Department of Zoology
B.Sc. Honors Syllabus

B.Sc. 2 Year (Semester 3) Zoology Core Paper 1

Molecular Biology, Bioinstrumentation & Biotechniques (Theory)

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: Zoology		
Course Code: B050301T	Course Title: **Molecular Biology, Bioinstrumentation & Biotechniques**	

Course outcomes:
The student at the completion of the course will be able to have:

- A detailed and conceptual understanding of molecular processes viz. DNA to trait.
- A clear understanding of the processes of central dogma viz. transcription, translation etc. underlying survival and propagation of life at molecular level.
- Understanding of how genes are ultimately expressed as proteins which are responsible for the structure and function of all organisms.
- Learn how four sequences (3 letter codons) generate the transcripts of life and determine the phenotypes of organisms.
- How genes are regulated differently at different time and place in prokaryotes and eukaryotes.

Credits: 4	Core Compulsory
Max. Marks: 30+70	Min. Passing Marks: 40 %
Total No. of Lectures-60	

Units	Topic	No of Lectures 60
I	**Process of Transcription** • Fine structure of gene • RNA polymerases • Transcription factors and machinery • Formation of initiation complex • Initiation, elongation and termination of transcription in prokaryotes and eukaryotes	7
II	**Process of Translation** • The Genetic code • Ribosome • Factors involved in translation • Aminoacylation of tRNA, tRNA-identity, aminoacyltRNAsynthetase • Initiation, elongation and termination of translation in prokaryotes and eukaryotes	**7**

Department of Zoology
B.Sc. Honors Syllabus

III	**Regulation of Gene Expression I** • Regulation of gene expression in prokaryotes: lac and trpoperons in *E. coli* • Regulation of gene expression in eukaryotes: Role of chromatin in gene expression • Regulation at transcriptional level, Post-transcriptional modifications: Capping, Splicing, Polyadenylation • RNA editing.	8
IV	**Regulation of Gene Expression II** • Regulation of gene expression in eukaryotes: • Regulation at translational level, Post- translational modifications: protein folding etc. • Intracellular protein degradation • Gene silencing, RNA interference (RNAi)	8
V	**Principle and Types of Microscopes** • Principle of Microscopy and Applications • Types of Microscopes: light microscopy, dark field microscopy, phase-contrast microscopy, • Fluorescence microscopy, confocal microscopy, electron microscopy	6
VI	**Centrifugation and Chromatography** • Principle of Centrifugation • Types of Centrifuges: high speed and ultracentrifuge • Types of rotors: Vertical, Swing-out, Fixed-angle etc. Principle and Types of Chromatography: paper, ion-exchange, gel filtration, HPLC, affinity	8
VII	**Spectrophotometry and Biochemical Techniques** • Biochemical techniques: Measurement of pH, Preparation of buffers and solutions • Principle of Colorimetry/Spectrophotometry: Beer-Lambert law • Measurement, applications and safety measures of radio-tracer techniques	8
VIII	**Molecular Techniques** • Detection of nucleic acid by gel electrophoresis • DNA sequencingDNA fingerprinting, RFLP • Polymerase Chain Reaction (PCR) • Detection of proteins, PAGE, ELISA, Western blotting	

Suggested Readings:

1. Lodish et al: Molecular Cell Biology: Freeman & Co, USA (2004).
2. Alberts et al: Molecular Biology of the Cell: Garland (2002).
3. Cooper: Cell: A Molecular Approach: ASM Press (2000).
4. Karp: Cell and Molecular Biology: Wiley (2002).
5. Watson et al. Molecular Biology of the Gene. Pearson (2004).
6. Lewin. Genes VIII. Pearson (2004).

