



Shri Sangameshwar Education Society's
Sangameshwar College, Solapur [Autonomous]
 (Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur) Kannada
 Linguistic Minority Institute
NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 4(4.2)
 26th March, 2022

UG Science Programme: B.Sc.-III to be implemented from A.Y. 2022-2023

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in: Zoology

Structure of Choice Based Credit System for Undergraduate Science **Program B.Sc. III (Zoology)** to be implemented from **A.Y.2022-2023**

Table:5

Semester	Course		Course Code	Teaching Scheme/week			
				Hours	Lectures	Credits	
V	AECC-C	ENGLISH FOR COMMUNICATION-III	2231501	3.2	4	2	
	DSE-1A	Theory Paper-IX: Molecular Biology	2231571	2.4	3	3	
		Practical-IV: Molecular Biology & Animal Physiology: Life Sustaining Systems	2231676	4	5	2	
	DSE-2A	Theory Paper-X: Principles of Genetics	2231572	2.4	3	3	
		Practical-V: Principles of Genetics & Evolutionary Biology	2231677	4	5	2	
	DSE-3A	Theory Paper-XI: Endocrinology	2231573	2.4	3	3	
		Practical-VI: Endocrinology & ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	2231678	4	5	2	
	ANY ONE from DSE-4A (1) & 4A (2)						
	DSE-4A (1)	Theory Paper-XII: Wildlife Conservation & Management	2231574	2.4	3	3	
		Practical-VII: Wildlife Conservation & Management OR Animal Biotechnology	2231679	4	5	2	
	DSE-4A (2)	Theory Paper-XII: ANIMAL BIOTECHNOLOGY	2231575	2.4	3	3	
		Practical-VII: Applied Zoology OR BIOLOGY OF INSECTA	2231679	4	5	2	
	SGSEC-3	Theory Paper-III: NUTRITION AND BODY WEIGHT MANAGEMENT	2231576	2.4	3	2	

		Total		31.2	39	24	
VI	AECC-D	ENGLISH FOR COMMUNICATION-IV	2231601	3.2	4	2	
	DSE-1B	Theory Paper-XIII: Animal Physiology: Life Sustaining Systems	2231671	2.4	3	3	
		Practical-IV: Molecular Biology & Animal Physiology: Life Sustaining Systems	2231676	4	5	2	
	DSE-2B	Theory Paper-XIV: Evolutionary Biology	2231672	2.4	3	3	
		Practical-V: Principles of Genetics & Evolutionary Biology	2231677	4	5	2	
	DSE-3B	Theory Paper-XV: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	2231673	2.4	3	3	
		Practical-VI: Endocrinology & ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	2231678	4	5	2	
	ANY ONE from DSE-4B (1) & 4B (2)						
	DSE-4B (1)	Theory Paper-XVI: Applied Zoology	2231674	2.4	3	3	
		Practical-VII: Wildlife Conservation & Management OR Animal Biotechnology	2231679	4	5	2	
	DSE-4B (2)	Theory Paper-XVI: BIOLOGY OF INSECTA	2231675	2.4	3	3	
		Practical-VII: Applied Zoology OR BIOLOGY OF INSECTA	2231679	4	5	2	
	Total				28.8	36	22
	Total Semester V and VI				60	75	46

Table: 6

Semester	Course		EXAMINATION			Credits
			Marks			
			CA	SEE	Total	
V	AECC-C	ENGLISH FOR COMMUNICATION-III	15	35	50	2
	DSE-1A	Theory Paper-IX: Molecular Biology	30	70	100	3
	DSE-2A	Theory Paper-X: Principles of Genetics	30	70	100	3
	DSE-3A	Theory Paper-XI: Endocrinology	30	70	100	3
	ANY ONE from DSE-4A (1) & 4A (2)	Theory Paper-XII: Wildlife Conservation & Management	30	70	100	3
		Theory Paper-XII: ANIMAL BIOTECHNOLOGY				
	SEC-3	Theory Paper-III: NUTRITION AND BODY WEIGHT MANAGEMENT	15	35	50	2
Total			135+15	315+35	450+50	16
VI	AECC-D	Theory-V: ENGLISH FOR COMMUNICATION-IV	15	35	50	2
	DSE-1B	Theory Paper-XIII: Animal Physiology: Life Sustaining Systems	30	70	100	3

DSE-2B	Theory Paper-XIV: Evolutionary Biology	30	70	100	3
DSE-3B	Theory Paper-XV: ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	30	70	100	3
ANY ONE from DSE-4B (1) & 4B (2)	Theory Paper-XVI: Applied Zoology	30	70	100	3
	Theory Paper-XVI: BIOLOGY OF INSECTA				
DSE-1A & DSE-1B	Practical-IV: Molecular Biology & Animal Physiology: Life Sustaining Systems	30	70	100	4
DSE-2A & DSE-2B	Practical-V: Principles of Genetics & Evolutionary Biology	30	70	100	4
DSE-3A & DSE-3B	Practical-VI: Endocrinology & ANIMAL BEHAVIOUR AND CHRONOBIOLOGY	30	70	100	4
DSE-4A & DSE-4B	Practical-VII: Wildlife Conservation & Management OR Animal Biotechnology Practical-VII: Applied Zoology OR BIOLOGY OF INSECTA	30	70	100	4
Total		240+15	560+35	800+50	30
Total Semester V and VI		405	945	1350	46

CA: Continuous Assessment SEE: Semester End Examination

Note:

The above structure (Table-5 and Table-6) is for Sem-V and Sem-VI of the undergraduate B.Sc.-III programmes* under science faculty.

* B.Sc.-III Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology.

DSE: Discipline Specific Elective Core Course (When a Student opts a particular course^s as a principal course from the core courses opted at B.Sc.- II excluding Geography and Psychology).

\$ Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology

AECC: Ability Enhancement Compulsory Course **SEC:** Skill Enhancement Course

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC courses.

Programmes	Total Marks	Credits
B.Sc.-I	1200+100+50	52
B.Sc.-II	1300+50	56
B.Sc.-III	1250+100	46
Total	3750+250+50	154

PROGRAM OUTCOMES OF B.Sc. PROGRAM

PO1 Acquire skill, training and knowledge to enhance thinking, comprehension and application abilities to compete, succeed and excel globally.

PO2 Gain knowledge and experience (through theory, experiments, tutorials, projects and industrial / field visits), to achieve ultimate progress and improvement, to be capable of employment and meet the global competencies.

PO3 Identify, formulate and analyze problems. Create, select, and apply suitable techniques, resources, and modern scientific tools to accomplish verified conclusions with an understanding of the limitations.

PO4 Apply moral principles and commit to the norms of scientific practice in every endeavor. Validate expertise to conduct wide range of scientific experiments to solve problems.

PO5 Communicate efficiently scientific events with the Scientific community and with Society at large with capability to comprehend and pen operative reports and design documentation, make effective presentations, and give and receive clear instructions.

PO6 Reveal knowledge with thoughtful expression of the scientific principles in

one's own work, as an individual member and capable leader in a team, to manage projects in multidisciplinary environments.

Program Specific Outcomes:

PSO-1: Inculcate analytical/ critical, logical and innovating thinking and problem solving skills in the area of Zoology.

PSO-2: Use their knowledge to solve problems in society related to environment and wild life.

PSO-3: Acquire skills from Animal diversity to identify and classify the different animals from their surroundings.

