



JECRCTM
UNIVERSITY
BUILD YOUR WORLD

School of Sciences

Department of Zoology

Course Structure and Syllabi

B. Sc. Pass Course (Zoology)
(Session 2021-2024)

DEPARTMENT OF ZOOLOGY

The curriculum and syllabus for B.Sc. Program conforms to outcome based teaching learning process. In general, several outcomes have been identified and the curriculum and syllabus have been planned in such a way that each of the courses meets one or more of these outcomes. These relate to the skills, understanding and behaviors that students acquire as they progress through the program. Further each course in the program brings out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

1. An ability to apply profound understanding of Chemistry, Zoology and Botany
2. An ability to design and perform experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve scientific problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of scientific solutions in global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills, and modern scientific tools that provide the learning base for future careers in disciplines such as health sciences, agriculture, environmental management, the emerging biotechnologies, publishing, teaching, research and consultancy.

**JECRC UNIVERSITY
SCHOOL OF SCIENCE
SESSION 2021-2022
B Sc. (Pass course)**

Details of Scheme for B Sc. (Pass course) with various Courses and their credits with contact hours are given below:

Semester-I

S.No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ001A	4	-	2	4		1	5	Core
2	Subject B (Course 1)		4	-	2	4		1	5	Core
3	Subject C (Course 1)		4	-	2	4		1	5	Core
4	Web Development		2	-		2			2	Fundamental
5	Web Development Lab				2			1	1	Fundamental
6	Environment Studies		3		2*	3		1	4	Fundamental
7	Communication Skills		2	0	0	2	0	0	2	Foundation
8	Communication Skills Lab		0	0	2	0	0	1	1	Foundation
9	Culture Education I		2	-		2			2	Foundation
			21		12	21		6	27	

*Field/ Project Work and Report

Semester II

S. No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ003 A	4	-	2	4		1	5	Core
2	Subject B (Course 2)		4	-	2	4		1	5	Core
3	Subject C (Course 2)		4	-	2	4		1	5	Core
4	Project Management Lab			-	2			1	1	Fundamental
5	Professional Skills		2	0	0	2	0	0	2	Foundation
6	Professional Skills Lab		0	0	2	0	0	1	1	Foundation
7	Culture Education-2		2	0	0	2	0	0	2	Foundation
			16		10	16		5	21	

Semester III

S. No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ005 A	4	-	2	4		1	5	Core
2	Subject B (Course3)		4	-	2	4		1	5	Core
3	Subject C (Course3)		4	-	2	4		1	5	Core
4	Advanced Spread Sheet Lab			-	2			1	1	Fundamental
5	Life Skills1 (Personality Development)		1	0	2	1	0	1	2	Foundation
6	Value Education and Ethics-1		1	0	0	1	0	0	1	Foundation
7	Open Elective- I		3		0	3		0	3	Interdisciplinary
			17		10	17		5	22	

Semester IV

S.No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ007A	4	-	2	4		1	5	Core
2	Subject B (Course4)		4	-	2	4		1	5	Core
3	Subject C (Course 4)		4	-	2	4		1	5	Core
4	Python programming		2	-		2			2	Fundamen tal
5	Python programming Lab				2			1	1	Fundamen tal
6	Life Skills-2 (Aptitude)		1	0-	2	1	0	1	2	Foundatio n
7	Value Education and Ethics-2		1	0	0	1	0	0	1	Foundatio n
			16		10	16		5	21	

Semester V

S.No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ009A	4	-	2	4		1	5	Core
2	Subject B(Course5		4	-	2	4		1	5	Core
3	Subject C(Course5)		4	-	2	4		1	5	Core
4	Project	BSZ011A			12			6	6	Discipline Specific
			12		18	12		9	21	

