PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ZOOLOGY

Name of the Course: B.Sc. II (Sem–III& IV)

(Draft Syllabus to be implemented from w.e.f. June 2020)

P.A.H.Solapur University, Solapur , Faculty of Science
Choice Based Credit System (CBCS)
B.Sc.-II Zoology
(2020-2021 : W.e.f. June 2020)

Background of Curriculum:

In accordance with the UGCs reference to standardize curricula at the national level and bring a match across all the Indian Universities, an attempt has been made to follow the pattern given in the UGCs Undergraduate Template.

Zoology deals with the study of animal kingdom specially the structural diversity, biology, embryology, evolution, habits and distribution of animals, both living and extinct. As it covers a fascinating range of topics, the modern zoologists need to have insight into many disciplines. The learning outcomes-based curriculum framework for a B.Sc. degree in Zoology is designed to cater to the needs of students in view of the evolving nature of animal science as a subject. The framework is expected to assist in the maintenance of the standard of Zoology degrees/programmes across the country by reviewing and revising a broad framework of agreed expected graduate attributes, qualification descriptors, programme learning outcomes and course-level learning outcomes. The framework, however, does not seek to bring about uniformity in syllabi for a programme of study in Zoology, or in teaching learning process and learning assessment procedures. Instead, the framework is intended to allow for flexibility and innovation in programme design and syllabi development, teaching learning process, assessment of student learning levels. A comprehensive knowledge of structure-function relationship at the level of gene, genome, cell, tissue, organ, and systems, through development would further add to the knowledge base and the learning outcome in terms of editing of genes and genomes for industrial application and research purposes.

Learning Outcomes based approach to Curriculum Planning:

The courses should be delivered in terms of concepts, mechanisms, biological designs & functions and evolutionary significance cutting across organisms at B.Sc. level. These courses should be studied by students of all branches of biology. Both chalk and board, and PowerPoint presentations can be used for teaching the course. The students should do the dissertation/ project work under practical of different courses, wherever possible.

The students are expected to learn the courses with excitements of biology along with the universal molecular mechanisms of biological designs and their functions. They should be able to appreciate shifting their orientation of learning from a descriptive explanation of biology to a unique style of learning through graphic designs and quantitative parameters to realize how contributions from research and innovation have made the subjects modern, interdisciplinary and applied and laid the foundations of Zoology, Animal Sciences, Life Sciences, Molecular Biology and Biotechnology. These courses and their practical exercises will help the students to apply their knowledge in future course of their career development in higher education and research. In addition, they may get interested to look for engagements in industry and commercial activities employing Life Sciences, Molecular Biology and Biotechnology. They may also be interested in entrepreneurship and start some small business based on their interest and experience.

Graduate Attributes in Zoology:

- Disciplinary knowledge and skills: Capable of demonstrating (i) comprehensive knowledge and understanding of major concepts, theoretical principles and experimental findings in Zoology and its different subfields (ii) ability to use modern instrumentation for advanced genomic and proteomic technology.

- Skilled communicator: Ability to impart complex technical knowledge relating to Zoology in a clear and concise manner in writing and oral skills.

- Critical thinker and problem solver: Ability to have critical thinking and efficient problem solving skills in the basic areas of Zoology

- Sense of inquiry: Capability for asking relevant/appropriate questions relating to issues and problems in the field of Zoology, and planning, executing and reporting the results of an experiment or investigation.

- Team player/worker: Capable of working effectively in diverse teams in both classroom, laboratory and in industry and field-based situations.

- Skilled project manager: Capable of identifying/mobilizing appropriate resources required for a project, and manage a project to completion, while observing responsible and ethical scientific conduct; and safety and chemical hygiene regulations and practices.

- Digitally literate: Capable of using computers for Bioinformatics and computation and appropriate software for analysis of genomics and proteomics data, and employing modern bioinformatics search tools to locate, retrieve, and evaluate location and biological annotation genes of different species.

- Ethical awareness/reasoning: Capable of conducting their work with honesty and precision thus avoiding unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciating environmental and sustainability issues. Research ethics committee expects them to declare any type of conflict of interest that may affect the research. Any plan to withhold information from researchers should be properly explained with justification in the application for ethical approval.

- Lifelong learners: Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development and reskilling

Choice Based Credit System: With the view to ensure worldwide recognition, acceptability, horizontal as well as vertical mobility for students completing undergraduate degree, Solapur University has implemented Choice Based Credit System (CBCS) at Undergraduate level. The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations.

