and antifertilizin as enzymes and gamones as hormones).	
	4.3	Sperm penetration: acrosome reaction, capacitation & decapacitation.	
	4.4	Activation of ovum: fertilization cone, polyspermy prevention: fast block (fertilization potential) & slow block (cortical reaction) & perivitelline space fertilization membrane.	
	4.5	Amphimixis.	
	4.6	Significance of fertilization.	
Cleavage:			

5	5.1	Planes and symmetry.	03
	5.2	Types of cleavage.	
	5.3	Significance of cleavage.	
6.	Blastula: Definition and type:		02
7.	Gastrulation:		06
	7.1	Definition and Concept.	
	7.2	Basic cell movements in gastrulation: Epiboly, Emboly. Convergence, invagination, ingression & involution (with reference to frog).	
	7.3	Organizer: primary, secondary and tertiary.	
8	Chick Embryology:		11
	8.1	Structure of Hen's egg.	
	8.2	Fertilization and cleavage.	
	8.3	Formation of primitive endoderm.	
	8.4	Primitive streak development.	
	8.5	Head process and regression of Primitive streak.	
	8.6	Development of chick embryo - 24 hours, 36 hours, 48 hours.	
9	Extra embryonic membranes:		02
10	Introduction to teratogenesis:		01

Reference Books

12. An Introduction to Embryology 2012, 5thEdn., Balinsky B. L., Fabian B. C. Brooks Cole Pub. Co., USA.

13. Developmental Biology: Patterns, principle and problems, 1982, Saunders J. W., Prentice Hall Coll Div.

14. Developmental Biology 1992 3rd den Browder L. W., Erickson C.A. & Jeffery W. R., Saunders college pub., London.

15. Developmental Biology, 2013, 10thEdn. Gilbert S. F., Sinauer Associates Inc.

Paper Code: ZOO 3606

Paper: VI

Title of Paper: (A) Medical Entomology

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- To introduce the concept of entomology, its branches & importance.
- To introduce the general body organization of insect.
- To introduce the few insects of veterinary importance.
- To introduce the few insects of medical importance.
- To introduce the concept of pest control & IPM.
- To introduce the concept of forensic science & forensic entomology.

B. Learning outcomes:

- Students understand the meaning of entomology, its various branches & importance in human life.
- Students can identify various body divisions and appendages of insect.
- Students can identify the insects of veterinary importance & their control.
- Students can identify the insects of medical importance & their control.
- Students understand the meaning of insect pests of agricultural & household importance.
- Students become aware about methods of pest control & concept of IMP.
- Students become aware about careful observation of insect life cycle & its application in forensic field.

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Paper Code: ZOO 3606

Paper: VI

Title of Paper: (A) Medical Entomology

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1	Introduction:		02
	1.1	Definitions & Scope of Agricultural, Medical, Veterinary and Forensic Entomology	
2	Basics of Entomology:		10
	2.1	General Morphology & Anatomy of Insects: Tagmosis: Head, Thorax, Abdomen	
	2.2	Typical Structure of Antenna, Mouthparts, Compound Eye, Typical Leg, Typical Wing	
	2.3	Digestive system Circulatory system Male & Female Reproductive system Nervous system	
3	Veterinary Entomology:		08
	3.1	Habits, Habitats, Brief Morphology, Life History, Pathogenesis & Control Measures of- <i>Tabanus</i> spp. (Horse Fly)	
	3.2	<i>Calliphora</i> spp. (Blow Fly / Green Bottle Fly)	
	3.3	<i>Hippobosca</i> spp. (Forest Fly / Louse Fly)	
	3.4	<i>Oestrus ovis</i> (Nasal Grub Fly)	
4	Medical Entomology:		08
	Habits, Habitats, Brief Morphology, Life History, Pathogenesis & Control Measures of-		
	4.1	Flea	
	4.2	Sand fly	
	4.3	Bed bug	
4.4	Head louse		
5	Introduction to Pest & Pest Control:		12
	5.1	Concept of Pest	
	5.2	Brief study of Household Pests: Cricket, Cockroach, Ants	
	5.3	Brief Study of Agricultural Pests: Cotton Boll worm, Aphids, Pulse beetle	
	5.4	Introduction to Pest Control: Biological Control; CRISPER Technology, Knipling Model, IPM	
6	Introduction to Forensic Entomology:		08

6.1	Concept of Forensic Entomology	
6.2	Insects of Forensic Importance: Blow Flies, Flesh Flies, Carrion Beetles.	
6.3	Collection of Entomological Evidence During Legal Investigation.	