PSO-4: Acquire skills about Evolution and Developmental biology of vertebrates.

PSO-5: Acquire the skills about organization of cells and it's related cell organelles structure and functions for the higher studies and for research.

PSO-6: Acquire skills in some of the specialized areas of fundamentals of biochemistry, Animal physiology, principles of ecology, Molecular biology, principles of genetics, Evolutionary biology, Animal behavior and chronobiology, Animal biotechnology and Biology of insect of their carrier development in higher education and research or related opportunities in industry.

PSO-7: Understand surrounding ecology and how they related to terrestrial and aquatic plant and animal conservation and management.

PSO-8: Identify species habitat requirement of different animals and their conservations.

PSO-9: Applied Zoology will allow students to employ the knowledge of zoology in entrepreneurship.

PSO-10: Acquire capability to communicate complex technical knowledge related to zoology in writing and oral skills.

PSO-11: To have competent problem-solving skills in the basic area of zoology.

PSO-12: Acquire skills about team work and ethical awareness and adopt scientific temper and leadership concerned for nation building.

PSO-13: Become flexible and versatile personality person in the work place.

B.Sc. III (Semester-V)

Zoology-IX (2231571)

Paper- -IX- DSE-1A Molecular Biology

[Credits -3, Total Hours-36 & Marks: 100]

Unit 1: Nucleic Acids

4

Structure and types of DNA and RNA, Watson and Crick model of DNA

Unit 2: DNA Replication

8

DNA Replication in prokaryotes and eukaryotes: Mechanism of replication and enzymes involved in replication (DNA polymerase, DNA primase, DNA helicase, DNA ligase, topoisomerase) leading strand, lagging strand and okazaki fragments

Unit 3: Transcription

8

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, transcriptional factors.

Unit 4: Translation

10

Process of protein synthesis in prokaryotes and eukaryotes: Ribosome structure and assembly, mechanism of translation: initiation, elongation and termination, Proteins (translational factors) involved in translation mechanism, amino-acyl tRNA synthetase and charging of tRNA; properties of genetic code and wobble hypothesis; Difference between prokaryotic and eukaryotic translation

Unit 5: Post Transcriptional Modifications and Processing of Eukaryotic RNA

6

Mechanism of Capping, Splicing (concept of exon and intron) and Polyadenylation of eukaryotic m- RNA and its significance.

CO1- Describe the Structure Of DNA and RNA .

CO2- Create Watson and Crick model of DNA.

CO3- Describe DNA Replication in Prokaryotes and Eukaryotes.

CO4-Describe process of transcription and translation in prokaryotes and eukaryotes.

CO5-Interpret post transcriptional modification of eukaryotic mRNA.

About the course:

The course provides an insight into the life processes at the subcellular and molecular levels. Other important aspects include DNA and molecular genetics including gene cloning, sequencing and gene mapping in addition to the powerful techniques that revolutionized the pharmaceutical, health and agricultural industry.

SUGGESTED READINGS:

- 1) 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.
 - 2) Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: Molecular Biology of the Cell, IV Edition.
 - 3) Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V-Edition, ASM Press and Sinauer Associates.
 - 4) De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
 - 5) Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI-Edition. John Wiley and Sons. Inc.
 - 6) Lewin B. (2008). Gene XI, Jones and Bartlett
 - 7) McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV-Edition. GS, Taylor and Francis Group, New York and London.
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Paper -X- DSE-2A: Principles of Genetics
Zoology-X (2231572)

[Credits -3, Total Hours -36 & Marks-100]

Unit 1 : Basic Concepts in Genetics

concept of genes and alleles, homologous chromosomes ,concept of homozygous and heterozygous , concept of dominance and recessive

4

Unit 2: Mendelian Genetics ,allelic and genetic interaction

10

Laws of Mendelian Inheritance: Law of dominance ,law of segregation and law of independent assortment , Allelic interactions: Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles; Gene Interactions: Supplementary, Complementary & Inhibitory interactions ,Examples of Sex-linked, sex-influenced and sex-limited characters inheritance.

Unit 3: Linkage, Crossing Over and Chromosomal Mapping

7

Linkage : Characteristics of genetic linkage ,types of linkage(complete and incomplete linkage)and crossing over, mechanisms of crossing over,steps of crossing over during meiosis, Recombination frequency as a measure of linkage intensity.

Unit 4: Mutations

8

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Causes of mutation:physical and chemical mutation.Detection of mutations: CIB method.

Unit 5: Sex Determination

4

Chromosomal mechanisms of sex determination; Human Genetic Disorders: Mechanism, symptoms, treatment: Down's Syndrome, Klinefelter's Syndrome and Turner's Syndrome

.Unit 6: Recombination in Bacteria and Viruses

3

Conjugation, Transformation, Transduction with examples

CO1- Elaborate basic concepts in genetics.

CO2- Describe mendelian inheritance pattern.

CO3-Describe various gene interaction .

CO4- Describe the mechanism of crossing over.

CO5-Describe the types of linkage.

CO6- Describe the various kinds of mutation and their importance .

CO7- Describe different mechanism of sex determination.

CO8- Describe recombination in bacteria.

About the course

The course is designed to revise basic concepts of Genetics and then move on to advanced concepts. Some key aspects include the mechanism of inheritance, gene structure and function, sex chromosomal and autosomal anomalies, aspects of human genetics, etc. will be covered. A strong emphasis will be laid on the modern tools and techniques used in genetics.

SUGGESTED READINGS:

- 1) Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India
 - 2) Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V-Edition. John Wiley and Sons Inc
 - 3) Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings
 - 4) Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings
 - 5) Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
 - 6) Fletcher H. and Hickey I. (2015). *Genetics*. IV Edition. GS, Taylor and Francis Group, New York and London
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Paper- -XI DSE-3A: Endocrinology
Zoology-XI (2231573)

[Credits -3, Total Hours -36 & Marks- 100]

Unit 1: Introduction to Endocrinology **10**

Brief introduction of endocrine glands, Classification, Characteristic and Transport of Hormones,

Unit 2: Epiphysis **06**

Location & structure of pineal gland, Secretions and their functions in biological rhythms and reproduction.

Unit-3: Hypothalamo-hypophysial Axis

5

Structure of hypothalamus, Hypothalamic nuclei and their functions, Regulation of neuroendocrine glands, Feedback mechanism.

Unit 4: Structure of pituitary gland, Hormones and their functions, Hypothalamo-hypophysial portal system, Control and Disorders of pituitary gland. **6**

Unit 5: Regulation of Hormone Action **9**

Hormone action at Cellular level: Hormone receptors, transduction and regulation
Hormone action at Molecular level: Molecular mediators, Genetic control of hormone action

CO1-Describe different endocrine glands and their hormones.

CO2- Describe the mechanism and explain the concept behind biological rhythms.

CO3- Describe the structure, function and regulation of neuroendocrine gland.

CO4- Explain the pituitary gland and its hormones and their functions ,control mechanism and their disorders.

CO5- Describe various hormone secreted by pituitary gland , control mechanism and their disorders.

CO6- Discuss the mechanism of hormone action.

About the course

The course envisages information on endocrine system with emphasis on the structure of hypothalamus and anterior pituitary. The associated hormones and the related disorders will be explained.