• Outline of Choice Based Credit System:

1. *Core Course:* A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. *Elective Course:* Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.

3. *Ability Enhancement Courses (AEC):* The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) Environmental Science and (ii) English/MIL Communication. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

• Credit: Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 20 marks and University Evaluation for 80 marks.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Faculty of Science & Technology
Choice Based Credit System (CBCS): (w.e.f.2020-21): Draft Structure for B. Sc-II

Subject/ Core Course	**Name and Type of the Paper**		**No. of papers/ Practical**	**Hrs/week**			**Total Marks Per Paper**	**UA**	**CA**	**Credits**
	Type	**Name**		**L**	**T**	**P**				
Class :	B.Sc.- II : semester-III									
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject OR		C-5	Paper-V	3.0	--	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		C-6	Paper-V	3.0	--	--	50	40	10	4.0
			Paper-VI	3.0	--	--	50	40	10	
		C-7 (Zoology)	**Paper-V: Cell Biology**	**3.0**	**--**	**--**	**50**	**40**	**10**	**4.0**
			Paper-VI: Principles of Ecology	**3.0**	**--**	**--**	**50**	**40**	**10**	
		SEC-1								
		GE-3								
Grand Total				18	--	--	300	240	60	12
Class :	B.Sc.- II Semester – IV									
Core (*Students can opt any Three subjects among the Four Subjects offered at B.Sc.I. Out of Three Subjects offered One Subject will be the Core Subject **OR** Students can opt any Two subjects among the Four Subjects offered at B.Sc.I. Out of Two Subjects One Subject will be the Core Subject and any One Subject among the other will be Elective		C-8	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		C-9	Paper-VII	3.0	--	--	50	40	10	4.0
			Paper-VIII	3.0	--	--	50	40	10	
		C-10 (Zoology)	**Paper-VII Fundamentals of Biochemistry**	**3.0**	**--**	**--**	**50**	**40**	**10**	**4.0**
			Paper-VIII Physiology-Control & Coordination	**3.0**	**--**	**--**	**50**	**40**	**10**	

Subject									
	SEC-2								
	GE-4								
	Environmental Studies		3.0	--	--	50	40	10	NC
Total (Theory)			21	--	--	350	280	70	12
Practical	C-5 & C-8	Pr. III&IV	--	--	8	100	80	20	4.0
	C-6 & C-9	Pr. III&IV	--	--	8	100	80	20	4.0
	C-7 & C-10 (Zoology)	**Pr. I: (Cell Biology & Principles of Ecology) & Pr. II: (Fundamentals of Biochemistry & Physiology-Control & Coordination)**	**--**	**--**	**8**	**100**	**80**	**20**	**4.0**
	GE-3 & GE-4								
Total (Practical)					24	300	240	60	12
Grand Total			39		24	950	760	190	36

*Core Subjects
Chemistry/Physics/Electronics/Computer Science/Mathematics/Statistics/Botany/Zoology/ Microbiology/Geology/ Geography/Psychology
Core Subjects- (Additional)-Geochemistry/Biochemistry/Meteorology/Plant Protection

Summary of the Structure of B.Sc. Programme as per CBCS pattern

Class	**Semester**	**Marks-Theory**	**Credits-Theory**	**Marks-Practical**	**Credits-Practicals**	**Total – credits**
B.Sc.-II	III	300	12	--	--	12
	IV	350	12	300	12	24
Total		650	24	300	12	36

B.Sc. Programme :
Total Marks : Theory + Practical's = 650 +300 =950
Credits : Theory + Practical's = 12 + 24 = 36
Numbers of Papers Theory: Ability Enhancement Course (AECC) : 00
Theory: Discipline Specific Elective Paper (DSE) : 00
Theory: CC : 06
Skill Enhancement Courses : 00
GE : 00
Total : Theory Papers :

: Practical Papers :

Abbreviations:

L: Lectures
T: Tutorials
P: Practicals
UA : University Assessment
CA : College Assessment
DSC / CC: Core Course
AEC : Ability Enhancement Course
DSE : Discipline Specific Elective Paper
SEC : Skill Enhancement Course
GE : Generic Elective
CA: Continuous Assessment
ESE: End Semester Examination

PAH SOLAPUR UNIVERSITY, SOLAPUR
Faculty of Science
Choice Based Credit System (CBCS)
(W.e.f. 2020-21)

• Title of the Course: B.Sc. Part-II

• Subject: Zoology

• **Introduction**: This course provides a broad overview of Zoology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using Zoology. The course structure is basic science centric where students learn core science and are taught necessary fundamental subject for that purpose.