Semester VI

S. No	Subject	Code	Lecture (Hr.)	Tutorials (Hr.)	Practical (Hr.)	Credits			Total Credits	Paper Category
						L	T	P		
1	Subject A (Zoology)	BSZ012 A	4	-	2	4		1	5	Core
2	Subject B (Course 6)		4	-	2	4		1	5	Core
3	Subject C (Course 6)		4		2	4		1	5	Core
4	Open Elective- II		3			3			3	Interdisciplinary
5	Open Elective – III		3			3			3	Interdisciplinary
			18		6	18		2	21	

Total Credits

Credits	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	Total
	27	21	22	21	21	21	133

JECRC UNIVERSITY
School of Science
Department of Zoology
B.Sc. Pass Course
Academic session 2021-22

	Semester –I	
Course Code	Title of Course	Credits
BSZ001A	Animal Diversity (Non Chordates) and Evolution	4
BSZ002A	Non Chordates & Evolution Lab	1
	Total	5
	Semester –II	
BSZ003A	Cell Biology and Genetics	4
BSZ004A	Cell Biology and Genetics Lab	1
	Total	5
	Semester –III	
BSZ005A	Biology of Chordates and Economic Zoology	4
BSZ006A	Chordates and Economic Zoology Lab	1
	Total	5
	Semester –IV	
BSZ007A	Developmental Biology and Immunology	4
BSZ008A	Developmental Biology and Immunology Lab	1
	Total	5
	Semester –V	
BSZ009A	Ecology, Ethology and Biostatistics	4
BSZ010A	Ecology, Ethology and Biostatistics Lab	1
BSZ011A	Project (Discipline Specific)	6
	Total	5
	Semester –VI	
BSZ012A	Animal Physiology and Biochemistry	4
BSZ013A	Physiology and Biochemistry of Animals Lab	1
	Total	5
	Total Credits	30

JECRC UNIVERSITY
SCHOOL OF SCIENCE
DEPARTMENT OF ZOOLOGY
B.Sc. Pass Course

Program Educational Objective (PEO's):

A graduate of the B.Sc. (Pass course) **Program** should:

PEO- I

The student will recognize and be able to apply basic ethical principles to basic and applied biological/biomedical practice and will understand the role of chemical/biological/biomedical science, scientists, and practitioners in society.

PEO- II

The student will be able to facilitate their acquisition of basic and specialist science skills that instill qualities of self-confidence and self-reliance, so that the products of the degree Programs can play active and informed roles in personal, community, national and international development strategies.

PEO- III

Students will be able to make valuable contributions to contemporary chemical/biological issues of national and international interest.

PEO- IV

Students will be provided with a modern, high-quality foundation education that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

Program Outcome (PO's)

A graduate of the B.Sc. (Pass course) Program will demonstrate:

PO1 Core competency: The graduates are expected to know the fundamental concepts of Science and other subjects. These fundamental concepts would reflect the latest understanding of the subject and in allied subject areas. Students will learn to investigate, experiment, relate information and draw logical conclusions based on scientific reasoning.

PO2 Disciplinary knowledge and skill: To learn and apply the knowledge in understanding research and addressing practical problems and to apply various scientific methods to address different questions by formulating the hypothesis, data collection and critically analyze the data. The student will be inquisitive about processes and phenomena happening during experiments in laboratories and seeks answers through the research path..

PO3 Skilled communicator: Communicate effectively on various scientific issues with the with society at large, They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea.

PO4 Critical thinker and problem solver: Critical thinking and analytical reasoning and the scientific knowledge will help to develop scientific temper that will be more beneficial for the society. The student will be able to draw logical conclusions based on a group of observations, facts and rules.

PO5 Team player: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based work, project and industry.

PO6 Moral and ethical awareness: Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world.. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.

PO7 Skilled project manager: Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader by acquiring knowledge about project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

PO8 Digitally literate: The student will acquire knowledge in understanding and carrying out data analysis, use of library search tools, and use of software and related computational work. Students will acquire digital skills and integrate the fundamental concepts with modern tools.

PO9 Environment and sustainability: Apply the knowledge of basic science and allied fields to protect environment and to prevent environmental degradation as science graduate, to stay firm on the value systems, of their culture, including their own for a healthy socio cultural environment.