7. Pierce B. Genetics. Freeman (2004).
8. Sambrook*et al* .Molecular Cloning Vols I, II, III. CSHL (2001).
9. Primrose. Molecular Biotechnology. Panima (2001).
10. Clark & Switzer. Experimental Biochemistry. Freeman (2000)

This course can be opted as an elective by the students of following subjects:
The eligibility for this paper is 10+2 with Biology as one of the subject

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questions
- Attendance

Further Suggestions:
It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:
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Department of Zoology
B.Sc. Honors Syllabus

B.Sc. 2 Year (Semester 3) Zoology Paper 1

Bioinstrumentation & Molecular Biology Lab (Practical)

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **B050302P**	Course Title: **Bioinstrumentation & Molecular Biology Lab**	

Course outcomes:
The student at the completion of the course will be able to

- Understand the basic principles of microscopy, working of different types of microscopes
- Understand the basic techniques of centrifugation and chromatography for studying cells and separation of biomolecules
- Understand the principle of measuring the concentrations of macromolecules in solutions by colorimeter and spectrophotometer and use them in Biochemistry.
- Learn about some of the commonly used advance DNA testing methods.

Credits: 2	Core Compulsory
Max. Marks: 30+70	Min. Passing Marks: 40 %

Total No. of Lab Periods/Practical= 30 (60 hours)

Units	Topic	No of Lab Periods
I	• **To study the working principle and Simple, Compound and Binocular microscopes.** • **To study the working principle of various lab equipments such as pH Meter, Electronic balance, use of glass and micropipettes, Laminar flow, Incubator, Waterbath, Centrifuge, Chromatography apparatus, etc.**	08
II	• **To prepare solutions and buffers.** • **To measure absorbance in Colorimeter or Spectrphotometer.** • **Demonstration of differential centrifugation to fractionate different components in a mixture.**	10
III	• **To prepare dilutions of Riboflavin and verify the principle of spectrophotometry.** • **To identify different amino acids in a mixture using paper chromatography.** • **Demonstration of DNA extraction from blood or tissue samples.** • **To estimate amount of DNA using spectrophotometer.**	17
IV	**Virtual Labs (Suggestive sites)** **www.labinapp.com** **www.uwlax.edu** **www.labster.com** **www.onlinelabs.in** **www.powershow.in**	04

Department of Zoology
B.Sc. Honors Syllabus

	https://vlab.amrita.edu **info@premiereducationaltechnologyies.com** **https://li.wsu.edu**	

Suggested Readings:

- Sambrook et al .Molecular Cloning Vols I, II, III. CSHL (2001).
- Primrose. Molecular Biotechnology. Panima (2001).
- Clark & Switzer. Experimental Biochemistry. Freeman (2000).

Suggestive digital platforms web links- ePG- Pathshala, inflibnet,IGNOU & UPRTOUonline study material.

Svayam Portal, http://heecontent.upsdc.gov.in/Home.aspx

Suggested Continuous Evaluation Methods:

- Assessment of observation report.
- Preparation of
- questionnaire.
- Visits Records.Attendance.

This course can be opted as an elective by the students of following subjects:
The eligibility for this paper is 10+2 from Science

Further Suggestions:
It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions

B.Sc. 2 Year (Semester 3) Zoology Core Paper 2

Animal Physiology: Controlling and Coordinating Systems (Theory+ Practical)

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: BSc Zoology		
Course Code: **B050302TP**	Course Title: **Animal Physiology: Controlling and Coordinating Systems**	

Course outcomes:

The student at the completion of the course will be able to:

1. Develop understanding for the fundamental concepts of physiology of digestion
2. Develop understanding of blood vascular system
3. Develop the fundamental concepts of physiology of respiration
4. Familiarize students with renal physiology and muscle
5. Develop basic understanding of endocrine system and its interactions with other systems
6. Develop abilities required for industrial employment as well as self-employment.