• **Objectives of the course: The objectives of B. Sc. Zoology course are:**
To provide an intensive and in depth learning to the students in field of Zoology. Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world. To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students. To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

- **Course outcome and Advantages:** Zoology has tremendous job potential. The successful students will be able to establish research organizations with the help of agriculture, environment protection and also their own industry for transgenic animals, clinical pathology, genetic counseling, human karyotyping etc. Scientific Research Organizations. Universities in India & aboard.

• Medium of Instruction: English
• Syllabus Structure:
• The University follows semester system.
• An academic year shall consist of two semesters.
• B.Sc. Part-II Zoology shall consist of two semesters: Semester III and Semester IV

In semester III: there will be two DSC papers having paper V and paper VI of 100 marks. There will a **Compulsory paper on "Ability Enhancement Compulsory Course (AECC)" on** Environmental Studies

In Semester IV: there will be two DSC papers having paper VII and paper VIII of 100 marks.

The scheme of evaluation of performance of candidates shall be based on **University Assessment (UA**) as well as **College Internal Assessment (CA)** as given below.

For B.Sc.Part-II Zoology Sem III & IV the "internal assessment" will be based on Internal tests, Home assignment, Tutorials, Open Book Examination, Seminars, Group discussion, Brain storming sessions etc. as given below.

- **Practical course examination** is of 100 marks shall be conducted at the end of semester II. The

practical examination of 100 marks shall also consist of **80 marks for University practical assessment** and **20 marks for college internal assessment (CA)**.

• **Scheme of Evaluation**: As per the norms of the grading system of evaluation, out of 100 marks, the candidate has to appear for college internal assessment of 20 marks and external evaluation (University assessment) of 80 marks.

Semester – III: Theory: (100 marks): Comprising DSC-

a) University Examination (UA) (80 marks): No. of theory papers: 2 (paper V and paper VI of 40 marks each)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 2 (paper V and paper VI of 10 marks each)

c) **Compulsory paper on "Ability Enhancement Compulsory Course (AECC)" on** Environmental Studies

Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.

Semester – IV: Theory: (100 marks): Comprising DSC-

a) University Examination (UA) (80 marks): No. of theory papers: 2 (paper VII and paper VIII of 40 marks each)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 2 (paper VII and paper VIII of 10 marks each)

Internal test- Home assignment / tutorials / seminars / viva/ group discussion/ outreach programs.
Practical Examination: (100 marks)
University Examination (80 marks): No. of practicals': 02

Practical-I: Based on papers V & VI : (40 UA + 10 CA)
Practical-II: Based on papers VII & VIII : (40 UA + 10 CA)

Internal Continuous Assessment: (20 marks): Practical-I (10) + Practical-II (10)

(a) Internal practical test and
(b) Viva/group discussion/model or chart/attitude/attendance/overall behavior
(c) University practical examination of 80 marks (Practical I & II for two separate days) will be conducted at the end of semester IV

Passing Standard:

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade.

Such student will have to reappear for University Examination only. A student who fails in internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same 70 marks of external examination and his performance shall be scaled to 100 marks.

• ATKT:

Candidate passed in all papers, except 5 (five) papers combined together of semester I and II of B.Sc. Part-I Zoology examination shall be permitted to enter upon the course of Semester III of B.Sc. Part-II Zoology

B.Sc .II Semester-III & IV, ZOOLOGY

Choice Based Credit System (CBCS) Structure (2020-21)

Semester- III (Theory)

Paper	Title	Marks
V	Cell Biology	50 (40- UA and 10-CA)
VI	Principles of Ecology	50 (40- UA and 10-CA)

Semester- IV (Theory)

Paper	Title	Marks
VII	Fundamentals of Biochemistry	50 (40- UA and 10-CA)
VIII	Physiology-Control & Coordination	50 (40- UA and 10-CA)

PRACTICALS

PRACTICAL	Title	Marks
I	Cell Biology & Principles of Ecology	50 (40- UA and 10-CA)
II	Fundamentals of Biochemistry & Physiology Control & Coordination	50 (40- UA and 10-CA)
	Total Marks	100 (80-UA + 20-CA)