SUGGESTED READINGS

- 1) General Endocrinology C. Donnell Turner Pub- Saunders Toppan
- 2) Endocrinology: An Integrated Approach; Stephen Nussey and Saffron Whitehead.
- 3) Oxford: BIOS Scientific Publishers; 2001.
- 4) Hadley, M.E. and Levine J.E. 2007. Endocrinology, 6th Edition. Pearson Prentice-Hall, Pearson Education Inc., New Jersey
- 5) David O. Norris & J. A. Carr. Vertebrate Endocrinology, 6th Ed., Academic Press

Paper -XII- DSE-4A (I): Wildlife Conservation & Management
Zoology-XII (2231574)
[Credits -3, Total Hours -36 & Marks:100]

Unit 1: Introduction to Wild Life

4

Importance of wild life- positive and negative; Importance of conservation; Conservation ethics; ; World conservation strategies.

Unit 2: Evaluation and Management of Wild life

8

Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS (applications).

Unit 3: Management Planning of Wild life in Protected Areas

3

Estimation of carrying capacity; Eco tourism / wild life tourism in forests;

Unit 4: Population Estimation

7

Methods of population estimation: Sex ratio computation; Fecal analysis of ungulates and carnivores: Hair identification, Pug marks and census method.

Application of biostatistics in Biodiversity estimation: Analysis of Shannon and Simpson's Diversity Indices.

Unit 5: Protected areas

10

National parks & sanctuaries in India, Wetlands, Mangroves, Ramsar Sites, Zoogeographical regions of world and India, Biodiversity hotspots, Community reserve; important features of protected areas in India; Tiger conservation- Tiger reserves in India & its management challenges; Great Indian Bustard (GIB) Reserve & its management.

Unit 6: Wildlife Protection Acts and Conservation

4

Wildlife Conservation Laws in India; Concept of environmental movement, Origin of Environmental Movements in India, Some of popular environmental Social movements in India. Definition and concept of different categories of IUCN's Red Data list.

CO1- Describe importance of wild life and its conservation

CO2- Evaluate different requirement for the management of wild life.

CO3- Manage wild life tourism.

CO4- Estimate population of wild life.

CO5- Describe various socio environmental movements in India.

CO6- Classify animals under IUCN Red Data List.

CO7-Evaluate current events and public information related to wildlife conservation and management as being scientifically-based or opinion.

About the course

The course envisages information on wildlife management

SUGGESTED READINGS:

- 1) Caughley, G., and Sinclair, A.R.E. (1994). *Wildlife Ecology and Management*. Blackwell Science.
- 2) Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence?* Cambridge University.
- 3) Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*, 5 th edition. The Wildlife Society, Allen Press.
- 4) Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
- 5) Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing

OR

Paper- -XII- DSE-4A (II) ANIMAL BIOTECHNOLOGY
Zoology-XII(2231575)

THEORY (Credits -3, Total Hours-36 & Marks:100)

Unit 1. Introduction	4
Concept and scope of biotechnology	
Unit 2. Molecular Techniques in Gene manipulation	16
Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, , BAC, YAC, MAC ,Restriction enzymes: Nomenclature, detailed study of Type II. Southern, Northern and Western blotting DNA sequencing: Sanger method Polymerase Chain Reaction, DNA Finger Printing and DNA micro array	
Unit 3. Genetically Modified Organisms	8
Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection Applications of transgenic animals: Production of pharmaceuticals, production of donor organs,	
Unit 4. Culture Techniques and Applications	8
Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia) Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy	
CO1-Describe scope of Biotechnology.	
CO2-Describe Molecular Techniques in Gene manipulation .	
CO3- Explain importance of genetically modified organisms.	
CO4-Describe the process of animal cell culture.	
CO5-Evaluate applications of animal biotechnology in tissue engineering, and pharmaceuticals.	

SUGGESTED READINGS

- Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
- Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
- Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y.,USA.
- Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

SEMESTER –VI

Academic Council 5(5.2)
15th June, 2022

B.Sc. III-Zoology (Semester-VI)

Paper- -XIII- **DSE-1B** Animal Physiology: Life Sustaining Systems

Zoology-XIII (2231671)

[Credits -3, Total Hours -36, Marks:100]

Unit 1: Physiology of Digestion	7
Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Digestion and absorption in stomach and intestine; Role of bacteria in intestine;	
Unit 2: Physiology of Respiration	7
General mechanism of respiration in mammals, Pulmonary ventilation; Respiratory volume and capacities; Transport of oxygen and carbon dioxide in blood; Dissociation curves and the factors influencing it ; Control of respiration: Chemical & Nervous.	
Unit 3: Respiratory pigments: Types, structure and function	3
Hemoglobin, hemocyanin, chlorocruorin, haemoerythrin	
Unit 4: Renal Physiology	5
Structure of Kidney and its functional unit (nephron); Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance; Dialysis.	
Unit 5: Blood and Blood groups :	6
Haemopoiesis – Brief account, Components of blood – RBC, WBC & Platelets and their functions, Blood clotting system, Complement system & Fibrinolytic system, Types of Blood groups -ABO and MN type, Rh factor	
Unit 6: Physiology of Heart	5
Structure of mammalian heart; Origin, structure & working of heart beat (SA Node, AV Node & Purkinje’s Fibre), Coronary circulation; Pacemaker.	
Unit 7: Cardiac cycle:	3

Cardiac output and its regulation, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

CO1-Describe the process of digestion .

CO2- Discuss the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient. .

CO3-Explain the renal physiology.

CO4-Describe component of blood and types of blood groups.

CO5-Describe the process of Physiology of Heart.

CO5-Interpret the electrocardiogram .

CO6-Explain the blood pressure and it's regulation.

CO7-Compare the different respiratory pigments

About the course:

The course deals with various physiological functions in mammals. It also gives an account of the metabolic/ biochemical pathways and the probable impact of environment on them.

SUGGESTED READINGS

- 1) Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herculat Asia PTE Ltd. W.B. Saunders Company.
- 2) Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI-Edition John Wiley & sons,
- 3) Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- 4) Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

Academic Council 5(5.2)
15th June, 2022

Paper -XIV- **DSE-2B: Evolutionary Biology**

Zoology-XIV (2231672)
[Credits -3, Total Hours -36 & Marks:100]

Unit 1: Life Beginnings	5
Chemogeny, RNA world, organic evolution, Evolution of eukaryotes.	
Unit 2: Historical Review of Evolutionary Concepts	3
Lamarckism, Darwinism, Neo-Darwinism	
Unit 3: Evidences of Evolution:	7
Fossil record (types of fossils, transitional forms) geological time scale, evolution of horse, Recapitulation theory, Homologous and Analogous organs	
Unit 4: Population Genetics	7
Hardy-Weinberg Law: statement and derivation of equation, application of law to human Population; Evolutionary forces upsetting H-W equilibrium: Natural selection, genetic drift, mutation and migration.	
Unit 5: Product of Evolution:	8
Micro evolutionary changes - inter-population variations, clines, races, species concept, isolating mechanisms, modes of speciation—allopatric, sympatric & parapatric; Adaptive radiation/macroevolution as exemplified by Galapagos finches.	
Unit 6: Origin and Evolution of Man	6
Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens, molecular analysis of human origin; Socio-cultural evolution of man.	