PO10 Lifelong learner: Graduates will acquire the ability to engage independent and self-learning as well as to successfully pursue their career objectives in advanced education and in professional courses, through the use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability.

Program Specific Outcomes (PSO's)

In pursuit of the general objective of producing these self-reliant young biological scientists and contributing to scientific knowledge, the following are the **Program Specific Outcomes** of the B.Sc. (Pass course) degree Programme:

PSO1. Understand the nature and basic concepts of cell biology, Biochemistry, Taxonomy and ecology and analyze the relationships among animals, plants and microbes. **(Scientific Knowledge)**

PSO2. Perform procedures as per laboratory standards in the areas of Biochemistry, ethology, Biostatistics, Taxonomy, Economic Zoology and Ecology and Understand the applications of biological sciences in Apiculture, Aquaculture, Pisciculture, Agriculture and Medicine. **(Professional Skills)**

PSO 3: To train academically sound future researchers and intellectuals in the area of general biology, with emphasis in areas on the cutting edge of modern biology, e.g., Molecular biology, Biochemistry, physiology, Genetics, Cytology and Environmental Conservation.**(Successful Career and Entrepreneurship)**

Course Learning Objective:

- To study individual organisms and populations, as well as their relationships to each other and the environment, with the core foundation of evolution and ecology.
- To comprehend the genetics, anatomy, physiology and behavior along with other specialized fields of interest
- To comprehend the basic phylogenetic relationships of the major groups of vertebrates

- To comprehend and analyze the adaptive changes that have occurred in invertebrates & vertebrates
- To comprehend and analyze the changes in homologous structures which accompanied the invasion of terrestrial habitats by vertebrates
- To recognize, describe, and point out the external and internal features that characterize the major groups of modern day vertebrate & invertebrates
- To recognize and describe the basic habit, habitat & behavior of chordates
- To gain an in-depth knowledge and practical skills in various aspects of animal biology.
- To Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

**JECRC UNIVERSITY
SCHOOL OF SCIENCE
DEPARTMENT OF ZOOLOGY
B.Sc. Pass course**

SEMESTER-I

BSZ001A: Animal Diversity (Non-Chordates) and Evolution Credit(s)-4
Unit I

Animal Diversity (Non chordates)

Taxonomy and classification: General principles of taxonomy - Binomial nomenclature, Trinomial nomenclature, Rules of nomenclature, Concept of Five kingdom, Basis of Classification: symmetry, coelom, segmentation and embryogeny.

Unit II

Salient features and Outline Classification upto class in Non-Chordates (Protozoa to Coelenterata)

Phylum Protozoa: Type study-*Paramecium*,

Phylum Porifera Type study- *Sycon*

Phylum Coelenterata, Type study – *Obelia*

Reproduction in Protozoans

Evolution of canal system in sponges

Unit III

Salient features and Outline Classification upto class in Non-Chordates (Platyhelminthes to Annelida)

Phylum Platyhelminthes, Type study- *Fasciola*

Onychophora: Peripatus (salient features) and as connecting link

Phylum Annelida: Type study- *Neries*

Parasitic adaptations in Platyhelminthes

Unit IV

Salient features and Outline Classification upto class in Non-Chordates (Arthropoda to Echinodermata)

Phylum Arthropoda, Type study- Prawn

Phylum Mollusca, Type study - *Pila*

Phylum Echinodermata Type study- *Asterias*

Metamorphosis in insects

Water vascular system of star fish

Unit V

Evolution: Lamarckism, Darwinism, Natural Selection, Modes of speciation, Isolation and Isolating mechanisms, Variations: Heritable variations and their role in evolution, Adaptations, Mimicry, Fossils

Course Outcomes (COs) of the course “Animal Diversity (Non Chordates) & Evolution”:

On completion of the course, students are able to:

- CO1 Understand general taxonomic rules on animal classification, the principles and methods of taxonomy, the Levels of structural organization and the Basis of Classification -coelom, symmetry, segmentation and its types.
- CO2 Critically analyse the organization, complexity and characteristic features of non-chordates making them familiarize with the morphology and anatomy of representatives of various animal phyla like Protozoa, Porifera, Coelenterata, using examples and Understand the concept of canal system in Porifera
- CO3 Write down the classification and characteristics of Phylum Platyhelminthes, Aschelminthes Onychophora, Annelida and understand about the Parasitic adaptations in Platyhelminthes
- CO4 Write down the classification and characteristics of Phylum Arthropoda, Mollusca and Echinodermata and Understand Metamorphosis in insects, Water vascular system of star fish
- CO5 Understand the process of evolution, Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Natural selection, Speciation, Isolation, Variation, Adaptations, Mimicry

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

<i>Course Outcome</i>	Program Outcome										Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	M		L							H	M	M
CO2	H	M		L							H	M	M
CO3	H	M		L							H	M	M
CO4	H	M		L							H	L	L
CO5	H	M		L							H	L	L

H = Highly Related; M = Medium L = Low

Recommended readings:

- Barnes, R.D. (2006). Invertebrate Zoology, VII Edition, Cengage Learning, India.
- Pechenik, J. A. (2015). Biology of the Invertebrates. VII Edition, McGraw-Hill Education
- R.L.Kotpal :Modern text book of biology – Invertebrate –(Rastogi Publication, Meerut).
- Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing.
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers

BSZ002A: Non-Chordates and Evolution Lab Credit(s) -1

1. Study the working of optical microscope- compound & dissecting and methods of preparation of permanent slides-single staining and double staining.
2. To prepare permanent slides of - Hydra, Obelia colony, sponge-fibre/spicules/gemmules
3. To identify and study the characteristics of whole mount of *Euglena*, *Amoeba*, *Paramecium*, Binary fission and Conjugation in *Paramecium*, *Elphidium*, *Vorticella*, *Planaria w.m.*
4. Study of animals through museum specimens in the laboratory with details on their classification, biogeography and diagnostic features of *Euplectella*, *Vellela*, *Alcyonium*, *Metridium*, *Gorgonia*, *Physalia*, *Penatulla*, *Aurelia*. any Ctenophore
5. To identify and study the characteristics of: *Heteronereis*, *Aphrodite*, *Arenicola*, *Limulus*, *Scorpion*, *Centipede*, *Millipede*, *Lepas*, *Squilla*, *Eupagurus*, *Crab*, *Mantis*, *Peripatus*.
6. To identify and study the characteristics of: *Chiton*, *Loligo*, *Nautilus*, *Pentaceros*, *Echinus*, *Ophiothrix*, *Antedon*,
7. Examination of water samples collected from different places to observe diversity in Protista
8. Study of adult *Fasciola hepatica*, *Taenia solium*, *Ascaris lumbricoides* and their life stages (Slides/microphotographs)
9. Comparison of two species of birds belonging to same genus (Interspecific difference) and same family but dissimilar genera.
10. Study of adaptive radiations in feet of birds and mouth parts of insects.
11. Study of homology and analogy from suitable specimens (like wings of birds and insects, forelimbs of bat and rabbit), Serial homology in appendages of *Palaemon*.
12. Collection of five species (preferably invertebrates, insects) belonging to a clade. A project work on their generic identification, description and illustration with a note on their locality.
13. Submit a Project Report on field study of the social behaviour of any insect (bees/termites/ants/wasps) or behavioural pattern of earthworm in nature or life cycles of parasites or pathogens.

Note: Classification to be followed from “Barnes, R.D. (2006). Invertebrate Zoology, VII Edition, Cengage Learning, India”

Study of live animals should be done without painning them, prefer studies of species which are easy to culture. Digital media can be used to study various characters of animal species. Use of animals for dissection is subject to the conditions that these are not banned under the Wild life (Protection) Act, 1972.