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Choice Based Credit System (CBCS)
Zoology

Paper-V

CELL BIOLOGY: THEORY (Credits-02 & contact hours-30)

Unit 1: Overview of Cells **02**
Prokaryotic and Eukaryotic cells, Virus, Viroids

Unit 2: Plasma Membrane **03**
Singer & Nicholson's model of plasma membrane. Transport across membranes: An overview of active and passive transport

Unit 3: Endomembrane System **06**
Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes

Unit 4: Mitochondria **04**
Mitochondria: Ultrastructure, Semi-autonomous nature, Endosymbiotic hypothesis Mitochondrial Respiratory Chain, functions.

Unit 5: Cytoskeleton **04**
Structure and Functions: Microtubules, Microfilaments

Unit 6: Nucleus **05**
Structure and functions of Nucleus, Nuclear envelope, Nuclear pore complex, Nucleolus, Chromatin: Euchromatin, Hetrochromatin and nucleosome

Unit 7: Cell Division **04**
Cell cycle, Mitosis and Meiosis

Unit 8: Cell Signaling **02**

- Types of cell signaling , Brief idea of G-Protein Coupled Receptor (GPCR) and Role of secondary messengers (cAMP)

SUGGESTED READINGS

1) Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
2) De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
3) Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
4) Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
5) Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008).

Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

Learning outcomes : Students will come to know about:

- Cellular architecture & their functions at organismic level
- This knowledge will help students in future to explore areas like: oncology, medical diagnostics and treatment
- Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
- Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
- Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.
- Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.

Paper-VI

PRINCIPLES OF ECOLOGY: THEORY (Credits-02 & contact hours-30)

Unit 1: **Introduction to Ecology** **02**

History of ecology, Autecology and synecology

Unit 2: **Population Ecology** **05**

Brief idea about attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves.

Unit 3: **Animal Associations- Brief idea and definitions** **05**

- Intraspecifc associations: Parental care in fishes, groupism and social behavior
- Interspecific associations: commensalism, mutualism, predation and parasitism

Unit 4: **Abiotic Factors** **03**

Introduction & Effects on animals: Temperature, light, water, water hardness, humidity, soil, oxygen and carbon dioxide.

Unit 5: **Community** **04**

Community characteristics: species richness, dominance, diversity indices, abundance.

Unit 6: **Ecosystem** **05**

General characteristics & faunal adaptations in:

- Aquatic (freshwater ecosystem: lotic and lentic) &
- Terrestrial (grassland and desert ecosystem).

Unit 7: **Food chain:** **04**

Pond ecosystem: with reference to food chain, ecological pyramid, energy flow and ecological succession

Unit 8 **Applied Ecology** **02**

Brief idea of: Biodiversity hot-spots and sacred groves in India with examples

SUGGESTED READINGS:

1) Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2) Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3) Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4) Robert Leo Smith Ecology and field biology Harper and Row publisher
5) Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

Learning Outcomes (LO): Students will come to know about

- Ecological principles & applications that govern the planet Earth
- This knowledge will help students in future to explore areas like: biodiversity, conservation biology, forestry & natural resource management
- Know the evolutionary and functional basis of animal ecology.
- Understand what makes the scientific study of animal ecology a crucial and exciting endeavor.
- Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.
- Analyze a biological problem, derive testable hypotheses and then design experiments and put the tests into practice.
- Solve the environmental problems involving interaction of humans and natural systems at local or global level.

Semester-IV

B.Sc.-II Zoology (CBCS): Semester-IV

PAPER-VII: FUNDAMENTALS OF BIOCHEMISTRY

THEORY (CREDITS 2; Contact Hours-30)

Unit 1: **Carbohydrates** **(04)**
Structure and biological Significance of: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

Unit 2: **Lipids** **(04)**
Structure and biological Significance of: Physiologically important of saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Unit 3: **Amino Acids** **(03)**
Amino acids: Structure, Classification and General Properties of α-amino acids;

Unit 4: **Proteins:**
Levels of organization in proteins (primary, secondary, tertiary & quaternary); Simple and conjugate proteins with examples **(02)**

Unit- 5: **Immunoglobulins:**
Basic Structure, Classes and biological significance **(02)**

Unit 6: **Nucleic Acids** **(04)**
Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids: Base pairing, Denaturation and Renaturation of DNA; Types of DNA and RNA.

