Deccan Education Society's

FERGUSSON COLLEGE, PUNE

(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

THIRD YEAR B.Sc. (Zoology)

SEMESTER - V

SYLLABUS FOR T.Y. B.Sc. Zoology

Academic Year 2018-2019

Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004
Scheme of Course Structure (Faculty of Science)
2018-2019
T. Y. B. Sc. - Zoology

Sem.	Paper Code	Paper Title	Paper No.	No. of Credits	Exam (I / E)	Marks (50/ 50)
V	ZOO3501	Life & Diversity of Animals- V	Paper - I	03	I & E	50+50
	ZOO3502	Fundamentals of Histology	Paper - II	03	I & E	50+50
	ZOO3503	Bio-Chemistry	Paper - III	03	I & E	50+50
	ZOO3504	Ecology and Environmental Biology	Paper - IV	03	I & E	50+50
	ZOO3505	Animal Pathology.	Paper - V (A)	03	I & E	50+50
		OR				
	ZOO3506	Insect Pest Management	Paper - V(B)	03	I & E	50+50
	ZOO3507	General Endocrinology	Paper - VI (A)	03	I & E	50+50
		OR				50+50
	ZOO3508	Forensic Entomology	Paper -VI(B)	03	I & E	50+50
	ZOO3511	Zoology Practicals- I	Practical - I	02	I & E	50+50
	ZOO3512	Zoology Practicals- II	Practical - II	02	I & E	50+50
	ZOO3513	Zoology Practicals- III	Practical - III	02	I & E	50+50
VI	ZOO3601	Life and Diversity of Animals - VI	Paper - I	03	I & E	50+50
	ZOO3602	Physiology: Life Sustaining Processes	Paper - II	03	I & E	50+50
	ZOO3603	Molecular Biology	Paper - III	03	I & E	50+50
	ZOO3604	Organic Evolution	Paper - IV	03	I & E	50+50
	ZOO3605	Immunology	Paper - V(A)	03	I & E	50+50
		OR				
	ZOO3606	Human Genetics	Paper - V(B)	03	I & E	50+50
	ZOO3607	Biological Techniques & Bioinformatics	Paper - VI(A)	03	I & E	50+50
		OR				
	ZOO3608	Poultry Science	Paper - VI(B)	03	I & E	50+50
	ZOO3611	Zoology Practicals - IV	Practical - IV	02	I & E	50+50
	ZOO3612	Zoology Practicals - V	Practical - V	02	I & E	50+50
	ZOO3613	Zoology Practicals - VI	Practical - VI	02	I & E	50+50

T.Y.B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PAPER - I
Title: Life and Diversity of Animals - V
PAPER CODE: ZOO3501

[Credits - 3]

Learning Objectives:

1. To learn basic characteristics of invertebrates.
2. To learn about evolution and development of system and animals.
3. To make the students aware about conservation and sustainable use of biodiversity.
4. To emphasise on the habitat diversity of animals.

	Title and Contents	No. of Lectures
Unit - I	**1. Study of *Pila globosa* with reference to the following:** 1.1 Systematic position, habit and habitat and external characters. 1.2 Body wall and pallial complex. 1.3 Functional Anatomy - Digestive, Respiratory, Circulatory, Excretory, Reproductive, Nervous system and Sense organs.	15
Unit - II	**1. Study of the minor and major phyla with reference to:** 1.1 Protozoa: locomotion, nutrition and reproduction; general features of Paramecium. 1.2 Porifera: canal system and skeleton. 1.3 Coelenterata:-polymorphism, corals and coral formation. 1.4 Helminthes: Parasitism and Parasitic adaptation of helminthes. Regeneration in planaria 1.5 Annelida: Metamerism 1.6 Mollusca: Torsion and detorsion in Gastropoda. 1.7 Rotifera: General characters, classification and affinities with Arthropoda, Platyhelminths and Trochophore larva. 1.8 Hemichordata: Affinities of hemichordate with different group of Animal.	30

References:

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. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.

6. Phylum series from Protozoa to Echinodermata - R. L. Kotpal. Rastogi Publ., Meerut.
7. Modern text book of Zoology, Invertebrates 10th Edn., 2009, R. L. Kotpal, Rastogi publ., Meerut.
8. Invertebrates Structure and Function, 2nd Edn.1979, EJW Barrington, John Wiley and Sons Inc.
9. Invertebrates Zoology, 1994, 6th Edition, Ruppert, E. Edward, R. D. Barnes; Saunders College Publishing, USA.
10. Invertebrate Zoology, 1991, P. A. Meglitsch and F. R. Schram, Oxford University Press; New York.
11. Invertebrate: A New synthesis, 1988, R.S.K. Barnes, P. Calow and P. J. W., Olive Blackwell Scientific, U.K.
12. An Introduction to Protochordata, 1990, H. S. Bhamrah and Kavita Juneja, Anmol Publication, New Delhi.
13. The Invertebrates: Protozoa through Ctenophora Vol. I, 1959, Hyman, Libbie Henrietta, McGraw-Hill Book Co., Inc. New York.
14. A text book of Zoology, Vol. II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi.
15. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.

T.Y.B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PAPER - II
Title: Fundamentals of Histology
PAPER CODE: ZOO3502

[Credits - 3]

Learning Objectives:

1. To make students understand the microscopic structures of various tissues and organs of the body.
2. To inculcate interest and foundation of histological organization of body parts for further studies in life sciences.
3. To develop laboratory skills in the students regarding histological techniques which will be helpful to them in research work in the future.

	Title and Contents	No. of Lectures
Unit - I	1. **Tissues and Glands, Integumentary system and Alimentary canal.** 1.1 Definition and types of tissues: Epithelial, Connective, Muscular, Nervous and types of glands. 1.2 Histology of Skin, Epidermal derivatives: nails, hair, Structure and modifications of cutaneous glands: sweat gland, sebaceous gland, mammary glands. 1.3 Histology of tooth and tongue, types of papillae, structure of taste buds. Basic histological organization of alimentary canal, microscopic structure of oesophagus, stomach, small intestine (duodenum and ileum) and large intestine (rectum).	15
Unit - II	**1. Mammalian Respiratory organs, Blood vessels, Excretory organs and Reproductive organs.** 1.1 Histology of Trachea and Lung. 1.2 Histological structure of artery, vein and capillaries. 1.3 Histology of mammalian kidney, ureter and urinary bladder. 1.4 Histology of mammalian testes, mature spermatozoa, histology of mammalian ovary and ovarian follicles.	15
Unit - III	**1. Endocrine and Exocrine glands:** Embryological origin, histological structure, blood supply of Pituitary, Adrenal, Thyroid, Salivary gland, Liver and Pancreas.	15

References:

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. Essential Histology, 2001, 2nd Edition, David H. Cormack, Lippincott Williams &

Wilkins, Philadelphia.
3. A text book of Histology, 2014, 5thedn. Krishna Garg, Indira Bahl & Mohini Kaul CBS Publication & Distributors, Delhi.
4. Histology, 1977, 4th Edn. R. O. Greep and L. Weiss, McGraw Hill Int. Book Co. New York.
5. Hand book of Basic Mictotechnique, 1964, 3rd Edn. Peter Gray, McGraw Hill Book Co. New York.
6. Bailey's Textbook of Histology - Williams and Wilkins Baltmore and Scientific Book Agency, Culcutta Copenhaver W. M.
7. Text book of Histology - Bloom W. and Fawcett D. W.
8. Histology - Lippinocott, Han A. W.
9. Human Histology - Leslie Brainerd Arey (Khosla Pub. House, Delhi)

T.Y. B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PAPER - III
Title: Bio-Chemistry
PAPER CODE: ZOO3503

[Credits - 3]

Learning Objectives:

1. To study and understand biochemical concepts; basic reactions and the structural details of bio-molecules.
2. To make the students aware of applications of Bio-Chemistry.
3. To provide knowledge about biomolecules related to biological systems.