SEMESTER II

L	T	P	C
4	-	1	5

BSZ003A: Cell Biology and Genetics

Credit(s)-4

Unit I

Introduction to cell: Prokaryotic & Eukaryotic

CO1	H	M		L							H	L	L
CO2	H	M		L							H	L	L
CO3	H	M		L							H	M	M
CO4	H	M		L							H	L	L
CO5	H	M		L							H	L	M

H = Highly Related; M = Medium L = Low

Suggested books

- De Roberties, E.D.P. and De Roberties, E.M.F.: Cell and Molecular Biology, B.I. Publications Pvt. Ltd. Lippincott Williams and Wilkins.
- Rastogi, S.C. Cell biology, New age international (P) Ltd, Publishers.
- Lodish, H, Matsudaira, P. and Darnell, J. Molecular cell biology, W.H. Freeman and company.
- Rastogi V.B.: Genetics , Rastogi Publications, Meerut.
- Freifelder, D. Essential of Molecular biology, Narosa Publishing House.
- Gardner : Genetics

BSZ004A: Cell Biology and Genetics Lab Credit(s): 1

1. To study the permanent slides and prepare slides of mitotic stages from onion root tip.
2. To study the permanent slides of meiotic cell division.
3. To isolate RNA from Yeast.
4. To Extract DNA from onion.
5. To study and prepare slide of giant chromosome in salivary glands of Chironomous larva.
6. To prepare slide and study Barr body for identification of Gender in Human.
7. To identify male and female *Drosophila*.
8. To prepare culture and study the life-cycle of *Drosophila*.
9. To identify wild and mutant forms of *Drosophila*.
10. To study the permanent prepared slides: Sex comb, Salivary gland chromosomes.
11. To do exercises related to the Human pedigree chart.
12. To do genetics exercises related to monohybrid cross, dihybrid cross, multiple allelism, sex-linked inheritance, genetic interaction

SEMESTER-III

L	T	P	C
4	-	1	5

BSZ005A: Biology of Chordates and Economic Zoology

CREDIT(S): 4

Unit I

Protochordata: Classification upto order, General characters

Ascidia: retrogressive metamorphosis, salient features of Amphioxus.

CO1	H	M		L							H	L	L
CO2	H	M		L							H	L	L
CO3	H	M		L							H	L	L
CO4	H	M		L							H	L	L
CO5	H	M		L							H	L	L

H = Highly Related; M = Medium L = Low

Suggested books

- R.L.Kotpal :Modern text book of biology –Vertebrate –(Rastogi Publication, Meerut).
- Young, J.Z. : Life of Vertebrate.(E L B S) 1983.Oxford.
- Dalela, R.C. : A text book of Chordate Zoology, (Jai Prakash Nath publications, Meerut.).
- Park, K. (2007). Preventive and Social Medicine. XVI Edition. B.B Publishers.
- Newman, H.H. : The phylum Chordate, (Satish Book Enterprise, Agra).
- Jordon, E.L. : Vertebrate Zoology, (S.Chand and Co., New Delhi.).
- Arora, D. R and Arora, B. (2001). Medical Parasitology. II Edition. CBS Publications and Distributors.
- Kumar and Corton. Pathological Basis of Diseases.
- Atwal, A.S. (1986). Agricultural Pests of India and South East Asia, Kalyani Publishers.
- Dennis, H. (2009). Agricultural Entomology. Timber Press (OR).
- Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
- Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
- Pedigo, L.P. (2002). Entomology and Pest Management, Prentice Hall.