- CO1- Explain the beginning of life on earth
- CO2- Describe various evolutionary theories .
- CO3- Identify types of fossil.
- CO4- Relate various evidences in the process of evolution .
- CO5-Describe products of evolution.
- CO6- Describe various stages of evolution of man

About the course

The course provides information about the patterns and processes of evolution above the species level. Besides elaborating the process of speciation, it also categorically differentiates between the three methods of phylogenetic analysis viz., evolutionary systematics, phonetics and cladistics.

SUGGESTED READINGS:

- 1) Ridley, M (2004) Evolution III Edition Blackwell publishing
- 2) Hall, B.K. and Hallgrimson, B (2008). Evolution IV Edition. Jones and Barlett Publishers.
- 3) Campbell, N.A. and Reece J.B (2011). Biology. IX Edition. Pearson, Benjamin & Cummings.
- 4) Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
- 5) Pevsner, J (2009). Bioinformatics and Functional Genomics. II Edition Wiley-Blackwell

**Paper -XV- DSE-3B: ANIMAL BEHAVIOUR AND
CHRONOBIOLOGY**

Zoology-XV (2231673)
[Credits -3, Total Hours -36 & Marks: 100]

Unit 1: Patterns of Behavior

8

Stereotyped Behaviours (Orientation, Reflexes); Instinct vs. Learnt Behavior; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit 2: Social Behavior

5

Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging & dance language in honey bee and its advantages.

Unit 3: Sexual Behavior

5

Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter- sexual selection (female choice).

Unit 4: Introduction to Chronobiology

9

Historical developments in chronobiology; Biological oscillation: the concept of average, amplitude, phase and period. Adaptive significance of biological clocks.

Unit 5: Biological Rhythm

9

Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Photoperiod and regulation of seasonal reproduction in vertebrates; Role of melatonin in biological rhythms.

CO1- Describe various types of behavioral pattern.

CO2- Describe various types of social behavior in animals

CO3- Describe various sexual behavior in animals

CO4- Describe various aspects in chronobiology

CO5- Describe types and characteristics of biological rhythm

About course:

Many animal species have a sort of internal clock, called a biological clock, which predicts cyclical environmental change and prepares the animal to deal with it. Biological rhythms are self –sustaining natural cycles of animal life history which maintain themselves regardless of the environmental factors

SUGGESTED READINGS:

- 1) David McFarland, *Animal Behaviour*, Pitman Publishing Limited, London, UK.
- 2) Manning, A. and Dawkins, M. S, *An Introduction to Animal Behaviour*, Cambridge, University Press, UK.
- 3) John Alcock, *Animal Behaviour*, Sinauer Associate Inc., USA.
- 4) Paul W. Sherman and John Alcock, *Exploring Animal Behaviour*, Sinauer Associate Inc., Massachusetts, USA.
- 5) *Chronobiology Biological Timekeeping*: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc.Publishers, Sunderland, MA, USA
- 6) *Insect Clocks* D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D.Lewis. (3rdEd) 2002 Baren's and Noble Inc. New York, USA
- 7) *Biological Rhythms*: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

Paper -XVI- DSE-4B (I): Applied Zoology

Zoology-XVI (2231674)

[Credits -3, Total Hours 36 & Marks: 100]

UNIT 1: Fisheries:

9

Inland Fisheries; Marine Fisheries, Fishing crafts and Gears; Designing and construction of Fishing tanks, Fish Culture, Breeding Pond, Fish Seed, Hatching pond. Transport of fish fry to rearing ponds. Harvesting, preservation of fish. Fresh water fish varieties for small scale fishery, Food and feeding, Fish farm management, Common fish diseases; Economic importance. morphometric analysis of Fishes length, weight to determination.

UNIT 2: Apiculture:

5

a) Apiculture: Species of honey bees in India. Life history of *Apis*. Methods of Bee keeping. Bee products and their uses. Natural enemies and their control.; Medicinal value of honey; Importance of bee colonies in crop pollination.

Unit-3:Cattle and Buffalo breeding and Dairy

6

Cattle and Buffalo Breeds, Cattle and Buffalo farm and shed, Food and feeding, Farm management, various Equipment's required for farm management. Diseases, Breeding, Economic importance. Techniques of dairy management. Milk and milk products.

Unit 4:Sericulture

5

Types of silk; Silkworms and their host plants; Mulberry silkworm culture; Life history of silkworm Rearing of silk worm and farm management, various Equipment's required for farm management.; Natural enemies and their control, Silk marketing.

Unit 5: Poultry Management

6

Types of breeds. Rearing method. Diseases and control measures. Housing and Equipment, Deep litter System, Laying cages, Methods of brooding and Rearing,. Feed formulations for chicks, Diseases of fowl. Nutritive value of egg and meat. Incubation and hatching of eggs.

UNIT 6: Vermiculture

5

Species of earthworms for rearing, Design of vermiculture pit, preparation of vermi bed, Vermiculture pit management, , Vermiwash, vermicompost, enemies and diseases, commercialization of vermicompost.

CO1- Describe various fishing strategies

CO2- Use honeybees for economical production of honey

CO3- Manage milk production and preservation and maintaining

CO4- Rear silk worms for production of silk by using different equipments.

CO5- Manage poultry farm with different breeds.

CO6- Rear earthworms for production of vermicompost .

About course:

Applied Zoology is the enterprise of raising or harvesting of fishes, honey bees,earthworms,silkworms, poultry birds and dairy industry. It will allow students to employ the knowledge of zoology in entrepreneurship.

SUGGESTED READINGS

- 1) Q Bone and R Moore, Biology of Fishes, Talyor and Francis Group, CRC Press, U.K.
- 2) D. H. Evans and J. D. Claiborne, The Physiology of Fishes, Taylor and Francis Group, CRC Press, UK von der Emde, R.J. Mogdans and B.G. Kapoor. The Senses of
- 3) Fish: Adaptations for the Reception of Natural Stimuli, Springer, Netherlands
- 4) C.B.L. Srivastava, Fish Biology, Narendra Publishing House
- 5) J.R. Norman, A history of Fishes, Hill and Wang Publishers
- 6) S.S. Khanna and H.R. Singh, A text book of Fish Biology and Fisheries, Narendra Publishing House

Academic Council 5(5.2)
15th June, 2022

OR

Paper -XVI- DSE-4B (II) BIOLOGY OF INSECTA

Zoology-XVI (2231675)

THEORY (Credits 3, Total Hours -36 & Marks:100)

Unit 1: Introduction	3
General Features of Insects	
Distribution and Success of Insects on the Earth	
Unit 2: Insect Taxonomy	3
Basis of insect classification; Classification of insects up to orders	
Unit 3: General Morphology of Insects	6
External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits	
Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat	
Abdominal appendages and genitalia	
Unit 4: Physiology of Insects	16
Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system	
Sensory receptors Growth and metamorphosis.	
Unit 5: Insect Plant Interaction	4
Theory of co-evolution, role of allelochemicals in host plant mediation	
Host-plant selection by phytophagous insects, Insects as plant pests	
Unit 6: Insects as Vectors	4
Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors	

- CO1-Classify different insect.
- CO2-Identify different insects.
- CO3-Describe physiology of insect.
- CO4-Explain insect plant interaction.
- CO5-Illustrate insects as vectors.