	Title and Contents	No. of Lectures
Unit - I	**1. Basic Bio-Chemistry:** 1.1 Bonds - Types: Ionic, covalent, non-covalent bonds (hydrogen, hydrophobic, electrostatic, Van der Waal forces) and their relevance in bio molecules. 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.	08
Unit - II	**1. Carbohydrates:** 1.1 Definition and classification of carbohydrates. 1.2 Properties of carbohydrates-stereoisomerism - Enantiomeres, anomers, epimerism, mutarotation, racemisation. 1.3 Detection techniques for carbohydrates. 1.4 Biological significance of carbohydrates.	08
Unit - III	**1. Proteins:** 1.1 Amino acids- structure, properties and classification 1.2 Essential, non essential, non protein amino acids 1.3 Physical properties of amino acids 1.4 Reactions related to R group, COOH group and NH_2 group, titration curves - (reference to Alanine), isoelectric point, Zwitterions 1.5 Determination of N-terminal and C-terminals. 1.6. Types of protein structure (bonds responsible for the structure). 1.7 Biological significance of proteins	09
Unit - IV	**1. Lipids:**	07

	1.1 Introduction and classification 1.2 Fatty acids and triglycerides, soap formation. 1.3 Biological significance of lipids	
Unit - V	**1. Enzymes:** 1.1 Introduction and Classification of enzymes 1.2 Reversible and irreversible enzyme inhibition 1.3 Factors influencing enzyme activity Enzyme kinetics, MM equation and its importance and LB plot. 1.4 Isoenzyme**,** co-enzymes (NAD, NADP, FAD, FMN, Co-A, TTP), cofactors, 1.5 Immobilized enzymes 1.6 Ribozymes.	09
Unit - VI	**1. Vitamins:** 1.1 Introduction, water soluble and fat soluble vitamins (sources, functions and deficiency).	04

References:

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. Zuby G. Wm, C. Brown Communications USA
3. Harper's 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 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, John Willey, New York
9. Principles and techniques of Biochemistry and molecular biology - 2009, 7th Edition, Keith Wilson and John Walker, Cambridge University.
10. Biochemistry- 2012, Seventh International Edition, Jeremy Berg and Tymoczko and Stryer, Freeman and Company, New York
11. Biochemistry - 2011, Fourth International Student Edition, Voet and Voet, JohnWiley and Sons, Inc.

T.Y.B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PAPER - IV
Title: Ecology and Environmental Biology
PAPER CODE: ZOO3504

[Credits - 3]

Learning Objectives:

1. Learning the theory of ecology is very crucial, because a simple change in the environment can cause a great effect on all living things.
2. The larger objective of ecology is to understand the nature of environmental influences on individual organisms, their populations and communities and ultimately at the level of the biosphere.
3. The study of ecology will also provide knowledge about how the organisms are distributed and their abundance in the environment, the interaction between organisms and their environment, and the structure and function of ecosystems.
4. If the students studying ecology can achieve an understanding of these relationships, they will be well placed to contribute to the development of systems by which humans could sustainably use and maintain ecological resources judiciously. A better understanding of ecological systems can help society to know the consequences of human activity on the environment.

	Title and Contents	No. of Lectures
Unit - I	**1. Environmental Biology** 1.1 Introduction 1.2 Definition, basic concepts and scope. 1.3 Introduction to biodiversity.	2
Unit - II	**1. Ecosystem structure and function** 1.1 Concept and definition of ecosystem - structure and function; Abiotic components - temperature relations, water relations, light, humidity and precipitation (rainfall) Biotic components - relationship among organisms Positive interactions Negative interactions. 1.2 Major Ecosystems Natural ecosystem (one example) Artificial ecosystem (one example) 1.3 Ecological pyramids. 1.4 Food chain in ecosystem and food web. 1.5 Energy flow in ecosystem and flow models.	10
Unit - III	**1. Habitat Ecology** 1.1 Aquatic ecology - Habitat conditions. - Ecological classification of organisms. 1.2 Terrestrial ecology - Environmental conditions. 1.3 Desert ecology - The great Indian desert (Thar desert)	04
Unit - IV	**1. Environmental Pollution:**	10

	1.1 Definition and its types. 1.2 Introduction to different environmental pollutants. 1.3 Air pollution: Definition Kinds of pollutants Different sources of air pollutants 1.4 Air pollution and its relation with the following: Acid rain Green house effect Ozone layer 1.5 Water pollution: Definition Different sources of water pollutants Effect of pollution on aquatic ecosystem 1.6 Noise pollution: Definition Different sources of noise pollutants Effects and control	
Unit - V	**1. Environmental Assessment / Monitoring and Impact:** 1.1 Bioindicators and environmental monitoring. 1.2 Efforts for meeting environmental challenges.	3
Unit - VI	**1. Population structure and dynamics:** 1.1 Basic concept 1.2 Population characteristics	4
Unit - VII	**1. Natural Resources and Conservation:** 1.1 Renewable and non-renewable resources 1.2 Forest conservation 1.3 Energy sources: conventional and non-conventional	3
Unit-VIII	**1. Wildlife Management:** 1.1 Definition, causes of wildlife depletion 1.2 Importance of wildlife, management in India 1.3 Endangered species, rare species, threatened species. 1.4 Wild life conservation	5
Unit - IX	**1. Remote sensing for sustainable development:** 1.1 Introduction to remote sensing 1.2 Introduction to geographic information system	4

References:

1. Ecology and Environment, P. D. Sharma, Rastogi Publ. Meerut.
2. Environmental Biology, 1996, P. S. Sharma and V. K. Agrawal, S. Chand and Co.New Delhi.
3. Ecology, 1995 Mohan P. Arora Himalaya Publ. House Delhi.
4. Fundamentals of ecology, 1993 M. C. Dash, Tata Mcgrew Hill, New Delhi.
5. Elements of ecology, George L. Clarke, John Wiley and Sons, New York.
6. Ecology of Natural resources, 1995 John Wiley and Sons, New York.
7. Concepts of Ecology, 1996, E. J. Koprmondy, Pentice Hall of India, New Delhi.
8. Modern Concepts of Ecology, H. D. Kumar, Vikas Pub. House, New Delhi.
9. Ecology, E. P. Odum, Oxford & IBM Pub. Co., New Delhi.
10. Environmental Problems and Solution, D. K. Asthana, Meera Asthana, S. Chand Pub. Ramnagar, New Delhi.
11. Toxicology by P. D. Sharma, Rastogi Pub., Meerut.

12. R. Kumar, Pollution and Health Hazards in India. Ashish Pub. House, 8 / 81, Panjab Bag, New Delhi - 110026.
13. M. A. Subramanian, Toxicology - Principals and Methods, M. J. Publishers, Chennai.
14. M. Satake, Y. Mide, Environmental Toxicology, M. S. Sethi, S. A. Iqbal Discovery Pub. House, New Delhi.
15. E. J. Ariece, Simonis, Introduction to General Toxicology, Academic Press, London.
16. The Science of Ecology by Richard Brewer, Hardcover: 816 pages, Publisher: Brooks Cole.
17. Elements of Ecology (5^{th} Edition) by Robert L. Smith, Thomas M. Smith, Graham C. Hickman, Susan M. Hickman, Paperback: 682 pages, Publisher: Benjamin - Cummings.
18. APHA. 'Standard Methods for Examination of Water and Wastewater', American Public Health Association WWA, Washington, D. C. 2005.
19. Practical Methods in Ecology by Peter A. Henderson published in 2009.

T.Y.B.Sc. (ZOOLOGY) Semester-V
ZOOLOGY PAPER - V(A)
Title: Animal Pathology
PAPER CODE: ZOO3505

[Credits - 3]

Learning Objectives:

1. To introduce students with common communicable and non communicable diseases in fish, poultry, cow and humans.
2. To introduce students with clinical pathology, circulatory disturbances and common pathological processes like degeneration, necrosis and gangrene, mineral metabolism and pigmentation.
3. To impart practical knowledge about clinical tests for urine and gastric juice, and also about identification of common diseases of fish, poultry, cow and humans.

	Title and Contents	No. of Lectures
Unit - I	**1. Common diseases of animals:** 1.1 Introduction of Pathology: scope and branches 2. Diseases of animals 2.1 Diseases of fishes (Dropsy, Fin rot, Argularis, Anchor worm) 2.2 Diseases of fowls.(Fowl pox, Newcastle disease, Avian influenza, Mereks disease) 2.3 Diseases of cattle's (Anthrax, Foot and mouth disease, Mastitis, Milk fever)	11
Unit - II	**1. Human diseases:** 1.1 Communicable diseases in humans. 1.2 Pathogen, aetiology, pathogenesis of - Hepatitis, Tuberculosis, AIDS. 2. Zonotic diseases: 2.1 Bacterial disease - Leptospirosis 2.2 Fungal disease - Histoplasmosis 2.3 Viral disease - Rabies 2.4 Protozoan disease- Toxoplasmosis	10
Unit - III	**1. Common pathological processes:** 1.1 Retrogressive changes: 1.2 Cloudy swelling, 1.3 Degeneration - fatty degeneration, mucoid degeneration and amyloid degeneration 2. Necrosis: 2.1 Nuclear and cytoplasm changes 2.2 Types of necrosis 3. Gangrene: 3.1 Definition and causes 3.2 Types of gangrene - dry, moist and gas gangrene	11
Unit - IV	**1. Pathological disturbances and disorders:** 1.1 Circulatory disturbances Hyperaemia: active and passive (causes and effects) Ischaemia: causes and effects Haemorrhage: causes, effects and hemorrhagic	13

	effects Thrombosis: thrombus formation, its causes and effects Embolism: Definition, sources, types and effects **2. Disorders of pigmentations:** Causes and effects of pigmentation, melanises **3. Disorders of mineral metabolism:** Mechanism of calcification, pathological calcification (dystrophic and metastatic) Causes and its effects. Gout aetiology and pathogenesis.	