BSZ006A: Chordates and Economic Zoology Lab Credits :1

1. To identify and study the characteristics of: *Balanoglossus* , *Amphioxus*, *Petromyzon*, *Hippocampus*, *Torpedo*, *Acipenser*. *Amia*, *Clarias*, *Exocoetus*, *Echeneis*, *Protopterus*.
2. To identify and study the characteristics of: *Icthyophis*, *Proteus*, *Ambystoma*; *Axolotal*, *Alytes*; *Hyla*, fresh water Tortoise; *Sphenodon*; *Phrynosoma*, *Draco*; *Chameleon*; *Viper/ Hydrophis*
3. To identify and study the characteristics of: *Archaeopteryx Parrot*. *Ornithorhynchus*, *Tachyglossus*, *Macropus*, Bat, Loris
4. To Study the life cycle of endoparasites through permanent slides/photomicrographs / specimens.
5. To Study the life cycles of earthworm, silk-moth, honey bee.
6. To prepare permanent slides of - Herdmania spicules, Striped muscle fibers
7. To Study arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*
8. To study the identifying feature and economic importance of common food pest – locust, beetle, *Callosobruchus chinensis* (pulse beetle), *Sitophilus oryzae* (rice weevil) and *Tribolium castaneum* (red flour beetle)

9. A Visit to poultry farm / animal breeding centre/ wool industry and submission of visit report
10. To prepare and maintain freshwater aquarium or study of economic important fishes species through photomicrographs/ specimens
11. To make a chart explaining types of wools found in the world.
12. To study the Key for Identification of poisonous and non-poisonous snakes. An “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose
13. To study anatomy of any edible fresh water fish.

SEMESTER-IV

L	T	P	C
4	-	1	5

BSZ007A: Developmental Biology and Immunology **Credit(s): 4**

Unit I

Animal development: Gametogenesis (Spermatogenesis and oogenesis - vitellogenesis), fertilization, cleavage and morulation, blastulation, gastrulation, fate map, morphogenetic movement, Significance of cleavage and gastrulation.

Unit II

Elementary idea about embryonic induction: primary organizer and competence.
Extra-embryonic membranes in chick, their development and functions
Placentation in Mammals

Unit III

Brief idea of: Parthenogenesis, Regeneration, Cloning of animals, transgenesis
Stem cells: types and their applications
Teratology

Unit IV

Immunology -Overview of immune system; types of immunity
Mechanism of humoral immunity, Immunity regulating cells: Macrophages, lymphocytes (B & T types), Plasma cells and memory cells.
Antigens: Types and Properties of antigens

Unit V

Antibodies: Basic structure, classes and function, Antigen-Antibody interaction: precipitation reaction, agglutination reaction, neutralization reaction, complement and lytic reaction and phagocytosis. Brief idea of vaccines.

Course Outcomes (COs) of the course “Developmental Biology and Immunology”

On completion of the course, students are able to:

CO1 Understand the process of: Gametogenesis, Fertilization and early development.

CO2 Understand the concept of embryonic induction: primary organizer and competence, extra-embryonic membranes and placentation

CO3 Understand the concept of parthenogenesis, regeneration, cloning, transgenesis, stem cell and teratology

CO4 Understand the concept of Immunology, Mechanism of immunity, Immunity regulating cells, Antigens

CO5 Understand the basic structure, classes and function of Antibodies, Antigen-Antibody interaction

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome										Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO3
CO1	H	M		L							H	L	L
CO2	H	M		L							H	L	L
CO3	H	M		L							H	L	L
CO4	H	M		L							H	M	L
CO5	H	M		L							H	L	L

H = Highly Related; M = Medium L = Low

Suggested Books

- Gilbert, S.F. (2006) 8th edn. Developmental Biology, Sinauer Associates, Inc.
- Rastogi, V.B.: Development Biology
- Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006). VI Edition. Immunology. W.H. Freeman and Company.
- Delves, P. J., Martin, S. J., Burton, D. R., Roitt, I.M. (2006). XI edition. Roitt's Essential Immunology, Blackwell Publishing

BSZ008A: Developmental Biology and Immunology Lab Credit(s): 1

1. To study developmental stages of frog: - egg, cleavage, blastula, gastrula, neurula (neural plate, neural fold, neural tube),
2. To study developmental stages of frog: - tadpole larva, metamorphic stages of tadpole.
3. To Study developmental stages of chick - 18h, 24h, 33h,
4. To Study developmental stages of chick - 48h, 72h , 96h of incubation.
5. To make a window in shell of egg to study developmental stages of chick embryo.
6. To identify different blood groups and Rh factor in human blood samples.
7. To study the Rh compatibility conditions.
8. To study the differential count of W.B.Cs.
9. To study the antibiotic resistance in bacterial culture.
10. To study the effect of disinfectants/antiseptic on microorganism.
11. To study cell permeability in mammalian RBC.