Unit 7: **Central Dogma**
Basic concepts of replication, transcription and translation in prokaryotes **(04)**

Unit 8: **Enzymes** **(07)**
Nomenclature and classification; Co-factors; Properties of enzymes; Mechanism of enzyme action; Factors affecting enzyme actions; Enzyme inhibition, Isozymes

Learning Outcome:

After successfully completing this course, the students will be able to:

- 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.

PAPER-VIII
ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

THEORY (CREDITS 2; Contact Hours-30)

Unit 1: Tissues (04)

Structure, location, classification and functions of: epithelial tissue, connective tissue, muscular tissue and nervous tissue :

Blood –Types of blood cells(RBC,WBC ,Platelets , Plasma) , functions of blood

Unit 2: Histology of following mammalian organs: (04)

i) Tooth ii) Salivary gland iii) Stomach iv) IIeum
v) Liver vi) Pancreas vii) Kidney viii) Testis ix) Ovary

Unit 3: Nervous System (04)

Ultastructure of neuron, resting membrane potential, origin of action potential and its propagation across the nerve fibers; Structure of Synapse and Synaptic transmission,

Unit 4: Muscle (03)

Types of muscles (smooth, Striated, cardiac) and Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction.

Unit 5: Reproductive Physiology (03)

Pituitary gland & its hormones, Sex hormones (male & female)

Unit 6: Reproductive Cycle (04)

Oestrous and Menstrual cycle, Hormonal control of pregnancy, parturition and lactation; Contraception methods: Physical, oral contraceptives pills, IUD, surgical methods

Unit 7: In-vitro Fertilization (02)

Technique of IVF and its applications

Unit 8: Endocrine System (06)

Histology, hormonal secretions & their functions and disorders of following endocrine glands- Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal.

*Note: With reference to mammals.

Learning outcomes:

After successfully completing this course, the students will be able to:

- Acquire knowledge of the coordinated physiological functioning
- Realize that very physiological mechanisms are used in very diverse organisms.
- Understand how cells, tissues, and organisms function at different levels.

- Develop an understanding of the related disciplines, such as cell biology, neurophysiology, pharmacology, biochemistry etc
- Get a flavor of research by working on project besides improving their writing skills. It will further enable the students to think and interpret individually.
- Undertake research in any aspect of animal physiology in future.

REFERENCES:

CELL BIOLOGY:

- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
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- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

ECOLOGY:

- Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
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- 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.

PHYSIOLOGY: CONTROL & COORDINATION:

- 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.

Practical

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Practical-I (Paper-V & VI): Cell Biology and Principles of Ecology (04 Credits)

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.

2. Study of various stages of meiosis in onion flower buds.

3. Demonstration/ Observation of Barr body using permanent slide(s) ***(spotter)***

4. Study of principle and procedure and technique using permanent slide ***(spotter)***
i) DNA by Feulgen technique.
ii) Mucopolysaccharides by Periodic Acid Schiffs Reaction (PAS)

5. Study and construction of ecological pyramid from given data:
i) Members of Grass land ecosystem –
Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Vulture, Squirrel, Earthworm, Centipede, Scorpion , Rabbit and Indian Bustard.
ii) Members of Pond ecosystem –
Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise , Diatoms Vallisneria, Hydrilla, Chara and Spirogyra.

6. Calculation of Shannon-Weiner diversity index from the given data/ model.

7. Study of an aquatic ecosystem: Identification of Zooplankton with the help of permanent slides (***Spotters***),
8. Estimation of Dissolved Oxygen (Winkler's method) from given sample,
9. Estimation of Carbondioxide (CO_2) from given sample.
10 .Estimation of Total Hardness content from given sample.

11 Study Visit: Report on a visit to National / Central / State institutes / Local water bodies/National Park/Biodiversity Park/Wild life sanctuary.

Practical-II
(Paper-VII & VIII):

FUNDAMENTALS OF BIOCHEMISTRY and ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS (CREDITS-04) **

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.