SUGGESTED READINGS

- A general text book of entomology, Imms , A. D., Chapman & Hall, UK
- The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
- Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
- Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
- The Insect Societies, Wilson, E. O., Harward Univ. Press, UK
- Host Selection by Phytophagous insects, Bernays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
- Physiological system in Insects, Klowden, M. J., Academic Press, USA
- The Insects, An outline of Entomology, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell, UK
- Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA

Academic Council 5(5.2)
15th June, 2022

B.Sc. III-Zoology

Practical Syllabus

(Where ever possible use virtual /CD/ Videos /models/simulations should be used during practical demonstration)

ZOOLOGY PRACTICAL –IV (2231676)

Paper No. based on : Papers- IX & XIII-

DSE-1A Molecular Biology

AND

DSE- 1B Animal Physiology: Life Sustaining Systems

(Credits-4, Total Hours- 48 & Marks:100)

DSE-1A Molecular Biology:-Practicals

- 1) Construct a Paper Model of DNA by using given nucleotides.
- 2) Molecular Biology: Isolation of DNA from suitable material
- 3) Chromatography: Demonstration/ Separation of amino acids using paper chromatography by TLC
- 4) Quantitative estimation of DNA using colorimeter (Diphenylamine reagent)
- 5) Quantitative estimation of RNA using Orcinol reaction
- 6) Demonstration of DNA and RNA using methyl green pyronine
- 7) Demonstrate of retrieval of gene sequence using bioinformatics tools - NCBI, Entrez, BLAST-
-hemoglobin / insulin-- gene /protein in FASTA format.
- 8) Electrophoresis: Demonstration of separate of protein /DNA by/Agarose/PAGE method
- 9) Codon Analysis: To find out codon sequences for known polypeptide chain of ten amino acids or to find out amino acid sequence from given codons (chart will be provided)
- 10) Karyotyping: Study of human Karyotype(s): Normal male and female (Classification of chromosomes according to size and position of centromere); Down syndrome, Klinefelter's syndrome, Turners syndrome using pictures of karyotypes &

Idiograms

DSE- 1B Animal Physiology: Life Sustaining Systems:- Practicals

1. Estimation of salivary amylase activity
2. Measurement of blood pressure and heart beat under normal and any two physical stress condition.
3. Determination of Body Mass Index (BMI)
4. Enumeration of Red Blood Cells (RBCs) and White Blood Cells (WBCs) using haemocytometer.
5. Differential count of WBCs using Leishman's/Geimsa stain
6. Estimation of haemoglobin and carrying capacity of blood.
7. Preparation of haemin crystals
8. To determine blood clotting time using capillary method
9. Determination of abnormal and normal constituents of urine
10. Estimation of normal oxygen (O₂) consumption using any aquatic animal and /or effect of temperature on the rate of oxygen consumption
11. Histological studies of mammalian organs: oesophagus, stomach, duodenum, ileum, rectum, liver, trachea, lung, kidney
12. Estimation of uric acid from sample
13. **Field Visits:** Visit to medical college / Hospitals / blood bank / **Pathology lab/ IVF center, / Biotechnology lab / survey, sample collection and Data analysis (optional) / Pranayam and yoga meditation center for study and submission of report (*Subject to UGC guidelines)**

ZOOLOGY PRACTICAL –V (2231677)

Paper No. based on : Papers- X &XIV

DSE- 2A Principles of Genetics

AND

DSE- 2B Evolutionary Biology

(Credits-4, Total Hours- 48 & Marks:100)

Practicals:-

DSE- 2A Principles of Genetics

1. Examples in Genetics based on Monohybrid ratio (05 examples)
2. Examples in Genetics based on Dihybrid ratio (05 examples)
3. Examples based on multiple alleles: Blood groups, Coat color in rabbit (05 examples)
4. Examples based on gene interactions (Complementary, Supplementary & Inhibitory interactions) (05 examples).
5. Examples based on human genetic traits: Rolling tongue, free & attached ear lobes, hitchhiker's thumb, PTC taste, Widows Peak Hairline (01 example from each)
6. Laboratory culture of *Drosophila* to study its life cycle
7. Study of normal genetic traits of *Drosophila* using cultured material
8. Pedigree analysis of some human inherited traits
9. Fieldwork to collect data on genetic diseases from local hospitals

Practicals:-

DSE- 2B Evolutionary Biology

1. Study of types of fossils using samples available in Zoology and Geology Lab./or models (for eg. Limulus, Peripatus, Dipnoi, Sphenodon, *Archaeopteryx*, examples based on: Molluscan, Echinoderms, Brachiopods and as available in laboratory)
2. **Study of Allopatric and sympatric speciation with respect to continental drift with examples**
3. **Study of recapitulation theory and phylogeny examples based given chart or Model.**
4. Study of macroevolution using Darwin's Finches using charts/models

5. Study of homologous and **analogous** organs from suitable specimens/models in the museum
6. Study of evolutionary stages of man from suitable specimens/ models in the museum
7. Study of adaptive radiation in mammals from museum specimens/models
8. Examples based on Hardy Weinberg Law (**05 examples**)
9. Study of phylogeny of horse using model/charts (reconstruction using limbs and teeth of horse ancestors)
10. **Study of geological time scale**/Construction of phylogenetic tree using bioinformatic tools/software (Searching sequences of any five genes or proteins using biological databased (NCBI, GenBank or DDBJ, construct phylogenetic tree using Clustal X, Phylip, NJ & submit the report).
11. Visit to natural history museum and submission of report
12. **Project work-** Research project should be prepared in consultation with faculty either individually or in group as required. The research guide will support students in selecting and executing the entire topic and preparing the report for final submission during examination after approval of the guide in the following format-
 - (a) Format of Report: Title, Introduction, Review of literature, Objectives, Material and Methodology, Result and discussion, Conclusion & References
 - (b) Submission & presentation of research work: At the time of practical examination submit the final project report (hard copy) and present your research findings using PowerPoint.

ZOOLOGY PRACTICAL –VI (2231678)

Paper No. based on: Papers- XI & XV

DSE- 3A Endocrinology

AND

DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

(Credits -4, Total Hours- 48 & Marks:100)

Practicals:- DSE- 3A Endocrinology

1. Identification explanation of endocrine glands in rat using model / virtual method
2. Study of the permanent slides of endocrine glands: Pineal, pituitary, testis, ovary and placenta
3. Observation of insect life cycle and its hormonal control- metamorphosis
4. Observation of amphibian metamorphosis and its hormonal control.
5. Study of circadian functions in human and its correlation with hormones (daily eating & pre & post-meal insulin level, sleep & role of melatonin and day length & body temperature w. r. t. hypothalamus).
6. To study cyclical variation in body temperature during menstrual cycle using model/chart
7. To study flight and fight behavior to understand reflex action and role of adrenal hormone
8. To collect data on hormonal disorders from local hospitals and its interpretation
9. Hormonal regulation of reproductive hormones in human with age using chart
10. Study of contraceptive pills with reference to hormone and its mechanism
11. Visit to IVF centre/hospital and submit a report

Practicals:- DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

1. Observation of nests and nesting behavior of the birds.
2. Observation of termatoria of ants and termites.
3. Study and observation of casts in ants and honey bees.
4. Observation of geotaxis behaviour in earthworm.
5. Observation of phototaxis behaviour in insect larvae.
6. Observation of intra-specific behavior: Dancing behavior in honey bees; flocking behavior in birds and Courtship behavior in Great Indian Bustard and Peacock (virtual)

7. Observation of inter-specific behavior between: Ant-*Acacia*, Buffalo-cattle egret, Fig-wasp pollination, Root nodules-bacteria, Tick-dog using models/charts/museum specimens

8. Recording and interpretation of calls, songs, vocalizations of insects (e.g. cricket), amphibians, birds and mammals and their importance in signaling behavior (based on actual records or internet collection)
9. Observation of foraging behavior in ants to study chemo-signaling
10. Observation of foraging behavior in *Calotes*, *Hemidactylus*, *Chameleon* and *Naja*
11. Observation of nest parasitism in Asian koel
12. **Study tour** /:
 - (a) Agriculture research center, Yoga & Meditation center, Biotechnology lab, etc.
 - (b) summer or winter training programmes/workshops/field survey with NGOs & GOs: students can work in various institutes/laboratories/NGOs etc. for period up to 07 days and prepare a report for submission during exam
 - (c) Visit to Forest/ Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.