References:

1. A text book of Pathology, 2009, 15th Rev Edn., Dey N. C. and Dey T. K. Sinha Debashish, New central book agency, Kolkata.
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 Haematology & 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
7. Wiley: Diseases of poultry, 13th edition - David E. Swayne.
8. Pathological basis of veterinary diseases, 5th edition, Editor - James Zachary Mc Gavin.
9. Wiley: Fish diseases - diagnosis and treatment, Edward James, 2nd edition.

OR

T.Y. B.Sc. (ZOOLOGY) SEMESTER V
ZOOLOGY PAPER - V(B)
TITLE: INSECT PEST MANAGEMENT
PAPER CODE: ZOO3506

[CREDITS - 3]

Learning Objectives:

1. Know basic taxonomy of insects which will help in identification of major insect pests.
2. Understand basic morphology of mouth parts and larval phases.
3. Understand the classification, formulation of insecticides and their use.
4. Harmful effects of chemical control and effective use of IPM.

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Insect Pest** Introduction and definition of insect pest A brief outline of classification of insects up to orders Food and feeding Types of mouthparts in insect Types of life cycles in insects Types of larvae in insects	10
Unit - II	**Insect Pests** Insect pest of cereals and pulces – **(**Nature of damage,diagnostic features, life history and control measures) Insect pests of vegetables – **(**Nature of damage,diagnostic features, life history and control measures) Insect pests of stored grains – **(**Nature of damage,diagnostic features, life history and control measures) Insect pests of fruit plants – **(**Nature of damage,diagnostic features, life history and control measures)	12
Unit - III	**Control Measures of Insect Pests** Classification of insecticides on the basis of their chemical nature, mode of entry and mode of action. Formulations of insecticides Applications of power and hand operated pest control equipments	12
Unit - IV	**Integrated Pest Management** History and Introduction of IPM Principles of IPM Applications of IPM in Pest Management Methods of IPM Process of IPM IPM practices in India	14

References:

1. Insect Biology - A Textbook of Entomology, H. E. Evans, 1984. (Addison-Wesley Publ. Co.).
2. General Entomology, M. S. Mani, 1982, (Oxford & IBH Publ. Co.)
3. Insects, M. S. Mani, 1995. (National Book Trust, India).
4. Destructive and Useful Insects, C. L., Metcalf & W. P. Flint, 1962. (Tata McGraw-Hill Publ. Co. Ltd.)
5. Agricultural Pests of India and South-East Asia by A. S. Atwal.

6. Taxonomy - A Text and Reference Book by Kapoor V. C., 1983, John Wiley & Sons, New York.
7. Theory and Practice in Animal Taxonomy by Blackwelder R. E., 1967, Oxford & IBH, New Delhi.
8. Chattopadhyay S. B., 1985, Principles and Procedures of Plant Protection, Oxford & IBH, New Delhi.
9. Gupta H. C., 1999, Insecticides: Toxicology and Uses, Agrotech Publ., Udaipur.
10. Integrated Pest Management - Concepts and Approaches, Dhaliwal G. S. & Arora R., 2003, Kalyani Publ., New Delhi, Dhaliwal G. S., Singh R. & Chillar B. S., 2006.
11. Essentials of Agricultural Entomology, Kalyani Publications, New Delhi.

T.Y. B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PAPER - VI (A)
Title: General Endocrinology
PAPER CODE: ZOO3507

[Credits - 3]

Learning Objectives:

1. To learn basics of organization of various endocrine glands.
2. Overview of structure and functions of endocrine glands with special reference to mammals and human beings.
3. To learn disorders of endocrine glands and their effects on overall functioning.
4. To learn basics of Assisted Reproductive technologies

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Endocrinology, Brief History and Scope** **Endocrine glands and hormones:** Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Thymus, Pancreas, Adrenal, Ovaries and Testes	04
Unit - II	**1. General characteristics of Hormones and Classes of Hormones:** (Location, Structure and Function, Hypoactivity and Hyperactivity of following glands) Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Thymus, Pancreas, Adrenal, Ovaries and Testes **2. Hormones of Adenohypophysis and Neurohypophysis:** Growth Hormone, Prolactin, Thyrotropin (TSH), AdenoCorticotropin Hormone (ACTH), Leutinizing Hormone (LH), Follicle Stimulating Hormone (TSH) **3. Types of Hormone Receptors and the Mechanisms of Action of Hormones and Feedback mechanism:** (Plasma membrane mediated actions as well as intracellular cAMP mediated actions)	15
Unit - III	**Endocrine regulation of metabolism**	05
Unit - IV	**Osmoregulatory Hormones:** ADH, Mineralocortocoids and renin- angiotensin mechanism.	04
Unit - V	**Neuroendocrine System:** Neurohormones: nature and mechanism of action; brief account of Neurotransmitters Growth Hormone releasing hormone, Somatostatin, Gonadotropin releasing hormone, Dopamine, Neurotensin, Oxytocin and Vasopressin	05
Unit - VI	**1. Hormonal Dysfunctions / Disorders:** **(with reference to glands)** 1.1 Insulin (Diabetes mellitus) 1.2 Hypothyroidism and Hyperthyroidism 1.3 Gigantism 1.4 Acromegaly 1.5 Dwarfism 1.6 Exopthalmic goitre	08

Unit - VII	**Osmoregulatory Hormones:** ADH, Mineralocortocoids and renin-angiotensin mechanism.	04
Unit -VIII	**Assisted reproductive technologies**: A brief account of Human Contraception and Human Reproductive Technologies.	03

References:

1. Bentley, P. J. (1998). Comparative Vertebrate Endocrinology, edn.3, Cambridge University Press, London.
2. Bollander, F. (1994). Molecular Endocrinology, edn. 2, Acad. Press, San Diego.
3. Hadely, M. E. (1996). Endocrinology. Edn. 4, Prentice Hall, Upper Saddle Park.
4. Hoar, W. S. and Hickman, C.P., Jr. (1983). A laboratory companion for general and comparative physiology. Edn. 3, Prentice - Hall, Englewood Cliffs, N. J., USA.
5. Sastry K. V. Endocrinology and Reproductive Biology, Rastogi Publications
6. Brown R. An Introduction to Neuroendocrinology, Cambridge University Press.
7. Hadley M.E. and Jon Levine. Endocrinology, 6th Edition, Pearson Publications.

OR

T.Y. B.Sc. (ZOOLOGY) SEMESTER - V
ZOOLOGY PAPER - VI (B)
TITLE: FORENSIC ENTOMOLOGY
PAPER CODE: ZOO3508

[CREDITS - 3]

Learning Objectives:

1. To introduce forensic entomology to students of Zoology.
2. To learn different insect groups, which are important in Forensic Science.
3. To learn basic tools and techniques used in Forensic Entomology.

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction to Forensic Science** Definition, Scope, History and Development of Forensic Science, Concept of Forensic Entomology, Scope and Medico legal aspects of Forensic Entomology What is Death? Somatic and Molecular Death, Brain Death and it's medico legal aspects	08
Unit - II	**Determination of Post-Mortem Interval** Rigor Mortis and conditions stimulating Rigor Mortis, Post-Mortem damage by predators, use of insects in determination of Post-Mortem interval	06
Unit - III	**Insects of Forensic Importance** Life Cycle patterns of Calliphoridae and Sarcophillidae insects (Any 2 examples each) Use of insects in determination in displacement of body, detection of poisoning cases by use of insects.	08
Unit - IV	**Role of Aquatic Insects in Forensic Investigation** Introduction, Decomposition in Aquatic Ecosystems Freshwater Ecosystems: First Stage - Submerged Fresh, Second Stage - Early Floating, Third Stage - Floating Decay, Fourth Stage - Bloated Deterioration, Fifth Stage - Floating Remains, Sixth Stage - Sunken Remains. Marine Ecosystems	08
Unit - V	**Crime Scene Investigation** Observations, Reporting of crime scene, analysis of data obtained at crime scene and its relevance with temperature, use of data for post-mortem interval determination.	05
Unit - VI	**Forensic DNA Typing** Introduction and brief review of Forensic DNA Typing Techniques used in DNA Typing Satellite DNA, Randomly amplified Polymorphic DNA, Mitochondrial DNA and Applications of Forensic Entomology	05
Unit - VII	**Case Study** Some crime cases solved by using Forensic Entomology: Any 2 cases from Aquatic Ecosystem Any 2 cases from Terrestrial Ecosystem	05

References:

1. Forensic Entomology edited by Jayson Byrd and James Castner.
2. Crime Scene Intelligence, an experiment in Forensic Entomology by Albert Cruz.
3. Handbook of Forensic Science, US Department of Justice, Federal Bureau of Investigation.
4. Text Book of Forensic Medicine and Toxicology: Principles and Practice by Krishnan Vij.
5. DNA in Forensic Science: Theory, Techniques and Applications (1st edition), by James Robertson.
6. DNA evidence and Forensic Science by David Newton.
7. Forensic Science: Modern Methods of solving Crime by Max M. Houck.
8. Forensic Art and Illustration by Karen T. Taylor.