2. Estimation of protein by colorimetric method.

3. Estimation of carbohydrates by colorimetric method.

4. Demonstration of paper chromatography of amino acids.

5. Action of amylase or papain enzyme under optimum conditions.

6. Effect of pH, temperature and inhibitors on the action of amylase.

7. Demonstration of proteins separation by SDS-PAGE.

8. Recording of simple muscle twitch/ Cardiogram – demonstration. (Virtual frog/ computer generated)
(Analysis of given graph of Frog- muscle twitch or cardiogram In the examination students are provided with any one computer generated graph and supposed to 'Analyze the given graph and explain details of principle, procedure, result, Inference and viva-voce based on the given practical is expected)

9. Study of permanent slides (T.S./V,S.) - of Mammalian organs using permanent slides:
i) Tooth ii) Salivary gland iii) Stomach iv) IIeum v) Liver vi) Pancreas vii) Kidney viii) Testis ix) Ovary

10. Study of ABO blood group system and blood group antigens

11. Microtomy: Study of principle , procedure and mechanism of micro-technique and microtome : flow chart of technique, study of procedure and observation of HE staining technique/ whole mount using permanent slides (study of protocol using flowchart).

12. Study visit: Visit to wetlands, medical college, pathology laboratory and blood bank

OR

13. Preparation and submission of small project/ review on topics related to ecology, cell biology, biochemistry and physiology

****Note:**

As per the guidelines of **UGC notification number F.14-6/2014(CPP-II) dated 1st August, 2014** it is now essential to make necessary modifications to stop dissection and promote and orient students towards the knowledge component rather than skill development. However, ITC based virtual dissections are promoted. Now, the responsibility to discontinue dissections and use of animals in experiments totally rests on concerned authorities of respective colleges/Institutes. As per the notification it is important to encourage the field trips and observations without disturbing the biodiversity. For laboratory observations existing permanent slides and specimens should be shown. As per the guidelines of UGC , all the Zoology departments should be empowered with infrastructure to adopt Information communication technology (ICT) required for the purpose of virtual dissections for which virtual class room / laboratory to be enriched with few computers (according to the strength of students),internet facility , printer etc.

Skeleton paper for practical examination
(University Examination for 40 Marks)

Practical-I (Paper-V & VI) **Cell Biology and Principles of Ecology**		
Questions		**Marks**
Q-1:	Preparation of temporary stained squash of onion root tip to study various stages of mitosis ***OR*** Study of various stages of meiosis in onion flower buds.	08
Q-2:	Estimation from given sample - of Dissolved Oxygen (Winkler's method) **OR** Carbondioxide (CO_2) ***OR*** Total Hardness content	08
Q:3:	Study and construction of ecological pyramid from given data: ***i) Members of Grass land ecosystem –*** Grasshopper, Rat Snake, Grass, Herbs, Shrubs, Weeds, Trees, Vulture, Squirrel, Earthworm, Centipede, Scorpion , Rabbit and Indian Bustard. **OR** ***ii) Members of Pond ecosystem –*** Sponge, Nepa, Leech, Planaria, Hydra, Lymnea, Planorbis, Heron, Kingfisher, Cyclops, Daphnia, Tortoise , Diatoms Vallisneria, Hydrilla, Chara and Spirogyra.	08
Q:4	Spotting / Identification (Any four) Zooplankton with the help of permanent slides (chart/ model /photo) / Bar body (***Spotters***).	08
Q:5	Submission of tour report and viva-voce	04
Q:6	Submission of certified journal	04
Total Marks		**40**

Practical-II (Paper-VII & VIII): Fundamentals of Biochemistry and Animal Physiology: Controlling and Coordinating Systems		
Questions		Marks
Q-1:	Qualitative tests of functional groups in carbohydrates, proteins and lipids. Or Estimation of protein and carbohydrates by colorimetric method.	08
Q-2:	Action of amylase or papain enzyme under optimum conditions **Or** Effect of pH, temperature and inhibitors on the action of amylase. **Or** Study of ABO blood group system and blood group antigens	08
Q:3:	Recording of simple muscle twitch demonstration. / Cardiogram (Virtual frog) **Or** Microtomy: Study of principle and mechanism of microtechnique: flow chart of technique, study of procedure and observation of Haemotoxylene Eosine staining technique using permanent slides.	08
Q:4	Spotting / Identification (any 4). **Mammalian T.S. or V.S. -** Tooth / Salivary gland / Stomach / IIeum / Liver / Pancreas / Kidney / Testis / Ovary	08
Q:5	Submission of tour report / Project/ review and viva-voce	04
Q:6	Submission of certified journal	04
Total Marks		**40**