ZOOLOGY PRACTICAL –VII (2231679)

Paper No. based on: Papers- XII & XVI
(Credits-4, Total Hours- 48 & Marks: 100)

DSE 4 A(I)- Wildlife Conservation & Management(Papers- XII)

OR

DSE 4 A (II)Animal Biotechnology (Papers- XII)

AND

DSE 4B(I)- Applied Zoology (Paper -XVI)

OR

DSE 4 B (II) BIOLOGY OF INSECTA (Paper-XVI)

Practicals:-DSE 4 A(I)- Wildlife Conservation & Management (Papers- XII)

1. Temporary preparation to study of faunal diversity of zooplanktons/insects/mollusca from surrounding area
2. Study of faunal diversity (amphibians, reptiles, birds and mammals) from campus & surrounding area
3. Demonstration of basic tools for field studies: Binocular, Global Positioning System, Cameras, Plankton & butterfly collecting net, insect collecting bottles, Mounting chamber for insects & preservation of museum specimens
4. Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
5. Casting of pug marks of common animals using plaster of Paris in and around campus
6. To perform line transect and quadrat method to study diversity in and around campus
7. To calculate species richness, abundance and Shannon diversity indices from collected data
8. Study of endangered species from India, their bio-geographic distribution and conservation status: Great Indian Bustard, Jerdon's Courser, Lesser Florican, Asian Elephant, Nilgiri Tahr, lion-tailed macaque, Nilgiri Langur, Lion, Sarus crane, Ganges River Dolphin, Hoolock Gibbon, Wild Ass, Olive Ridley Sea Turtle, Indian Pangolin, Leopard Cat.
9. Study of IUCN Categorization of Red List of animals (Data deficient, Least concern, Near Threatened, Vulnerable, Endangered, Critically endangered, Extinct in wild and Extinct)
10. Visit to local/state/national wildlife sanctuary or protected area or zoo, aquatic resources / Sea shore/ water

OR

Practical-DSE 4 A (II) ANIMAL BIOTECHNOLOGY

Practicals:- (**Papers- XII**)

1. Genomic DNA isolation from E. coli
2. Plasmid DNA isolation (pUC 18/19) from E. coli
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided..
6. To study following techniques through photographs
 - a. Southern Blotting
 - b. Northern Blotting
 - c. Western Blotting
 - d. DNA Sequencing (Sanger's Method)
 - e. PCR
 - f. DNA fingerprinting
7. Project report on animal cell culture

AND

Practicals: - DSE 4B(I)- Applied Zoology (Paper-XVI)

1. Morphometric and meristic characters of fishes (Length, width, weight, fins, scale type etc.)
2. Identification of major carps (*Labeo*, *Catla*, *Mrigal*, *Cyprinus*)
3. Preparation and study of temporary mount of cycloid and placoid scale from preserved specimens
4. Preparation and study of models of crafts, gears and their importance in Fisheries
5. Analysis of water quality parameters for Aquaculture: estimation of pH, Total Dissolved Solids (TDS); dissolved O₂ and free CO₂ and hardness of given sample.
6. Study of honey bee morphology and identification of castes in honey bees (museum specimens/charts/specimens)
7. Observation of life cycle of mulberry silkworm, *Bombyx mori* (model/chart/specimens) and life cycle of tasar silkworm, *Antheraea mylitta*, **sericulture equipments**.
8. Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized eggs (Light test, Cracking test).
9. Study of common dairy and poultry breeds in Solapur district
10. Study of N,P,K constituents of vermicompost.
11. Demonstration of induced breeding in Fishes (video/model)
12. **Tour/Review of research:**
 - a) Excursion/Study Tour:- Visit to any National Parks/ Zoo parks / visit to any fish farm/ pisciculture unit/or Lab./marine water / freshwater habitat / Wildlife Sanctuaries / National or State Research Institutes / University departments / or other appropriate Institutes/poultry/dairy/sericulture units.

OR

b) Review of research work / student research publication: Review of 10 research papers related to zoology or life science and to prepare a review articles of minimum 5-10 pages

OR

c) Publication of one research paper in a peer reviewed journal in collaboration with teacher (accepted/published or presented research paper in seminar/conferences/symposia and submission of copy of presented paper with certificate

OR

DSE -4B(II) BIOLOGY OF INSECTA (Paper-XVI)

Practical:

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Study of insect spiracles
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of Apis, Camponotus and Odontotermes
8. Study of any three insect pests and their damages
9. Study of any three beneficial insects and their products

Field study of insects and submission of a project report on the insect diversity

Note:

1. Kindly note that during field visits students shall observe only animals and make record of the observations without disturbing natural habitat not kill the animals. Students should be told about the importance of biodiversity and conservation;
2. Students are encouraged to prepare and submit a concise report of the excursion;
3. Report on multiple excursion tours may be clubbed for preparing and submitting report at the time of final examination will be allowed;
4. Reduce or avoid the use of plastic files during submission of reports / projects as an ecofriendly method

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Skeleton paper for practical examination (Examination for 70 Marks)

Practical – I

Practical – I:- Papers- IX & XIII- DSE-1A Molecular Biology

AND

DSE- 1B Animal Physiology: Life Sustaining Systems

Question	Marks
Que:1- Isolation of DNA from given material /DNA estimation/RNA estimation	10
Que:2- Example(s) based on codon analysis / bioinformatics	10
Que:3- Estimation/enumeration of- haemoglobin/RBC/WBCs/salivary amylase /uric acid from sample/BMI	10
Que:4- Preparation of haemin crystals from given sample/Differential count of WBCs/Estimation of O ₂ consumption from aquatic animals/ Determination of blood clotting time/ abnormal and normal constituents of urine	10
Que:5- Spottings based on: a)Identify and describe: analysis karyotype b)Identify and describe: analysis of nucleotides separated using electrophoresis c)Identify and describe: methyl green pyronin-tissue /stained image d)Identify, sketch and describe: T.S. of esophagus, stomach, duodenum, ileum e)Identify, sketch and describe: T.S. of rectum, liver, trachea, lung, kidney	10
Que:6- Submission of Field Visit Report (any one of): Visit to local water bodies for collection of planktons / Visit to medical college/ blood bank / IVF center/yoga center	10
Que:7- Journal & Viva	10

Practical –II Papers- X&XIV (Examination for 70 Marks)