12. To study about Vaccines/Vaccination programs.
13. To study about Immunity regulating cells.

SEMESTER-V

L	T	P	C
4	-	1	5

BSZ009A: Ecology, Ethology and Biostatistics

Credit(s): 4

Unit I

Ecology

Ecosystem – definition, Structure: Abiotic & Biotic
Basic concepts of ecology.

Population Ecology: Density and methods of its measurement, natality, mortality, age and ratio distribution, biotic potential, dispersal and dispersion of population, population interactions and propagation.

Unit II

Community Ecology: Characteristics of natural communities structure, composition, stratification, host-parasite interactions.

Ecological Succession: Types and patterns of succession, concept of climax (mono-, di-, polyclimax), ecotone and edge effect, niche.

Habitat Adaptations: Deep sea and Desert

Unit III

Ethology

Concepts of Ethology- Motivation, Fixed Action Patterns (FAP), Sign Stimulus; Innate Releasing Mechanism (IRM); Action Specific Energy (ASE); Learning; Imprinting.

Methods of Studying Behaviour: Studies in Laboratory- Neuroanatomical, Neurophysiological and Neurochemical techniques.

Brief account on Pheromones, Biological Clocks, Orientation.

Unit IV

Biostatistics

Introduction: Definition, Functions, scope and application of biostatistics.

Frequency distribution: Collection and tabulation of data, Graphical presentation of frequency distribution- Bar diagram, Histogram, Frequency Polygon, smooth frequency curve, ogives, Pie charts.

Unit V

Measures of Central Value: Average; Mean, Mode, Median. Mean and Standard Deviation.

Statistical Inference: student's 't' test.

Course Outcomes (COs) of the course “Ecology, Ethology and Biostatistics”

On completion of the course, students are able to:

CO1 Understand the basic concepts of ecosystem, ecology & Population Ecology.

CO2 Understand the Characteristics of Community; Ecological Succession and habitat adaptation.

CO3 Understand the concepts of Ethology, Methods of Studying Behavior and a Brief idea about Pheromones, Biological Clocks, Orientation.

CO4 Understand the Functions, scope and application of biostatistics, Data Classification and Graphical presentation of frequency distribution.

CO5 Understand the measures of central tendency and dispersion like Computation of arithmetic mean, mode and median, Standard Deviation, Standard error of mean and student's 't' test

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome										Program Specific Outcome		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3
CO1	H	M		L					H		M	L	L
CO2	H	M		L					H		M	L	L
CO3	H	M		L							M	L	L
CO4	H	M		L							H	M	L
CO5	H	M		L							H	M	L

H = Highly Related; M = Medium L = Low

Suggested Books

- Odum, E.P.: Fundamental of Ecology, W.B. Saunders, New Delhi.
- Verma, P.S. and Agarwal, U.K.: Environmental Biology, S. Chand and co., New Delhi.
- Gupta, P.K.: Environmental Biology, Rastogi Publication, Meerut.
- Manning, A.: An introduction to Behaviour, Edward Arnold, London.
- Mathur, R.: Animal Behaviour, Rastogi Publications, Meerut.
- Bailey: Biostatistics
- Gupta, S.P.: Biostatistics.