Reference Books

1. Social Insects: Their Origin and Evolution, 2006, W. M. Wheeler, Discovery Publishing House, Delhi
2. Lives of Social Insects, 1968, P. P. Larson, M. W. Larson, World Pub. Co.
3. Handbook of medical entomology, Riley W. A., Johannsen O. A., Comstock Pub., New York.
4. Medical and Veterinary Entomology, 1995, 2ndEdn., Kettle D. S., CABI, UK
5. Medical Entomology for Students, 2012, 5thEdn., Mike Service, Cambridge University Press, UK
6. Essentials of Parasitology, 2008, 8th Edn., Schmidt G. D., McGraw Hill.
7. Parasitology: Biology of animal parasites, 1982, 3rd Edition, Noble E. A. and Noble G. A., Lippincott Williams and Wilkins
8. A text book of preventive and social medicine 2011, 21st Edn., Park. K. Banarsidas Bhanot Publishers, Jabalpur, India.
9. Biotechnology, 2018, Dr. P. S. Lohar, MJP Publishers.

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Paper Code: ZOO 3606

Paper: VI

Title of Paper: (B) Public Health and Hygiene

Credits: 3

No. of Lectures: 48

A. Learning objectives:

- To enable the student to understand the basic nature of disease processes from the standpoint of causation, epidemiology, natural history, and the structural and functional abnormalities that result.
- To enable the student to classify diseases of various body systems and how they manifest clinically and histo-pathologically.
- To enable the student to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases.
- To enable the student to apply knowledge of pathology's role in the diagnosis, staging, and management of disease.
- To enable the student to utilize high quality peer-reviewed literature to maintain currency in the management of pathologic conditions.

B. Learning outcomes:

- Students will be able to identify the fundamental causes and mechanisms of disease, and the associated alterations in the structure and function of cells, tissues, organs and systems.
- Students will describe basic mechanisms of cellular pathology, including cell injury, necrosis, and cellular adaptations.
- Students will be able to describe the etiology and classification of inflammatory responses, and the mechanisms involved in healing and repair.
- Students will be able to devise likely diagnoses from clinical scenarios by recognizing key manifestations of congenital, hemodynamic, inflammatory, infectious, metabolic, environmental, and neoplastic diseases.
- Students will be able to apply knowledge of pathology's role in the diagnosis, staging, and management of disease.
- Students will be able to utilize high quality peer-reviewed literature to maintain currency in the management of pathologic conditions.

Paper Code: ZOO 3606

Paper: VI

Title of Paper: (B) Public Health and Hygiene

Credits: 3

No. of Lectures: 48

UNIT NO.	SUBUNIT NO.	SYLLABUS	NO. OF LECTURES
1		Introduction and scope of public health:	01
2		Health:	04
	2.1	Definition, factors affecting health (inborn, environmental).	
	2.2	Personal and community health.	
	2.3	Effects of alcohol, tobacco and drugs.	
	2.4	WHO and its programmes.	
3		Food:	06
	3.1	Sources: Plants and Animals.	
	3.2	Necessity: deficiency diseases.	
	3.3	Beverages and condiments.	
	3.4	Food preservation methods.	
4		Air and ventilation:	03
	4.1	Composition of air.	
	4.2	Purification of air.	
	4.3	Ventilation system: natural and artificial.	
5		Water and water supplies:	05
	5.1	Sources and properties of water, quality of water for human consumption.	
	5.2	Process of purification of water- small scale and large scale.	
	5.3	Slow sand or biological filtration of water and rapid sand or mechanical filtration of water.	
6		Soil:	03
	6.1	Composition, properties and diseases spread by soil.	
7		Sanitation:	05
	7.1	Definition and concept.	
	7.2	Disposal of human and animal waste, refuse, sewage.	
8		Diseases:	10
	8.1	Communicable diseases: causative organisms, signs and symptoms, modes of transmission, prevention and control measures of: influenza,	