DSE- 2 A Principles of Genetics AND

DSE- 2B Evolutionary Biology

Questions	Marks
Que:1- Example based on monohybrid/dihybrid ratios/supplementary /complementary interactions/Multiple alleles (any one)	10
Que:2- Construction of pedigree analysis of given data/example	05
Que:3- Example based on Hardy-Weinberg Law (any one)	10
Que:4- Construction of phylogenetic tree using bioinformatics tool/ Geological time scale/Types of fossils /Evolution of horse/Evolutionary stages of man.	05
Que:5- Spottings based on: a) Identify and describe: Human genetic traits (rolling tongue, free & attached ear lobes, hitch-hikers thumb, widow's peak, PTC taste) b) Identify and describe: Genetic traits of Drosophila (any one) c)Identify and describe: types of fossils (Limulus, Peripatus, Archaeopteryx, Sphenodon etc.) d)Identify, sketch and describe:Zoogeographic zones/biogeographic zones/ Allopatric speciation /Sympatric speciation /macroevolution using charts/models/photographs e) Identify, sketch and describe: Analogous/homologous organs/adaptive radiation using	

charts/models/photographs/museum specimens	10
Que:6 -Submission of Research Project Report & PPT presentation	20
Que:7 -Journal & Viva	10

Practical –III Papers- XI & XV(Examination for 70 Marks)

DSE- 3A Endocrinology AND

DSE- 3 B ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

Questions	Marks
Que:1 -Identify, sketch and discuss location, structure and function of endocrine glands of rat from model/chart (any two)	10
Que:2 -Identify, sketch and discuss: insect life cycle & its hormonal control/amphibian metamorphosis & its hormonal control	10
Que:3 Discuss the behavior & its significance: Nest/termatoria/geotaxis/phototaxis/foraging (model/chart/museum specimens)	10
Que:4 -Identify and interpret behavioral significance of call/song/vocalization (any 01 from journal)	10
Que:5 - Spotting's based on:	10
a) Identify and describe: Temperature variation during menstrual cycle/Circadian cycle & its hormonal correlation (any 01 from journal)/ -Interpret the given behavioral interaction: ant-Acacia; buffalo-cattle egret; fig-wasp; root nodules-bacteria; tick-dog based on model/chart/museum specimens	
b) Identify and describe: Flight & Fight response/contraceptive pill/	
c) Identify and describe: hormonal regulation of reproduction	
d) Identify and describe behavior: Dancing/flock/courtship	
e) Identify and describe: Casts in honey bee	10
Que:6. Study tour / Internship:	
(a) Agriculture research center, , Biotechnology lab, etc.	
(b) Summer or winter training programmes/workshops/field survey with NGOs & GOs: students can work in various institutes/laboratories/NGOs etc. for period up to 07 days and prepare a report for submission during exam	
(c) Visit to Forest/ Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.	
Que:7 -Journal & Viva	10

Practical –IV Papers- XII & XVI (Examination for 70 Marks) (Any 2)

DSE 4 AI- Wildlife Conservation & Management (35 marks) &
DSE 4BI- Applied Zoology(35 marks)

OR

DSE 4A II Animal Biotechnology (35 marks)
DSE-4BII Biology of insecta (35 marks)

DSE 4 AI- Wildlife Conservation & Management((Examination for 35 Marks)

Question	Marks
Que:1- Calculate Shannon Diversity Indices from given data	10
Que:2- Perform line transect/quadrat method to study diversity	10
Que:3- Perform temporary mount & identification of zooplanktons/insects/mollusca from given sample/	05
Que:4 Spottings based on:	05
a)Identify and describe: GPS/Binocular/Plankton collection Net/camera	
b)Identify and describe: Pug mark.	
c)Identify and describe bio-geographical distribution of endangered species from India (any 01 from journal)	
d)Identify and describe: IUCN categorization of given fauna	
e) Identify and describe (Amphibians/Reptiles/Birds/Mammals) (any 01 from journal)	
Que:5 -Journal	05

DSE 4B I- Applied Zoology ((Examination for 35 Marks)

Que:1- Perform estimation of O ₂ /CO ₂ /Hardness/TDS from given sample/biostatistics example	10
Que:2- Perform temporary mount of cycloid/placoid scales from preserved/specimens	05
Que:3- Spottings based on:	05
a)Identify and describe morphology & economic importance of fish.	
b) Identify and describe types of castes of honey bees.	
c) Identify and describe poultry breeds (chart/photo)-Any 01 from journal	
d) Identify and describe dairy breeds (chart/photo)-Any 01 from journal	
e)Identify and describe: any 01 cast or gear from journal	
Que:4- a) Excursion/Study Tour:- Visit to any National Parks/ Zoo parks / visit to any fish farm/ pisciculture unit/or Lab./marine water / freshwater habitat / Wildlife Sanctuaries / National or State Research Institutes / University departments / or other appropriate Institutes//poultry/dairy/sericulture units.	10

OR

b) Review of research work / student research publication: Review of 10 research papers related to zoology or life science and to prepare a review articles of minimum 5-10 pages

OR

10

10

c)Publication of one research paper in a peer reviewed journal in collaboration with teacher (accepted/published or presented research paper in seminar/conferences/symposia and submission of copy of presented paper with certificate

Que:5 Journal & Viva

05

OR

DSE 4AII Animal Biotechnology (35 marks)

Question	marks
Que 1-Isolate the genomic DNA from given bacterial cell culture of E.coli.	10
Que 2- Isolate the plasmid DNA from given bacterial cell culture of E.coli.	10
Que 3- Amplified the given DNA sample by using PCR/Proceed for the restriction digestion of plasmid DNA from given sample/Preparation of circular and linear map from the data provided /Identification /Study the technique from animal biotechnology (through photographs)	
a)Southern blotting	
b) Western blotting	
c) DNA sequencing	
d)DNA fingerprinting	10
Que 4-Journal	05

DSE-4B II Biology of Insecta (35 marks)

Question	marks
Que 1-. Describe the method of collection and preservation and identification of given insect.	05
Que 2-. Identification	10
1) Identify ,classify and describe the given insect.	
2) Identify and describe legs of honey bee.	
3) Identify and describe antennae of given insect.	
4) Identify sketch and label the mouth parts of given insect.	
5) Identify and describe insect product.	
Que 3- Describe damage caused by the following insect.	05
Que 4- Project.	10
Que 5- Journal.	05

Important Instructions:

-All necessary precautions must be taken while organizing study tour with special reference to the safety of students as per Higher Education rules and regulations.

Note:

-As per the guidelines of UGC notification number F.14-6/2014(CPP-II) dated 1stAugust, 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.