T.Y. B.Sc. (ZOOLOGY) Semester- V
ZOOLOGY PRACTICAL - I
(Life and Diversity of Animals - V and Fundamentals of Histology)
PAPER CODE: ZOO3511

D* = Demonstration, E = Experimental **[Credits - 3]**

Practical No.	Title and Contents
1.	Preparation of culture of paramecium (E)
2.	a. Observation of binnary fission and conjugation in Paramecium b. Study of cyclosis and trichocyst in Paramecium (E)
3.	Study of spicule in sponges (D)
4.	Study of Parmenant slides of Planaria and any five Helminthes parasites (*Fasciola, Schistosoma,Taenia*, *Ascaris* and *Wuchereria*). (D)
5.	Study of Rotifers from fresh water. (E)
6.	Observation of Balanoglossus and slides of T. S. of Balanoglossus passing through proboscis, collar and trunk. (D)
7.	Study of external characters and digestive system of *Pila.** (D)
8.	Study of Nervous system of *Pila.** (D)
9.	Study of radula, osphradium and statocyst of *Pila.** (D)
10.	Study of permanent slides of epithelial tissues, connective tissue, muscular tissue and neuron. (D)
11.	Preparation of temporary mount from preserved Rodents: Striated muscle fibres and medullated nerve fibre. (E)
12.	Observations of permanent histological slides of mammalian tooth, tongue, oesophagus, stomach, duodenum, ileum, trachea, lung, kidney. (D)
13.	Observations of permanent histological slides of pituitary gland, thyroid gland, adrenal gland, salivary gland, liver, pancreas, testis, ovary. (D)
14.	Preparation of different fixatives for preservation of tissues. (D)
15.	Study of collection and preservation of tissues and block making. (E)
16.	Sectioning and staining of tissues for preparation of permanent slides. (E)
17.	Any other practical suggested by concerned teacher based on syllabus.

Notes:

1. No live animals will be used for practical as per ethical guidelines.
2. Any ten practicals to be conducted.
3. * - with the help of images / charts.

T.Y. B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PRACTICAL - II
(Bio-Chemistry, Ecology and Environmental Biology)
PAPER CODE: ZOO3512

D* = Demonstration, E* = Experiment **[Credits - 3]**

Learning Objectives:

1. To learn the principals of basic instrumentation and techniques used in biochemistry.
2. To study techniques and methods related to, identification, isolation and estimation of biomolecules.
3. Will be taking method based approach rather than only a taxonomic approach to study population measures, biodiversity measures, species richness etc.

Practical No.	Title and Contents
1.	Study of principle and working of pH meter. (D)
2.	Study the effect of pH, temperature and inhibition etc on urea-urease reaction. (E)
3.	Identification of carbohydrates (monosaccharide, disaccharides and polysaccharides) with the help of suitable tests. (E)
4.	Isolation of Casein by isoelectric precipitation. (E)
5.	Protein estimation by Bradford method. (E)
6.	Isolation of starch from potato (Microscopic examination of starch) and action of salivary amylase on it. (E)
7.	Study of biotic and abiotic components of any simple ecosystem (natural or human modified ecosystem). (D)
8.	Study of the life table and fecundity table, plotting of the three types of survivorship curves from the hypothetical data. (E)
9.	Study of physico chemical properties of soil sample. (E)
10.	Estimation of free CO_2 in water. (E)
11.	Study any two endangered, threatened and rare species. (D)
12.	Principle of GPS (Global Positioning System). (D)
13.	Study of Red data book. (E)

Notes:

1. No live animals will be used for practical as per ethical guidelines.
2. Any ten practicals to be conducted.
3. * - with the help of images / charts.

T.Y. B.Sc. (ZOOLOGY) Semester - V
ZOOLOGY PRACTICAL - III
(Animal Pathology and General Endocrinology)
PAPER CODE: ZOO3513

D* = Demonstration, E = Experimental **[Credits - 3]**

Practical No.	Title and Contents
1.	Study of following pathogens: (D) a) *Mycobacterium tuberculae*. b) *Pneumococcus* spp. c) *Plasmodium* spp.. d) *Entamoeba* spp.
2.	Study of following diseases: (D) a) Dropsy. b) Fin rot. c) Avian influenza. d) Fowl pox. e) Anthrax. f) Mastitis.
3.	Study of following pathological slides / specimens: (D) a) Fatty degeneration (Fatty liver) b) Cloudy degeneration / Swelling c) Dying cell - necrosis d) Lung lobar pneumonia e) Lung tuberculosis.
4.	Study of following pathological slides / specimens: (D) a) Nutmeg liver b) Organized thrombus c) Breast Cancer d) Spleen infarct. e) Liver cirrhosis
5.	Detection of the normal and abnormal constituents of urine (E)
6.	Study of urine sediment (E)
7.	Histology of invertebrate and vertebrate neurosecretory and endocrine structure (D)
8.	Study of estrous cycle in rat by observation of slides. (D)
9.	Study and Demonstration of contraceptive devices (D)
10.	Determination of Acetylcholine esterase (colorimetric estimation) (E)
11.	Study of endocrine disorders: (D) (a) Hypothyroidism and Hyperthyroidism (b) Gigantism (c) Acromegaly (d) Dwarfism (e) Cushing's syndrome
12	Observation of permanent slides (D) Comparative morphology of Ovary Comparative morphology of Testes

Note: Any ten practicals to be conducted.

OR

T. Y. B.Sc. (ZOOLOGY) Semester -V **ZOOLOGY PRACTICAL - III** **(Insect Pest Management and Forensic Entomology)** **PAPER CODE: ZOO3513** **D* = Demonstration, E = Experimental**	**[Credits - 3]**
Practical No.	**Title of the practical**
1.	Study of morphological features of household insect pests - cockroach, mosquito, flea and bedbugs (D)
2.	Study of different types of insect control appliances. (Any four) (D)
3.	Collection, preservation, identification and submission of any five insect pests. (E)
4.	Temporary mounting of mouthparts, legs and wings of any five crop pests. (E)
5.	Study of different types of larvae of insect pest. (D)
6.	Study of life history of important insect pest (Any one stored grain pest, fruit plant pest and vegetable pest. (D)
7.	Temporary mounting of mouth parts of three major insect pests. (E)
8.	Identification of Insects of Forensic importance (D)
9.	Study of Life Cycle Stages of Calliphorids (Any 2 Blow Flies) (D)
10.	Study of Life Cycle Stages of Sarcophilids (Any 2 Flesh Flies) (D)
11.	Culture of Insects from Animal Carcasses (E)
12.	Quantification of DNA by using Biological Samples - Saliva / Blood / Hair / Semen (E)
13.	Determination of time duration of different stages of Calliphorids and Sarcophilids at various temperatures (D)

Note: Any ten practicals to be conducted.

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FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

THIRD YEAR B.Sc. Zoology
SEMESTER - VI

SYLLABUS FOR T.Y. B.Sc. Zoology
Academic Year 2018-2019

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - I
Title: Life and Diversity of Animals - VI
PAPER CODE: ZOO3601

[Credits - 3]

Learning Objectives:

1. To learn basic characteristics of vertebrates.
2. To learn about evolution and development of various system and animals.
3. To make the students aware about conservation and sustainable use of biodiversity.
4. To emphasise on the habitat diversity of animals.