		chicken pox, measles, tuberculosis, leprosy, swine flu and encephalitis.	
	8.2	Non Communicable diseases: rheumatic heart disease, coronary heart disease and Diabetes.	
9	Demographic Biostatistics:		04
	9.1	Introduction.	
	9.2	Purpose of data sampling.	
	9.3	Methods of sampling.	
10	Epidemiology:		03
	10.1	Introduction.	
	10.2	Epidemiologic methods.	
	10.3	Causes of epidemiology.	
11	Social and Industrial hygiene:		02
	11.1	Accident, emergencies in home and industries.	
	11.2	Occupational disease (details of diseases not expected).	
	11.3	Provisions for disabled and mental hygiene.	
	11.4	Bio-safety for disabled and mental hygiene.	
12	Radiation risk		02

Reference Books

1. A text book of preventive and social medicine 2011, 21st Edn., Park. K., Banarsidas Bhanot Publishers, Jabalpur, India
2. Preventive and social medicine in India, 2013, 4th Edn., B. K. Mahajan, M. C. Gupta, Jaypee Brothers Medical Publishers, New Delhi, India
3. Medical Zoology and Medical Technology. R.C. Sobti, Shobanlal and Co., Jalandhar
4. Review in community medicine, 2006, 2nd Edn., V. V. R. Seshu Babu, Paras Medical Books Pvt. Ltd., Hyderabad.

Paper Code: ZOO 3607

Zoology Practical: VIII

Credits: 02

No. of Practical: 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3607

Subject Title: ZOOLOGY PRACTICAL-VIII

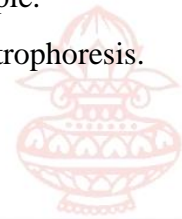
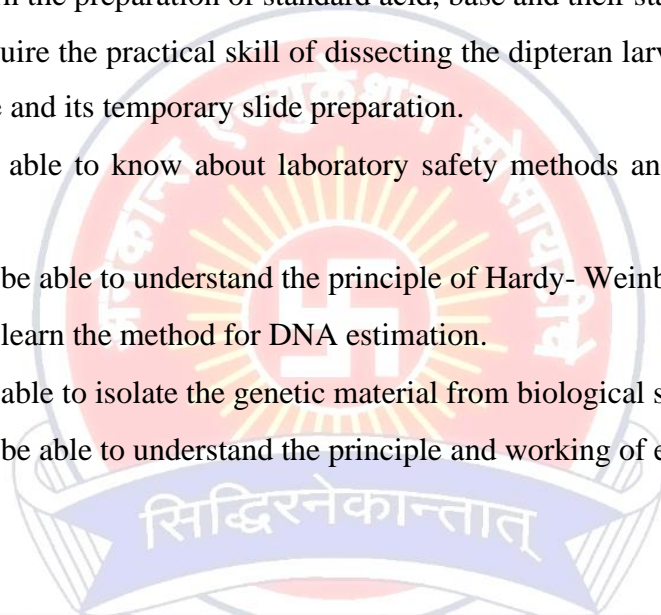
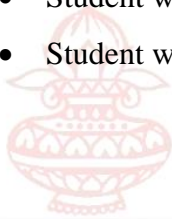
A. Learning objectives:

- To learn the use of camera lucida.
- To learn the tissue collection, fixation and block making.
- To learn the preparation of permanent histological slides of tissues.
- To understand the hematological tools and techniques.
- To learn the preparation of blood smear.
- To understand the working principle and applications of colorimeter and spectrophotometer.
- To study the separation of biomolecules by ascending paper chromatography.
- To understand the use of online tools to search biological information/literature.
- To familiarize students with the basic facts of mammalian physiology and with some of the laboratory techniques and equipment used in the attainment of physiological data.
- To introduce the learners to methods of haemoglobin, blood glucose estimation.
- To explain Measurement of lung capacity.
- To study the laboratory safety and instrument handling techniques.
- To study the problems based on Hardy- Weinberg law of equilibrium.
- To estimate the DNA with Diphenylamine method.
- To detect DNA and RNA with Methyl green pyronine.
- To isolate the DNA from biological sample.
- To build a DNA double helix model.
- To know about techniques of DNA separation.