Credits: 4	Core Compulsory
Max. Marks: 30+70	Min. Passing Marks: 40 %
Total No. of Lectures-60	

Units	Topic	No of Lectures 60
I	**Tissues** Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue **Bone and Cartilage** Structure and types of bones and cartilages, Ossification, bone growth and resorption	19
II	**Nervous System** Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision. **Muscle** Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus	12
III	**Reproductive System** Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female	15
IV	**Endocrine System** Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal	14

	transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones	
	PRACTICALS	
	• Recording of simple muscle twitch with electrical stimulation (or Virtual) • Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex) • Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells • Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid • Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues	**30** Lab

Suggested Readings:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer

questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:

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B.Sc. 2 Year (Semester 3) Zoology Core Paper 3

Fundamentals of Biochemistry

(Theory+ Practical)

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: BSc Zoology		
Course Code: **B050303TP**	Course Title: **Fundamentals of Biochemistry**	

Course outcomes:

The student at the completion of the course will be able to:

- Understand about the importance and scope of biochemistry.
- Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
- Understand the structure and function of immunoglobulins.
- Understand the concept of enzyme, its mechanism of action and regulation.
- Understand the process of DNA replication, transcription and translation.
- Learn the preparation of models of peptides and nucleotides.
- Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
- Learn measurement of enzyme activity and its kinetics. Get employment in different applied sectors

Credits: 4T+2P = 6	Core Compulsory
Max. Marks: 30+70	Min. Passing Marks: 40 %

Total No. of Lectures-60 Theory 30 Practical= 90

Units	Topic	No of Lectures
I	**Carbohydrates** Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates **Lipids** Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids	14
II	**Proteins** **Amino acids:** Structure, Classification and General properties of α-amino acids; Physiological importance of essential and non-essential α-amino acids **Proteins:** Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins **Immunoglobulins:** Basic Structure, Classes and Function, Antigenic Determinants	15

III	**Nucleic Acids** Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hpyo-Hyperchromaticity of DNA	17
IV	**Enzymes** Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of Km and Vmax, Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action	14
	PRACTICALS	
	• Qualitative tests of functional groups in carbohydrates, proteins and lipids. • Paper chromatography of amino acids. • Action of salivary amylase under optimum conditions. • Effect of pH, temperature and inhibitors on the action of salivary amylase. • Demonstration of proteins separation by SDS-PAGE.	**30** Lab

Suggested Readings:

- Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus

Test with multiple choice questions/ short and long answer questionsAttendance

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization up skillingthe people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions

2 Year (Semester 3) Zoology GE 3/Minor Elective

Human Physiology

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **B050304T**	Course Title: **Human Physiology**	

Course outcomes:

At the end of the course students will be able to understand:

- This course helps the students to know about the basic histology and physiology of human body.
- Students know how their body functions, what are the chemical changes taking place in their body during any action they do like how their brain and hand coordinate during writing.
- They know what the hormones are and how their concentration changes with puberty or some other conditions like menstruation, pregnancy, stress or happy moments.
- They also know how their heart, lungs, kidney and other glands work.
- They also become aware about various types of diseases of human body.
- Develop understanding for the fundamental concepts of physiology of digestion
- Develop basic understanding of endocrine system and its interactions with other systems

Credits: 4 Theory	GE 3/Minor Elective
Max. Marks: 30+70	

Total No. of Lectures-60

Units	Topic	No of Lectures
I	**Digestion and Absorption of Food** Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (in brief)	14
II	**Functioning of Excitable Tissue (Nerve and Muscle)** Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction **Respiratory Physiology** Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.	16
III	**Renal Physiology** Functional anatomy of kidney, Mechanism and regulation of urine formation **Cardiovascular Physiology** Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG	13

IV	**Endocrine and Reproductive Physiology** Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle	17

Suggested Readings:

- Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.
- Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
- Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley.
- Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.
- Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Company Ltd.