	Title and Contents	No. of Lectures
Unit - I	**1. Study of *Branchiostoma* with reference to following:** 1.1 Systematic position, habit and habitat and external characters. 1.2 Study of Body wall and Coelom. 1.3 Functional Anatomy - Digestive, Circulatory, Excretory, Reproductive, Nervous system and Sense organs.	08
Unit - II	**1. Study of *Calotes* with reference to the following:** 1.1 Systematic position, habit and habitat and external characters. 1.2 Functional Anatomy - Digestive, Circulatory, Excretory, Reproductive, Nervous system and Sense organs.	13
Unit - III	**1. Comparative study of following topics in vertebrates:** 1.1 Evolution of aortic arches. 1.2 Heart: Structure of heart of Shark, Frog, *Calotes*, *Pigeon* & Rat. 1.3 Kidney: Evolution of Archinephros, Pronephros, Mesonephros, Metanephros 1.4 Brain: Morphological variation in the different regions of the brain of Shark, Frog, *Calotes*, *Pigeon* and Rat	07
Unit - IV	1. **Study of following groups with reference to:** 1.1 Pisces: Dipnoi, Accessory respiratory organs, Migration and Electric organs. 1.2 Amphibia: Parental care and Neoteny. 1.3 Reptilia: Temporal vacuities or skull type, General characters of Rhyncocephalia. 1.4 Aves: Flight adaptation. 1.5 Mammalia: Dentition in mammals.	17

References:

1. An introduction to Protochordata. 1964, Vidya Ram Mishra and Ramesh Gupta. The Indian Book Depot, Lucknow.

2. Chordate Zoology, 1982, P. S. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.
3. The life of Vertebrates, 3rd edn.1993, J. Z. Young, Oxford University Press, USA.
4. The Phylum Chordata: Biology of Vertebrates and their Kin, 1987, H. H. Newman, Distributor Satish book enterprise, Agra.
5. A text book of Zoology, 1984, R. D. Vidyarthi, S. Chand and Co., New Delhi.
6. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr, 9th Edn., 2001, McGraw Hill, Boston, USA.
7. Vertebrate Practical Zoology, 11th revised Edition, 2014, S. S. Lal, Rastogi publ., Meerut.
8. The anatomy of the garden lizard (*Calotes versicolor,* Boulin.*)* 1974, S. Y. Paranjape. The Poona University Press, Poona - 7.
9. Chordate Zoology, 2009 reprint, E. L. Jorden, S. Chand and Co., New Delhi.
10. Text book of Zoology, Vertebrates, Vol. II, T. J. Parker and W. A. Haswell, edited by Marshall and Williams, CBS Publications, New Delhi.
11. Text Book of Vertebrate Zoology, R. L. Kotpal, Rastogi Publication, Meerut.

T. Y. B. Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - II
Title: Physiology - Life Sustaining Process
PAPER CODE: ZOO3602

[Credits - 3]

Learning Objectives:

1. To make students understand the mechanism of functioning of various organs and organ systems of the body.
2. To inculcate interest and foundation of physiological aspects for further studies in life sciences.
3. To develop laboratory skills in physiology which will be helpful to the students in research work in the future.

	Title and Contents	No. of Lectures
Unit - I	**Physiology** Definition and scope	01
Unit - II	**1. Digestion and Respiration:** 1.1 Digestion of carbohydrates, proteins and fats. Absorption in small intestine: water, ions and nutrients. Absorption in large intestine and formation of faeces. 1.2 Mechanism of Ventilation, exchange of gases at lungs and tissue level. 1.3 Mechanism of transport of gases: Transport of Oxygen, Bohr's effect, Transport of Carbon-dioxide, Haldane's effect. 1.4 Respiratory Quotient and BMR.	15
Unit - III	**1. Circulation and Excretion:** 1.1 Composition and functions of blood, blood coagulation mechanism, blood pressure, electrocardiogram. Cardiac cycle: systole, diastole, cardiac output and nodal tissues. 1.2 Ornithine cycle: synthesis of urea, Physiology of Urine formation, Counter-Current Multiplier theory for urine concentration.	15
Unit - IV	**1. Muscles and Temperature regulation:** 1.1 Ultrastructure of skeletal muscles. 1.2 Physiology of muscle contraction: sliding filament theory, physical and chemical changes in muscles. Simple muscle twitch, muscle fatigue and rigor mortis. 1.3 Normal body temperature, heat production, heat loss. Role of hypothalamus in temperature regulation. Abnormalities of body temperature: fever, exposure of body to extreme heat and cold.	07
Unit - V	**1. Reproduction:** 1.1 Reproductive cycles: physiological changes	07

		during oestrous cycle and menstrual cycle.	
	1.2	Physiological changes during pregnancy and lactation.	

References:

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 and Physiology: G. J. Tortora and S.R. Grabowski, Harper Row Publishers
3. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical applied agency, Kolkata.
4. Medical Physiology, 2006, Asis Das, Books and Allied Pvt. Ltd., Kolkata.
5. Endocrinology, 2005, Lohar P. S., M. J. P. Publishers, Chennai.
6. Animal Physiology (W. H. Freeman) Eckert R.
7. A Textbook of Animal Physiology - K. A. Goel and K. V. Shastri (Rastogi Pub.)
8. A Textbook of Practical Physiology - V. G. Ranade (P. V. G. Prakashan, Pune.)
9. Animal Physiology - A. Maria Kyttikan and N. Armugam (Saras Pub.)
10. Medical Laboratory Techniques - Ramni Sood, Jaypee Brothers medical Pub. Pvt. Ltd., New Delhi.
11. Williams Text Book of Endocrinology - Tenth Edition, Saunders, 2003.
12. Endocrinology - Mac E. Hadley, Fifth Edition, Pears on Education, 2004.
13. Molecular Endocrinology - Bolander, F. F., Academic, San Diego, 1989.
14. Textbook of Endocrinology - Griffin J.E., S. R. Ojeda, Oxford, New York, 1988.
15. Basic and Clinical Endocrinology - Greenspan, F. S., 3rd ed., Appleton and Lange.

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - III
Title: Molecular Biology
PAPER CODE: ZOO3603

[Credits - 3]

Learning Objectives:

1. To study and understand the basic structure of Nucleic acids.
2. To study the Chromatin structure; packaging of DNA (Prokaryotic and Eukaryotic cells); importance of DNA damage and various repair mechanisms.
3. To study the concept of Central Dogma of Molecular Biology etc.

	Title and Contents	No. of Lectures
Unit - I	**1. Nucleic acids:** 1.1 Purine and Pyrimidine bases, nucleoside, nucleotide, types of DNA, double helical structure of DNA, Physico-chemical properties of DNA [Tm, Hypochromacity & Hyperchromacity]. 1.2 DNA as genetic material - evidences, transformation, transduction (specialised and generalised), conjugation (Hfr cells), molecular basis of recombination. 1.3 Chromatin-Heterochromatin, Euchromatin, histones, nucleosome, super coiling of DNA (positive and negative).	16
Unit - II	**1. Central Dogma of Molecular Biology:** 1.1 Replication- Types of replication, Semi-conservative (Messelson and Stahl experiment) 1.2 Mechanism in prokaryotes and eukaryotes Primosome and replisome. **2. Transcription:** 2.1 Synthesis of RNA, types of RNA, transcriptional unit, RNA polymerase, 2.2 Transcription in prokaryotes and eukaryotes, post transcriptional modifications. **3. Translation:** 3.1 Genetic code, properties of genetic code, deciphering of genetic code. 3.2 Structure of tRNA and role as an adaptor. 3.3 Ribosome structure (prokaryotes and eukaryotes), biosynthesis of ribosome. 3.4 Protein synthesis–Initiation, elongation, termination and concept of post translational modification.	10
Unit - III	**1. Concept of operon**	10

	1.1 Regulation of gene action, Lac operon, Trp operon	
Unit - IV	**1. DNA damage and repair** 1.1 DNA damage due to ionising radiations, chemicals and intercalating agents. 1.2 DNA repair mechanism - Photo-repair, dark repair, base excision repair, SOS repair	09

References:

1. Principles of Genetics, 1997, P. D. Snustad, M. L. Simmons J. B. Jenkins, John Wiley
2. Molecular Biology of the Cell, 2007, 5th Edn. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Taylor & Francis, UK.
3. Text Book of Cell and Molecular Biology, 2009, Second Edition, Ajoy Paul, Books and Allied (P) Ltd.
4. Cell and Molecular Biology, 2010, Third Edition, P. K. Gupta, Rastogi Publications.
5. Fundamentals of Molecular Biology, 2005, First Edition, Avinash and Kakoli Upadhyay, Himalaya Publishing House.
6. Molecular Biology Genes to Proteins, 2008, Third Edition, Burton Tropp. Jones and Bartlett.
7. Gene IX, X, XI, 1994, Lewin Oxford University Press, Oxford.
8. Molecular Biology of the gene, 1993, Watson J. Hopkins, Roberts, Steitz and Weiner,Benjamin Cummings.
9. Text book of Molecular biology, 1994, K. Shivrama Sastry, G. Padmanabhan & C. Subramanyan, Mc. Millan India.
10. Cell and molecular biology, 2010, 8th ed., De Robertis EDP and De Robertis EMF Jr. Lippincott Williams & Wilkins, Philadelphia
11. Principles of Biochemistry, 1993, 2nd ed., Lehninger A. L. Nelson D.L. & Cox M. M. CBH Publisher and distributors, Delhi.
12. Principles and techniques of Biochemistry and Molecular biology, 2009, seventh edition, Keith Wilson and John Walker, Cambridge University.