B. Learning outcomes: After successful completion of this course, students are expected to:

- Understand basic principle of camera lucida.
- Understand basic methods of tissue collection, fixation and block making.
- Ability to use specific laboratory tools and techniques for the preparation of permanent histological slides of tissues.
- Ability to use Hematological tools and techniques (Total and differential count of WBCs manually).
- Understand basic concept of blood smear slide preparation.
- Understand Basic principle and applications of colorimeter and spectrophotometer.

- Understand the separation of biomolecules by ascending paper chromatography.
- Understand the application of online tools for search of biological information/literature.
- Learners will be familiar with various laboratory techniques and equipment used in the attainment of physiological data.
- Students will learn the estimation haemoglobin, blood glucose estimation.
- Learners will be able to measure the lung capacity.
- Students acquire the skill of handling the pH meter and use it to measure pH.
- Students acquire the skill of assessing the enzyme activity.
- Students learn the preparation of standard acid, base and their standardization.
- Students acquire the practical skill of dissecting the dipteran larvae to isolate polytene chromosome and its temporary slide preparation.
- Student will be able to know about laboratory safety methods and skill of instrument handling
- Student will be able to understand the principle of Hardy- Weinberg law.
- Student will learn the method for DNA estimation.
- Student will be able to isolate the genetic material from biological sample.
- Student will be able to understand the principle and working of electrophoresis.



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Paper Code: ZOO 3607

Zoology Practical: VIII

Credits: 02

No. of Practical: 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3607

Subject Title: ZOOLOGY PRACTICAL-VIII

Section- I: Practical based on: ZOO 3601: Biological Techniques (Any 4)

Practical No.	Title of Practical	E/D
1	a) Principle & use of camera lucida. b) Study of micrometer.	E
2	Tissue collection, fixation and Block making.	E
3	Sectioning, staining & mounting. Submission of any three permanent slides from three different organs.	E
4	Principle and applications of colorimeter and spectrophotometer.	D
5	To perform online search on Biological information/Literature	D

Section- II: Practical based on: ZOO 3602: Mammalian Physiology and Endocrinology (Any 4).

Practical No.	Title of Practical	E/D
1	a) Estimation of haemoglobin b) Total and differential count of W.B.Cs.	E
2	To estimate the blood glucose level by GOD-POD method.	E
3	Study of any five disorders caused by endocrine glands with the help of photographs	D
4	Measurement of lung capacity/ Analysis of ECG	E/E

Section- III: Practical based on: ZOO 3603: Genetic and Molecular Biology (Any 4).

Practical No.	Title of Practical	E/D
1	Study of Hardy- Weinberg law with suitable recording of genetic traits	E
2	Temporary preparation of polytene chromosome from suitable material	E
3	Detection of DNA and RNA by Methyl green Pyronine	E
4	Preparation of DNA paper model	E

Paper Code: ZOO 3608

Zoology Practical: IX

Credits: 02

No. of Practical: 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3608

Subject Title: ZOOLOGY PRACTICAL-IX

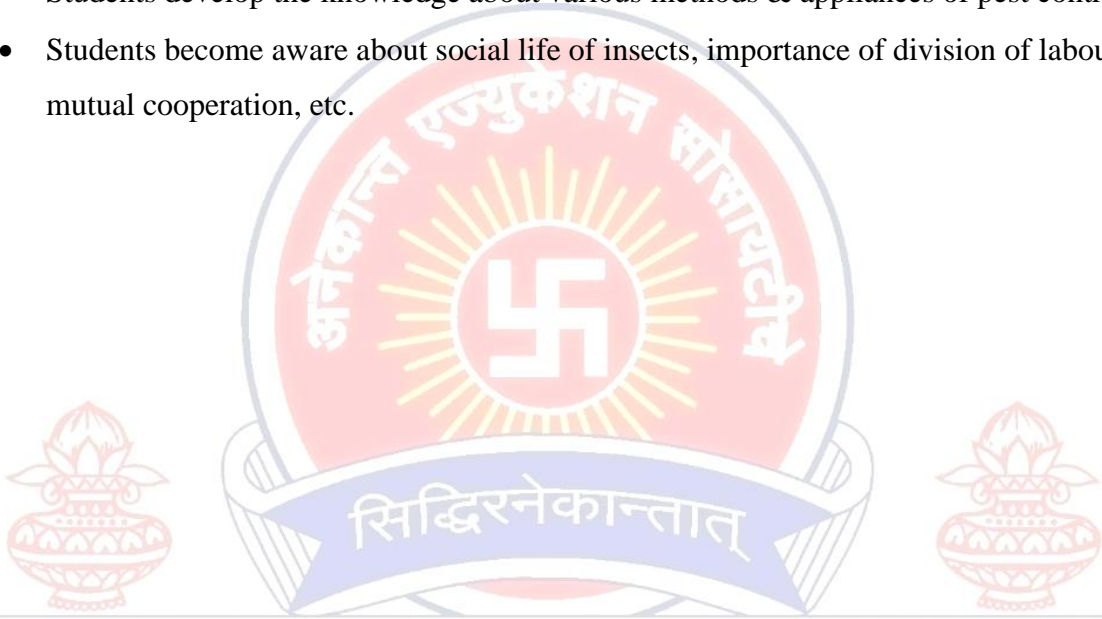
A. Learning objectives:

- To understand the differences between the morphological characters of man and ape
- To study various fossils and their evolutionary significance.
- To study the adaptations in animals suitable for their habitats.
- To study the evidences of evolution.
- To understand the evolution of man.
- To study the Zoo-geographical distribution of animals.
- To understand phylogenetic tree construction and analysis.
- To introduce the learners to the basics of embryology with reference to chick as a model.
- To make the students aware about the mechanisms related to embryonic development in *Amphioxus*, frog and hen.
- To introduce the learners to Ex- ovo culture of chick embryo.
- To enable the students to identify the pests of veterinary, medical importance.
- To enable the students to develop laboratory skills like dissection of insects and preparation of temporary/permanent slides of insect appendages.
- To acquaint the students about various appliances of pest control.
- To acquaint the students about social life of insects.

B. Learning outcomes: After successful completion of this course,

- Students will understand the adaptive radiation and how man has evolved from ape.
- Students will get to know various kinds of fossils.
- Students will understand the important characteristics and adaptations in animals.
- Students will understand that present day organisms are the result of organic evolution.
- Students will study the characteristic features and geographical distribution of human ancestors.
- Students will get to know the distribution of animals according to the ecological conditions and adaptations.

- Students will be able to design phylogenetic tree by morphological characteristics of organisms.
- Students will the learners to the basics of embryology with reference to chick as a model.
- Students will learn technique related to Ex-ovo culture of chick embryo.
- Students will be able to understand difference between embryonic development of *Amphioxus*, frog, hen.
- Students may develop the ability to identify the insect pests.
- Students will develop the laboratory skills of insect dissection, slide preparation, etc.
- Students develop the knowledge about various methods & appliances of pest control.
- Students become aware about social life of insects, importance of division of labour, mutual cooperation, etc.



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Paper Code: ZOO 3608

Zoology Practical: IX

Credits: 02

No. of Practical: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3608

Subject Title: ZOOLOGY PRACTICAL-IX

Section- I: Practical based on: ZOO 3604: Organic Evolution (Any 4).

Practical No.	Title of Practical	E/D
1	Study of morphological similarities and differences between man and ape.	D
2	Study of types of fossils with the help of specimens/ charts/ photos.	D
3	Study of animal adaptations in: Turtle, <i>Draco</i> , <i>Exocoetus</i> , Bat and Parrot.	D
4	Study of evidences of evolution- embryological, paleontological, connecting links, morphology and comparative anatomy.	D
5	Study of successive stages of evolution of man: a) Australopithecus b) <i>Homo erectus</i> c) <i>Homo neanderthalis</i> d) Cro-magnon man e) <i>Homo sapiens</i> .	D
6	To record Zoogeographical distribution of animals to respective zoogeographical realms on the world map (Lung fishes, marsupials, flightless birds, Camel, Elephant, Ostrich etc.)	E
7	Construction of phylogenetic tree from morphological characteristics.	E

Section- II: Practical based on: ZOO 3605: General Embryology (Any 4).