This course can be opted as an elective by the students of following subjects: Open for all
The eligibility for this paper is 10+2 with any subject

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questions

Attendance

Course prerequisites: To study this course, a student must have had the subject ALL in class12th. The eligibility for this paper is 10+2 with any subject

Further Suggestions:
It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:
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2 Year (Semester 3) Zoology SEC 3/Vocational Course

Vermiculture

Programme/Class: Diploma	Year: 2	Semester: 3
Subject: Zoology		
Course Code: **B050305T**	Course Title: **Vermiculture**	

Course outcomes:

At the end of the course students will be able to understand:

- Scope of vermiculture and also the utility of vermitechnology in India and its significance.
- Understand the culture techniques of various species *like Lumbricus terrestris, Eisenia eugenia, Eudrilus, Amynthas gracilus, Perionyx excavates* etc.
- Management of vermicomposting wastes in field pits, ground heaps, tank method, roof shed method etc.
- Harvesting the vermin-compost and its storage, vermiwash preparation and their application.
- Be aware of a broad array of career options and entrepreneurship possibilities in the area of vermiculture and vermitechnique for the organic manure preparation

Credits: 3 Theory	SEC 3/Vocational Course
Max. Marks: 30+70	

Total No. of Lectures-45

Units	Topic	No of Lectures
I	**Vermiculture** Definition, scope and importance; common species for culture; Environmental parmeters; culture methods – wormery – breeding techniques; indoor and outdoor cultures - monoculture and polyculture – merits and demerits. **Biology of Earthworms** Morphology & Anatomy: Earthworms- Taxonomic position, external features- shape, size, colour, segmentation, setae & clitellum. Body wall, coelom, locomotion, digestive, circulatory, respiratory, excretory & nervous system. Reproductive system-Male & Female, copulation, cocoon formation & fertilization, development of earth worm.	12
II	Vermicomposting of wastes in field pits, ground heaps, tank method, roof shed method, static pile windrows, top fed windrows, wedges & bin method, harvesting the compost, storage, Vermiwash-Preparation and application. Applications of vermiculture – Vermiculture Bio-technology, vermicomposting, use of vermicastings in organic farming/horticulture, earthworms for management of municipal/selected biomedical solid wastes; as feed/bait for capture/culture fisheries; forest regeneration.	10
III	**Vermitechnology** Definition, history, growth and development in other countries & India, significance. **Economic importance of Earthworms** In sustainable agriculture, organic farming, earthworm activities, soil fertility & texture, soil aeration, water impercolation, decomposition & moisture, bait & food.	13

IV	**Entrepreneurship prospects in vermiculture** Prospectus of vermiculture in India: employment strategies, Future perspectives – Predator / pathogen control in wormeries; Potentials and constraints for vermiculture in India. Marketing the products of vermiculture – quality control, market research,marketing techniques – creating the demand by awareness and demonstration, advertisements, packaging and transport, direct marketing. Visit to relevant Labs/Field Visits	10

Suggested Readings:

1. Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.
2. Bhatnagar & Patla, 2007. Earthworm vermiculture and vermin-composting, Kalyani Publishers, New Delhi.
3. Jordan & Verma, 2009. Invertebrate Zoology, Chand & Company Ltd.

Reference Books:

1. Mary Violet Christy,2008. Vermitechnology,MJP Publishers, Chennai

2. Edwards, C.A & P.J Bohlen, 1996. Biology and ecology of earthworms III Edn. Chapman & Hall N.Y.U.S.A.

3. Edwards, C.A & J.R Lofty Vermicoloogy – The Biology of earthworm, 1997 Chapman & Hall Publications N.Y.U.S.A.

4. Lee, K.E. 1985. Earthworms their ecology and relationships

5. Aravind Kumar, 2005.Verms & Vermitechnology, A.P.H. Publishing Corporation, New Delhi.

This course can be opted as an elective by the students of following subjects: Open for all
The eligibility for this paper is 10+2 with any subject

Suggested Continuous Evaluation Methods:

- Seminar/ Presentation on any topic of the above syllabus
- Test with multiple choice questions/ short and long answer questions

Attendance

Course prerequisites: To study this course, a student must have had the subject ALL in class12th. The eligibility for this paper is 10+2 with any subject

Further Suggestions:
It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure.

At the End of the whole syllabus any remarks/ suggestions:
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