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - IV
Title: Organic Evolution
PAPER CODE: ZOO3604

[Credits - 3]

Learning Objectives:

1. The aim of the course is to provide students with a deeper insight into the evolutionary processes - both selective and random - which can explain the genetic composition of populations, form, behaviour and distribution of organisms, and to teach students the basic methods of analysing the evolutionary relationships between species.
2. The course aims on developing a better understanding of how science generates knowledge by way of hypothesis testing, systematic observations, and the comparative method to the students. They will be able to better distinguish scientific from unscientific arguments.
3. This course includes various theories of evolution and show how natural selection ultimately underpins all biological processes and how evolution has generated biological diversity.
4. The aim of this course is create a deep understanding of how evolution works and outline the major transitions in evolution, from the origin of life to hominid evolution.

	Title and Contents	No. of Lectures
Unit - I	**1. Origin of life:** 1.1 Ancient and medieval beliefs. 1.2 Origin of eukaryotic cell.	5
Unit - II	**1. Evidences of organic evolution:** Study of evidences from: 1.1 Morphology and comparative anatomy - Homology, analogy and vestigial organs. 1.2 Embryology - Homology of early development, homology in the embryos, retrogressive metamorphosis. 1.3 Geographical distribution. 1.4 Palaeontology. 1.5 Connecting links. 1.6 Physiology.	7
Unit - III	**1. Theories of organic evolution**: 1.1 Lamarckism. 1.2 Darwinism and Neo Darwinism. 1.3 Modern synthetic theory.	6
Unit - VI	**1. Isolation:** 1.1 Definition. 1.2 Isolating mechanism: Premating mechanisms. Post mating mechanism. 1.3 Other classifications of isolating mechanism: Pre-zygotic isolating mechanism. Post-zygotic isolating mechanism	4
Unit - V	**1. The Origin of Species:** 1.1 Concept of species. 1.2 Categories of species.	4

	1.3 Causative factors for speciation 1.4 Modes of speciation.(Phyletic, Quantum and Gradual) 1.5 Patterns of speciation 1.6 Types of speciation. (Allopatric, Sympatric and Parapatric)	
Unit - VI	**1. Adaptations:** 1.1 Introduction. 1.2 Kinds of adaptations. Structural adaptation. Physiological adaptations. Protective adaptations. Animal association adaptations. 1.3 Divergent Evolution (Adaptive radiation).	4
Unit - VII	**1. Animal Distribution and barriers to distribution:** 1.1 Aspects of animal distribution. 1.2 Patterns of animal distribution. Continuous distribution. Discontinuous distribution. Bipolar distribution 1.3 Factors influencing animal distribution. 1.4 Barriers to dispersal. Physical barriers. Climatic or ecological barriers. Biological barriers. 1.5 Means of dispersal.	5
Unit - VIII	**1. Origin and Evolution of Man:** 1.1 Places of origin of man. 1.2 Monophyletic or polyphyletic origin. 1.3 Morphological similarities and difference between man and ape. 1.4 Evolution of man in Pleistocene: *Australopithecus* - Gracile form and robust form *Homo erectus - Java man* and *peking man*. *Neanderthal man* *Cro-Magnons man* *Homo sapiens*	6
Unit - IX	**1. Zoogeographical distributions**: 1.1 Introduction. 1.2 Types of zoogeographical distribution. 1.3 Study of different regions.	4

References:

1. Organic Evolution, Richard Swann Lull, Light & Life Publishers.
2. Introductions to Evolution, Paul Amos Moody, Kalyani Publishers, New Delhi.
3. Organic Evolution, 1991 T. S. Gopalkrishanan, I. Sambashivarab Publ. House.
4. Evolution, 1996 P. K. Gupta, Rastogi Publ., Meerut.
5. Evolutionary Biology, 2010, Mohan P. Arora, Himalaya Pub. House, Delhi.
6. Evolution, 1968, E. O. Dodson, Reinhold Pub. Corp., New York.
7. The major features of evolution, 1953, Simpson G. G. Columbia, New York.
8. American Museum of Natural History. The First Humans [Volume 1 of The Illustrated History of Humankind]. Harper Collins, 1993.

9. Andrews, Peter, and Christopher B. Stringer. Human Evolution: An Illustrated Guide. University Press, 1989.
10. Berger, Lee. "The Dawn of Humans: Redrawing Our Family Tree?" National Geographic 194 (August 1998): 90-99.
11. Bordes, Francois. A Tale of Two Caves. Harper and Row, 1972.
12. Caird, Rod and Robert Foley, scientific ed. Apeman, The First Story of Human Evolution. S & S Trade, 1994. Based on the A & E television series.
13. Cartmill, Matt. "Lucy in the Sand with Footnotes," Natural History (April 1981): 90-95.
14. The origin of species, 1959, Charles Darwin, New American Library, New York. 15. Diamond, Jared. The Third Chimpanzee: The Evolution and Future of the Human Animal. Harper Collins, 1992.
15. Edey, Maitland A. and Donald C. Johanson. Blueprints: Solving the Mystery of Evolution. Viking, 1990
16. Brunet, M., et al. 2002. A new hominid from the Upper Miocene of Chad, Central Africa. Nature 418:145-151.

T.Y. B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - V(A)
Title: Immunology
PAPER CODE: ZOO3605

[Credits - 3]

Learning Objectives:

1. The study of immunology will enable the student to gain a broad foundation base for understanding the defence mechanisms of the human body.
2. To introduce students with organs of immune system, antigen - antibody interactions and also common autoimmune disorders.
3. To impart practical knowledge about cells of immune system, their separation, dilution and observation technique. Students will be introduced with modern immunological techniques like RIA and ELISA.

	Title and Contents	No. of Lectures
Unit - I	**1. Introduction of Immune system:** 1.1 Introduction to immunology and immunity Definition and scope of immunology. Innate Immunity: Definition and characteristics, Innate immunity at species, race, family and individual levels. Mechanism: First line of defence, Second line of defence, Third line of defence. Acquired Immunity: Definition and characteristics. **2. Cells of Immune system and their activities:** 2.1 Lymphoid cells: B lymphocytes, T lymphocytes, Null cells. 2.2 Activities of mononuclear sear cells: phagocytosis, Antimicrobial and cytotoxic activities, secretion of factors, Mast cells, Dendritic cells. **3. Organs of immune system:** 3.1 Primary lymphoid organs: Thymus, bone marrow, Lymphatic system. 3.2 Secondary lymphoid organs: Lymph nodes, Spleen, 3.3 Gut associated lymphoid tissue (GALT), 3.4 Cutaneous associated lymphoid tissue(CALT).	23
Unit - II	**1. Antigen, antibody and their interaction:** 1.1 Antigens Complete antigens and haptens Determination of antigenicity: foreignness, molecular size, chemical composition and heterogeneity, susceptibility to tissue enzymes Antigen specificity **2. Antibodies:** 2.1 Immunoglobulin (antibodies); Basic structure of immunoglobulin. 2.2 Structure of typical immunoglobulin, types of	16

	immunoglobulins. **3. Antigen antibody interactions** 3.1 General features of antigen - antibody interactions 3.2 Precipitation reaction: Definition, characteristics and mechanisms, in fluids (tube test) and in gels (slide test) 3.3 Radial immunodiffusion (Mancini method) 3.4 Double immunodiffusion (Ouchterlony method) 3.5 Immunoelectrophoresis 3.6 Agglutination reaction: definition, characteristics and mechanism, Haemagglutinaion (slide and micro-tray agglutination), Bacterial agglutination (tube agglutination), passive agglutination, Coomb's test and agglutination inhibition; MHC, complement pathway.	
Unit - III	**1. Autoimmune disorders:** 1.1 Study of autoimmune disorders: Myasthenia Gravis. Systemic Lupus Erythematosus. Rheumatoid arthritis. Thyroiditis.	06

References:

1. Roitt's Essential Immunology, 13th Edition, Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt.
2. Fundamentals of Immunology, 5th edition, Edited by William E Paul , Lippincott Williams & Wilkins, 2003.
3. Immunology 7th Ed. - D. Male, J. Brostoff, D. Roth, I. Roitt (Elsevier, 2006)
4. Veterinary Immunology, 9th Edition, Ian Tizard
5. Immunology, 4th Ed. Janis Kuby, W. H. Freeman & Co.
6. Immunology, 6th Ed. Ivan M. Roitt
7. Immunology - Goldsby R. A., Kindt T. K., Osborne B. A. and Kuby J. (2003), 5th Edition, W. H. Freeman and Company, New York.
8. Immunobiology - Janeway C. A., Travers P, Walport M. and Shlomchik M. (2001), 6th Edition, Garland Publishing, New York.