Practical No.	Title of Practical	E/D
1	Study of sperm smear (any one animal), types of eggs (insect, <i>Amphioxus</i> , frog and hen).	D
2	To study the types of blastulae & gastrulae (<i>Amphioxus</i> , frog & hen).	D
3	Study of whole mount slides of chick embryology – 24h, 33hr and 48 hr.	D
4	Study of T. S. and V. S. of chick embryo of Brain & Heart with the help of slide / Photograph / chart / Model – 24 hrs., 33 hrs. & 48 hrs.	D
5	Ex-ovo culture of chick embryo.	E
6	Temporary preparation of chick embryo.	E
7	Effect of teratogen on chick embryo.	D

Section- III: Practical based on: ZOO 3606 (A): Medical Entomology (Any 4).

Practical No.	Title of Practical	E/D
1	Study of Identification & nature of damage: Veterinary Pests (Any two)	D
2	Study of Identification & nature of damage (Human Pests) (Any two)	D
3	Temporary preparation of: Antenna, Mouthparts of Mosquito	E
4	Temporary preparation of: Haltere, Legs of Mosquito	E
5	Study of Pest control Methods: (biological control measures, repellants, fumigation, dusting, netting).	D
6	Study of Social Insects: Termite.	D

OR

Section- III: Practical based on: ZOO 3606 (B): Public Health and Hygiene (Any 4).

Practical No.	Title of Practical	E/D
1	To detect adulterants in the food samples by appropriate tests.	E
2	To study the food preservation methods.	E
3	Study of housefly, cockroach, ants and rats with reference to public health and hygiene.	D
4	A compulsory visit to water purification / sewage treatment /effluent treatment plant.	D
5	Testing potability of water for human consumption by MPN method.	E
6	Any suitable example of measurement of dispersion (Mean deviation or Standard deviation).	E

Paper Code: ZOO 3609

Minor Research Project: X

Credits: 02

No. of Practical: Any 10

Evaluation Pattern: 40 (Internal Assessment) + 60 (External Assessment)

Subject Code: ZOO 3609

Subject Title: Minor Research Project

A) Learning Objectives:

1. To encourage the students to collect information of research work.
2. To make them understand the importance of research work in sustenance of environment.
3. To encourage the students to develop the habit of critical thinking.
4. To create awareness about innovative methods in research.
5. To inculcate the habit of finding the conclusions through critical thinking & research.
6. Apply foundational research skills to address a research problem.
7. To develop the habit of planning & time management.
8. To develop the leadership skills.
9. To develop the skill of collaborative work.

B) Learning Outcome:

1. Student surveys & collects information of research work.
2. Students understand the importance of research work in sustenance of environment.
3. Students develop the habit of critical thinking.
4. Students become aware about innovative methods in research.
5. Students become able to come to objective conclusions through critical thinking & research.
6. Students can apply foundational research skills to address a research problem.
7. Students develop the habit of planning & time management.
8. Students acquire the leadership skills.
9. Students acquire the skill of collaborative work.

Research Project: Projects will be allotted to students based on theory papers of Semester – V & VI.

The project course would involve:

1. Training to students in:

- a) Literature survey,
 - b) Planning and execution of experimental work,
 - c) Analysis of data and its presentation.
- Project will start at sixth semester and will be assessed at the end of sixth semester.
 - The experimentation work / surveys for the project work will be equivalent to minimum 10 practicals in the semester.

Evaluation

[A] Pattern of Examination: Evaluation of Students:

- 1) The Internal and External examinations will be of 40 & 60 marks respectively.
- 2) If necessary, there shall be revaluation of answer script of end semester examination (external examination), but not of internal assessment papers.

Internal Examination: Internal assessment for each course would be continuous and dates for each tutorials/practical tests etc. will be pre-notified in the time table for teaching or placed separately as a part of time-table.

Department / College Internal Assessment Committee will coordinate this activity.

A) Theory Courses:

Students should be encouraged to participate in various academic activities.

Teacher must select a variety of the procedures for conducting internal assessment suggested as follows:

- a) Multiple choice questions
- b) Combination of objective and subjective questions.
- c) Open book test (concerned teacher will decide the allowed books)
- d) Tutorial
- e) Surprise test on specified topics in a given notified period
- f) Oral
- g) Assignments
- h) Review of research paper
- i) Seminar presentation
- j) Journal/Lecture/Library notes

B) Practical Courses:

It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following:

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Assessment on practical course be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly in the form of viva, sketching, identification abilities, etc.

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