Academic Council 5(5.2)
15th June, 2022

CERTIFICATE COURSE (SEC-3)
NUTRITION AND BODY WEIGHT MANAGEMENT (2231376)
(Credits-2, Total Hours- 30 & Marks:50)

Objective of the course:

- 1) To under the parameters of over and under weight
- 2) To control obesity and related problems
- 3) To understand components healthy diet
- 4) To understand physiology behind weight reducing mechanism

Course duration: 30 contact hours

Credits- 2

Faculty: Dr. Bagale M.B. , Mr. Patil S.S. Miss. Trupti Awtade, Dr. Anand Chavan (exercise expert)

Structure and Scheme of Marking for compulsory Skill Enhancement course (2021-2022)

Paper	Total lectures	Examinations			Total credits
		CA	SEE	Total	
Theory	30	15	35	50	2

Marking Scheme and Award of grades

For the successful completion of course, each student must secure grades as given below:

Less than 40%	Fail
Marks between 40-60%	'B' Grade
Marks above 60%	'A' Grade

Syllabus: Theory (Contact hours-30)

Sr. No	Title	Contact hours
1	Concept of weight- Over weight, Under weight and Obesity and BMI	3
2	Nutrition- Proteins – Structure, Function, importance and sources	3
3	Nutrition- Carbohydrates – Structure, Function, importance and sources	3
4	Nutrition- Lipids – Structure, Function, importance and sources	3
5	Nutrition- Vitamins – Structure, Function, importance and sources	3
6	Nutrition- Minerals and others – Structure, Function, importance and sources	3
7	Physiology of digestion, absorption and assimilation	3
8	Physiology of circulation- Blood pressure, heart rate,	3
9	Physiology of Energy – Concept, Mechanism of generation energy expenditure, BMR	3
10	Physiology of stress and exercise	3

Course Outcome: Student will be able

1. to understand the parameters of over and under weight
2. to control obesity and related problems
3. to understand components of healthy diet
4. to understand physiology behind weight reducing mechanism

References:

- 1) Essentials Of Medical Physiology by K Sembulingam, Prema Sembulingam
- 2) Guyton and Hall Textbook of Medical Physiology (Guyton Physiology)
- 3) Molecular Biology of Cell by Bruce Alberts
- 4) Eat, Drink and be Healthy : The Harvard Medical School Guide to healthy eating by Walter Willet
- 5) The Baby Elephant Diet: A Modern Indian Guide to Eating Right by Ravi Mantha
- 6) Physiology of Sport and Exercise, Fourth Edition by Jack H. Wilmore
- 7) Exercise Physiology A Textbook by William D McArdle
- 8) Biochemistry A Textbook by U Satyanarayan

Academic Council 1(6)
2nd July, 2020

Skill Enhancement Course

Title: Bio fertilizers and Soil health management Total Credits: 04

SEMESTER – III PAPER – I Basics of Biofertilizers Credits:

Unit – I Types of soil, and Soil structure, components of soil (Organic and inorganic), soil profile, Soil health and fertility, water holding capacity of soil,

Unit II: Cation Exchange Capacity (CEC) and Base Saturation, Soil pH and effect of pH on nutrient availability and uptake, Soil acidity and alkalinity, Soil reaction in terms of degree of acidity and alkalinity.

Unit III: Types of nutrients for plant growth. Physiological roles and deficiency symptoms of essential nutrients, Symbiotic & Non-Symbiotic Nitrogen fixation, solubilisation of Phosphorus.

Unit IV: Introduction and scope of Biofertilizers, Types and classification of Biofertilizers. Different Nitrogen Biofertilizers, Nodule formation, Competitiveness, Associative and Free-living Nitrogen fixation. Cyanobacterial Biofertilizers

Unit V Phosphate solubilising Bacteria and Fungi. VAM in detail. Potassium and Zinc Biofertilizers. Phosphate mobilizing microorganisms. Plant Growth Promoting Bio fertilizers (PGPR).

Unit VI. Vermicompost: Design of vermiculture pit, types of earthworms for rearing,

Unit - VII

Unit IV 18. Production technology; Strain selection, Sterilization, Growth and Fermentation. Mass scale production of different carrier and liquid based biofertilizers, FCO specifications and quality control of biofertilizers.

20. Microbes beneficial for recycling of Organic wastes & Composting. 21. Bio remediators and its related Microbes. 22. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers – Storage, shelf life and marketing. Factors influencing the efficacy of Biofertilizers.

SEMESTER – V PAPER – BIOFERTILIZERS 9. Isolation of Nitrogen fixing organisms Rhizobium, Azotobacter. 10. Isolation of Phosphate solubilizing mobilizing microbes from soil sample. 11. Development & production of efficient Microbes. Preservation and pure cultures development. 12. Study of Nitrogen fixing Activity by ARA method. 13. Production of Indole Acetic Acid (IAA). 14 Production of Siderophores. 14.

Preparation of different Carrier based Biofertilizers. Bacterial and Fungal. 15. Study the Quality parameters of Biofertilizers

Practicals: Introduction to different microorganisms used in biofertilizer production

Introduction, definition, types, scope of biofertilizers

Isolation of Phosphate solubilizing micro-organisms from rhizosphere

Isolation of Rhizobium from root nodules of leguminous crop

Isolation and purification of Azotobacter from soil

Isolation and purification of Beijerinckia form soil

Isolation of Azospirillum

Isolation Blue Green Algae from soil

Isolation of organic matter decomposing microorganisms

Mass multiplication of Rhizobium, Azotobacter, and Azospirillum inoculum

Production and application of blue green algae

Production of Azolla biofertilizers

Methods of application of biofertilizers

Standards for commercial production of biofertilizers- Quality control of biofertilizers.

Nature of Question Paper

Certificate course in

Time: 2 hr Total Marks: 35

Q. 1. Choose the most correct alternative for the following and rewrite the sentence. 11

1) -----

a) b) c) d)

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

Q. 2. Answer any four of the followings. 08

i)

ii)

iii)

iv)

v)

Q. 3. Answer any two of the followings. 08

i)

- ii)
 - iii)
- Q. 4. Write note on any two of the following. 08
- i)
 - ii)
 - iii)

Chairman
BOS in Zoology

Academic Council 5(5.2)
15th June, 2022

CBCS BSc. PART III SEMESTER V

AECC- C

ENGLISH FOR COMMUNICATION-III (2231301)

SEE- 35 + CA- 15 = 50 marks

**COURSE CREDITS 03L+0IT=04
60**

COURSE CONTACT HOUR

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:

Module I: Prose

1. The Gift of the Magi: O' Henry
2. The Homecoming: Rabindranath Tagore
3. The California's Tale: Mark Twain

Module II: Poetry

1. The Solitary Reaper: William Wordsworth
2. The Queen's Rival: Sarojini Naidu
3. Oh! How I faint When I
of You Do Write (Sonnet No 80) : William Shakespeare
4. The Road Not Taken: Robert Frost

Module. III: Pronunciation Skills

- 1) Basic Sounds in English
- 2) IPA Symbols
- 3) Phonetic Transcription
- 4) Stress and Intonation

Module. IV: Soft Skills

1. Types of 21st Century Skills
2. Learning Skills (4Cs)
3. Preparation for Employment

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University, Solapur (With 20% new additions & changes)

CBCS BSc. PART III SEMESTER VI

AECC- D

ENGLISH FOR COMMUNICATION-IV (2231401)

SEE- 35 + CA- 15 = 50 marks

**COURSE CREDITS 03L+0IT=04
60**

COURSE CONTACT HOUR

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:

Module. I: Prose

- | | |
|----------------------------------|----------------|
| 1. Growing Up: | Joyce Cary |
| 2. God See the Truth, but Waits: | Leo Tolstoy |
| 3. On the Rule of The Road: | A. G. Gardiner |

Module. II: Poetry

- | | |
|---------------------|-----------------|
| 1. Sita: | Toru Dutt |
| 2. My Last Duchess: | Robert Browning |
| 3. Ode to Beauty: | John Keats |

4. Song: Go and Catch a Falling Star: John Donne

Module. III: Grammar

1. Simple and Multiple Sentences
2. Direct and Indirect Speech

Module. IV: Soft Skills

1. Literacy Skills
2. Life Skills
3. Employability Skills

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University Solapur (With 20% new additions & changes)

**Chairman
BOS in English**