OR

T.Y. B.Sc. (ZOOLOGY) SEMESTER - VI
ZOOLOGY PAPER - V (B)
TITLE: HUMAN GENETICS
PAPER CODE: ZOO3606

[CREDITS - 3]

Learning Objectives:

1. Learning Mendel's Law and it s application in human inheritance.
2. Understanding Karyotype analysis, inheritance of common human genetic diseases.
3. Concepts of pedigree study and acquire the basic knowledge of Genetic counselling.

	Title and Contents	No. of Lectures
Unit - I	**1. Applications of Mendel's Laws to Human Inheritance:** Pigmentation versus albinism. Mechanism of melanin synthesis Inheritance of albinism in human. Lethal genes in human Examples of dominant, recessive, semi-lethal genes in human. **2. Human Chromosomes:** Normal Human Karyotype: Paris Nomenclature, Flow karyotyping (Quantification of DNA of individual chromosomes) FACS - Fluorescence activated cell sorter **3. Genetic Diseases and Inheritance Pattern:** Autosomal inheritance- Dominant (E.g. - Adult polycystic kidney, Achondroplasia and Neurofibromatosis) Autosomal inheritance - Recessive (E.g. - Sickle cell anaemia, Phenylketonuria) Sex linked inheritance - The Lyon Hypothesis (X- Chromosome inactivation. Recessive: (E.g. - Duchenne muscular dystrophy - DMD) X-linked; Dominant (E.g. - Goltzs syndrome, Oral Facial - Digital syndrome) Y-linked inheritance (Holandric gene - E.g. - Double Y Syndrome (XYY Syndrome)	20

Unit - II	**1.**	**Pedigree Studies and Genetic Counselling:** Symbols used in pedigree studies, Pedigree analysis & construction, Pedigree analysis for the inheritance pattern of genetic diseases, Genetic Counselling. Stage 1: History and pedigree construction Stage 2: Examination Stage 3: Diagnosis Stage 4: Counselling Stage 5: Follow up	13
	2.	**Oncogenetics:** Properties of malignant cells, Types of Genes – Proto-Oncogenes, Oncogenes, Cellular Oncogenes, Tumor Suppressor Genes, Chromosomal abnormalities associated with the specific malignancies – Burkitt's Lymphoma, CML & Retinoblastoma	
Unit -III	**1.**	**Dermatoglyphics:** Introduction and classification, Flexion creases. Dermatoglyphics in clinical disorders. Clinical applications, its advantages and limitations.	15
	2.	**Prenatal Diagnosis:** Introduction and Definition. Various procedures used, such as Amniocentesis, Chorionic villus sampling, Ultrasonography and Fetoscopy.	
	3.	**Genetics and Society:** Eugenics: Positive and negative, Euthenics, Euphenics Human genome project Gene Therapy with reference to Haemophilia Stem Cells - Definition types and sources. A brief account on Cord Blood Banking and Stem Cell Therapy.	

References:

1. Essentials of Human Genetics by S. M. Bhatnagar etal (1999), IV edition, Orient Longman.
2. Human Genetics: Concepts and Applications by Lewis R. (2001), McGraw Hill, Boston.
3. Basic Human Genetics by E. J. Manage and A. P. Manage, (1997, Indian Reprint), Rastogi Publications, Meerut.
4. Molecular Basis of Inherited Diseases, (6^{th} Edition - 1989) by Scriver, C. R. A. L. Beudit, W. S. Sty and D. Valle, McGraw Hill, New York).
5. Human Genetics by S. D. Gangane, (2^{nd} edition - Reprint 2001), B. L. Churchill Livingstone Pvt. Ltd., New Delhi.
6. Genetics in Medicine by M. W. Thompson et al., 5^{th} Edition, W. B. Sounders Company, London.
7. Emery's Elements of Medical Genetics - Peter Turnpenny, Slan Ellard.
8. Medical Genetics - Jorde, Carney, Bamshad, White.
9. Human Genetics - Bruce R. Korf.
10. The New Human Genetics by Gerald J. Stine, WCB Publications.

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - VI (A)
Title: Biological Techniques and Bioinformatics
PAPER CODE: ZOO3607

[Credits - 3]

Learning Objectives:

1. To acquire knowledge of good laboratory practices.
2. To learn separation techniques used in Zoological laboratories.
3. To learn basic principles and applications of Microscopy.
4. Overview of Bioinformatics and its applications.

	Title and Contents	No. of Lectures
Unit - I	**Good Laboratory Practices:** Laboratory Safety, Biohazardous Agents, Risk Groups and Biosafety Levels, Laboratory Acquired Infections, Safety Measures, Laboratory Practices, Basic Requirements of Laboratory.	05
Unit - II	**Solution / Strengths of Chemicals:** Saturated Solution, Percentage, Normality, Molarity, Molality, Osmolarity, Osmolality, ppm, ppb	04
Unit - III	**Separation Techniques:** Principle and Applications, techniques related to isolation, purification and characterization of biomolecules. Chromatography Gas Chromatography, Ion-Exchange, Gel filtration and Column Chromatography Electrophoresis Native, Agarose and Polyacrylamide Ultracentrifugation, Colorimetry and Spectroscopy	10
Unit - IV	**Haematological Techniques:** Blood cell count - Total count of RBCs, WBCs and Differential count of WBCs and their significance. Examination of bone marrow. Hb%, bleeding time, clotting time and their significance	08
Unit - V	**Microscopy and Micrometry:** Simple and Compound Microscope, Phase Contrast Microscope, Electron Microscope (SEM and TEM) and Confocal Microscope - their principle, working and applications Micrometry: Camera lucida and micrometer scale	08
Unit - VI	**Introduction to Bioinformatics:** Study of computer and computer devices Definition - Bioinformatics Applications and Research - Bioinformatics Databases - Characteristics - Categories - Navigating Databases - Information Three levels of Bioinformatics in structural Biology	10

	Applications of Bioinformatics in life sciences Retrieval System - Sequence Databases - Nucleotide Sequence Databases - Secondary Nucleotide Sequence Databases - Protein Sequence Databases - Secondary and Specialized Protein Sequence Databases - Information Retrieval System: Entrez and SRS Structure Databases - Structure File Formats - Protein Structure Database Collaboration - Database - PubMed and PubMed Central Internet and Web site Search engines and computer programs useful in Biology	

References:

1. Introduction of Medical Laboratory Technique,1998, 7th Edn., Baker F. J., Silverton R. E., Pallister C. J., Butterworth-Heinemann, UK.
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3. Histological and Histochemical Methods, Theory and Practice, 2008, 4th ed., 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 ed., 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 ed., 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.

OR

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PAPER - VI (B)
Title: POULTRY SCIENCE
Skill-Based Course
(Elective Paper)
PAPER CODE: ZOO3608

[Credits - 3]

Learning Objectives:

1. The study of poultry science will develop and strengthen Human Resource by infusing knowledge and skill in Poultry science and thus providing skill development opportunities to the students.
2. This course aims to create awareness about the opportunities of employment and livelihood in poultry sector.
3. Introducing this subject aims on imparting basic knowledge and technical proficiency in poultry breeding, housing, management and nutrition

	Title and Contents	**No. of Lectures**
Unit - I	**1.** Introduction to poultry science. 1.1 Definition of poultry. 1.3 Historical background of poultry farms. 1.3 Advantages of poultry farming.	02
Unit - II	**Systematic position and study of external features of fowls.** .	02
Unit - III	**1. Classification of different fowls and study of different breeds**. 1.1 Indigenous breeds 1.2 Exotic breeds To study American class fowl breeds. To study Asiatic class fowl breeds. To study English class fowl breeds. To study Mediterranean class fowl breeds.	06
Unit - IV	**Study of digestive system of fowl.**	02
Unit - V	**Study of circulatory system of fowl.**	02
Unit - VI	**Study of respiratory system of fowl.**	02
Unit - VII	**Study of male and female reproductive system of fowl.**	04
Unit - VIII	**1. Breeding of poultry.** 1.1 Natural mating 1.2 Artificial insemination	05
Unit - IX	**Formation, structure and nutritive value of eggs.**	05
Unit - X	**1. Hatching of eggs. Brooding and rearing** 1.1 Natural hatching 1.2Artificial hatching 1.3 Natural brooding 1.4 Artificial brooding	04
Unit - XI	**1. Different systems of fowl farming.** 1.1 Free range system	03

	1.2 Semi-intensive system. 1.3 Folding unit system 1.4 Intensive system	
Unit - XII	**Study of poultry equipments and poultry feeding.** 1.1 Perches . 1.2 Brooder. 1.3 Feeder. 1.4 Watering devices. 1.5 Debeaker. 1.6 Incubator. 1.7 Nest boxes. 1.8 Dropping pit.	03
Unit - XIII	**Study of infectious and non-infectious diseases (two each)**	03
Unit - XIV	**Marketing of poultry products**	02

References:

1. Mead, G. C. & Wells, R. G. 1999. Poultry meat science. Wallingford, UK, CAB International Publishing.
2. Scientific poultry production Book · January 2006, Edition III, ISBN - 81-8189-147-3, Publisher: International Book Distributing Co., Sreenivasaiah P.
3. Text Book of Poultry Science by Sreenivasaiah P. V. (2008).
4. On the Web:
   a. Danish Poultry Network - www.poultry.kvl.dk
   b. Poultry Information Network - www.wattnet.com
   c. International Egg Commission - www.internationalegg.com
   d. Egg - Nutrition Centre - www.enc-online.org
   e. American Egg Board - www.aeb.org
   f. United States Department of Agriculture, Agricultural Marketing Services - www.ams.usda.gov

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PRACTICAL - IV
(Life and Diversity of Animals - VI and Physiology - Life Sustaining Process)
PAPER CODE: ZOO3611

Demonstration, E = Experimental **[Credits - 3]**

Practical No.	Title and Contents
1.	Study of external characters and digestive system of *Calotes.** (D)
2.	Study of arterial and venous system of *Calotes.** (D)
3.	Study of male and female reproductive systems of *Calotes.** (D)
4.	Study of permanent slide of *Branchiostoma*-external characters, T. S. through buccal cavity, pharynx, intestine and tail. (D)
5.	Comparative study of Heart: Shark, Frog, *Calotes*, Pigeon and Rat. (D)
6.	Comparative study of Brain: Shark, Frog, *Calotes*, Pigeon and Rat. (D)
7.	Study of accessory respiratory organs in fishes: *Anabas, Labeo, Clarias.* (D)
8.	Study of neotenic forms (Axolotl larva). (D)
9.	Visit to local Biodiversity spot and report writing. (E)
10.	Determination of Salivary amylase activity. (E)
11.	Measurement of blood pressure using sphygmomanometer. (E)
12.	Estimation of haemoglobin using Sahli's haemoglobinometer. (E)
13.	Preparation of haemin crystals. (E)
14.	Urine Analysis: Physical and chemical: Colour appearance, odour, urea, Ph. (E)
15.	Any other practical suggested by concerned teacher based on syllabus

Notes:

1. No live animals will be used for practical as per ethical guidelines.
2. Any ten practicals to be conducted.
3. *-with the help of images / charts.

T.Y.B.Sc. (ZOOLOGY) Semester - VI
ZOOLOGY PRACTICAL - V
(Molecular Biology and Organic Evolution)
PAPER CODE: ZOO3612

D* = Demonstration, E* = Experiment **[Credits - 3]**

Learning Objectives:

1. To learn the concepts related to Nucleic acids with suitable practicals.
2. Hands on experience with experimentation for the students to learn basic techniques and methods in Molecular biology.
3. The practical know how will inculcate the sense of basic evolutionary processes and will develop interest in basic science.
4. Through the course of time students will gain the experience of how to integrate / apply diverse learning methods which could help them in higher studies.

Practical No.	Title and Contents
1.	Temporary preparation of Polytene Chromosome from suitable material. (E)
2.	Estimation of DNA by Diphenylamine method. (E)
3.	Detection of DNA and RNA by Methyl Green Pyronin staining. (E)
4.	Preparation of DNA paper model . (E)
5.	Study of types of DNA. (D)
6.	Temporary mounting of Barr body. (E)
7.	Study of continuous and discontinuous type of distribution with two examples with the help of specimens / charts / photos. (D)
8.	Study of morphological similarities and differences between man and ape. (D)
9.	Study of types of fossils with the help of specimens / charts / photos. (D)
10.	Study of structural adaptations: (D) (a) Terrestrial adaptations. (b) Aquatic adaptations. (c) Aerial adaptation.
11.	Study of evidences of evolution - embryological, paleontological, connecting links, comparative anatomy. (D)
12.	Study of successive stages of evolution of man: (D) (a) *Australopithecus* (b) *Homo erectus* (c) *Homo neanderthalis* (d) *Cro-magnon man* (e) *Homo sapiens*
13.	To record Zoogeographical distribution of animals to respective zoogeographical realms on the world map (Lung fishes, marsupials, flightless birds, Camel, Elephant, etc.) (E)

Note: Any ten practicals to be conducted.

T. Y. B.Sc. (ZOOLOGY) Semester - VI ZOOLOGY PRACTICAL - VI (Immunology and Biological Techniques) PAPER CODE: ZOO3613 D* = Demonstration, E = Experimental [Credits - 3]	
Practical No.	**Title of the practical**
1.	Study of cells of Immune system (Blood smear method) (E)
2.	Determination of concentrations of lymphoid cells (Hemocytometer Method) (E)
3.	Study of antigen-antibody reaction in ABO blood group system. (E)
4.	Study of Radial Immune-Diffusion. (E)
5.	Isolation and observation of bone marrow cells (goat bone marrow obtained from slaughter house). (E)
6.	Study of an enzyme-linked immunosorbent assay. (ELISA) (D)
7.	Study of autoimmune diseases (Photographs/ charts) (Systemic Lupus Erythematosus, Vasculities, Graves disease, Multiple sclerosis, Rheumatoid arthritis) (D)
8.	Laboratory Safety Measures, Symbols used in Laboratories and Sterilization techniques. (D)
9.	Preparation of Solutions (Normal, Molar etc.) (E)
10.	Thin layer Chromatography of dyes (E)
11.	Agarose Gel Electrophoresis and PAGE (D)
12.	Differential count of W.B.Cs. (E)
13.	Principle and use of Camera Lucida (E)
14.	Study of micrometer and measure diameter of cells by using permanent slide. (E)
15.	Hands on Session on Publicly available Database study and searching: (E) Nucleotide Sequence Databases: NCBI, DDBJ and EMBL Protein Databases: UniProtKB, PDB CATH and SCOP Literature Databases: PubMed.
16.	Retrieval of sequences and Sequence analysis by: BLAST, FASTA (E)

Notes:

1. Any ten practicals to be conducted.
2. Animal tissue will be collected from slaughter house.
3. Human blood will be collected from pathology lab.

OR

T. Y. B.Sc. (ZOOLOGY) SEMESTER - VI ZOOLOGY PRACTICAL - VI (Human Genetics and Poultry Science) PAPER CODE: ZOO3613 D* = Demonstration, E = Experimental [CREDITS - 3]	
Practical No.	**Title of the practical**
1.	Study of Karyotypes I: Normal Karyotyping in Humans Male (46, XY), Female (46, XX). (D)
2.	Study of Karyotypes II: Abnormal Karyotypes, Down Syndrome (Autosomal), Turner Syndrome (Sex chromosomal), Kleinfelter Syndrome (Sex chromosomal). (D)
3.	Buccal Smear Study and staining methods for Barr Bodies. (E)
4.	Blood Smear Study of Drumsticks in Neutrophils. (E)
5.	Pedigree Analysis**:** Symbols used in autosomal recessive disorder, autosomal dominant disorder, Sex chromosomal (X & Y linked). (D)
6.	Dermatoglyphics 1: Recording of print of fingertips and palm. Classify ridges on the finger tips arch, loop and whorl. (E)
7.	Dermatoglyphics 2: Recording of palm print - area demark as hypothenar, thenar and inter-digital areas, record presence or absence of Simian Crease, Ridge Counting and atd angle calculation. (E)
8.	Study of chick embryo whole mounts with reference to staging method in chick development (By Hamburger & Hamilton, given the book by Balanskey): 18 h (primitive streak), 21h, 24h, 33h, 48h, 72h & 96h of incubation. (D)
9.	Study of permanent histological slides of chick embryo: Primitive streak (T. S), 24h (T. S. through neural tube) and33H (T. S. Through heart). (D)
10.	Study of permanent histological slides of chick embryo:48h (T. S. through pharynx and T. S. through extra embryonic membrane),72h embryo (T.S.) (D)
11.	To study various equipments used in poultry (fowl). (D)
12.	To Study the Circulatory system of Poultry(fowl). (D)
13.	Temporary preparation of chick embryo (E)
14.	To Study the Digestive system of Poultry (fowl). (D)
15.	To Study the Reproductive (Male and Female) system of Poultry(fowl) . (D)
16.	To Study Formation of egg. (D)
17.	To Study Structure of egg. (D)
18.	To study and prepare a report on different breeds of poultry. (Student Activity)
19.	Preparation and submission of model of any one type of poultry house. (Student Activity)
20.	Field visit to a poultry house and submission of report.

Notes:

1. Any ten practicals to be conducted.
2. No live animals will be used for practical as per ethical guidelines.