BSZ010A: Ecology, Ethology and Biostatistics Lab Credit(s): 1

1. To determine the alkalinity of given water sample.
2. To determine the acidity of given water sample.
3. To determine the free carbon dioxide of given water sample.
4. To determine the dissolved oxygen of given water sample.
5. To determine the moisture content and water holding capacity of given soil sample.
6. To determine the carbonate and bicarbonate content in given soil sample.
7. To prepare culture of Paramecium and study its behavior (Thigmotrophism, thermotrophism, chemotrophism).
8. To study behavior of different zoo-planktons.
9. To study food preference/ phototactic response in *Tribolium*.
10. To study antennal grooming in Cockroach.
11. To prepare a list of all animals found in and around your locality/Institute or A visit to a zoo/ national park / wildlife sanctuary and study their behavior.

12. To do exercises on Bar diagram, Histogram, Frequency Polygon, smooth frequency curve, ogives, Pie charts.
13. To do exercises on Mean, Mode & Median. Standard deviation

BSZ011A: Project (Discipline Specific)

Credit(s): 6

SEMESTER-VI

L	T	P	C
4	-	1	5

BSZ012A: Animal Physiology and Biochemistry

Credit(s): 4

Unit I

Animal Physiology

Physiology of Digestion: Mechanism of digestion, absorption and elimination.

Physiology of Respiration: Mechanism of breathing: exchange of gases, transport of oxygen & carbon dioxide in blood, regulation of respiration.

Unit II

Physiology of Circulation: Composition and function of blood, mechanism of blood clotting, heartbeat, cardiac cycle, homeostasis.

Physiology of nerve impulse and Reflex Action: Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission, reflex action.

Unit III

Physiology of muscle contraction: Functional architecture of skeletal muscles, chemical and biophysical events during contraction and relaxation of muscle fibre, Cori's cycle

Physiology of Excretion: Nitrogenous excretory products, role of liver in formation of these end products, Functional architecture of a nephron, mechanism and regulation of urine formation.

Unit IV

Physiology of endocrine glands: Types of Endocrine glands, their secretion, functions and mechanism of action, disorders related to hypo and hyper secretion – pituitary, adrenal, thyroid, islet of langerhan's, gonads (testes & Ovary).

Unit V

Biochemistry

Structure, function and significance of Carbohydrates, Proteins and Lipids.

Metabolism of Carbohydrate (glycolysis, kreb's cycle, oxidative phosphorylation and ETS)

Protein (Deamination, transamination and decarboxylation), Lipids (beta-oxidation)

Course Outcomes (COs) of the course "Animal Physiology and Biochemistry"

On completion of the course, students are able to:

CO1 Understand the Physiology of Digestion & Respiration.

CO2 Understand the Physiology of Circulation & nerve impulse and Reflex Action.

CO3 Understand the Physiology of muscle contraction & Excretion

CO4 Understand the Physiology & Types of Endocrine glands.

CO5 Understand the Structure, function, significance and Metabolism of Carbohydrates, Proteins and Lipid.

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcome	Program Outcome										Program Specific Outcome		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	M		L							H	L	M
CO2	H	M		L							H	L	M
CO3	H	M		L							H	L	M
CO4	H	M		L							H	L	M
CO5	H	M		L							H	H	M

H = Highly Related; M = Medium L = Low

Suggested books

- Berry, A.K.; A Textbook of Animal Physiology; Emkay Publisher, Delhi
- Chatterjee, M.N and Shinde, R.; Text Book of Medical Physiology; Jaypee brothers.
- Animal physiology and biochemistry, Dr. K.V. Sastry; rastogi publications, Meerut, India.
- Leninger, A.D. Principles of Biochemistry, CBS Publishers and Distributors, Shashtra, Delhi.
- Jain, J.L. Fundamentals of Biochemistry ,S.Chand publishers New Delhi.

BSZ013A: Physiology and Biochemistry of Animals Lab

Credit(s): 1

1. To study histological structure of major endocrine glands of mammals.
2. To enumerate the red blood cells in given blood sample.
3. To enumerate the white blood cells in given blood sample.
4. To estimate the hemoglobin content in given blood sample.
5. To estimate haematocrit values in given blood sample.
6. To study the enzymatic activity (catalases) in microorganisms/Liver.
7. To study the salivary digestion.
8. To perform the qualitative estimation of carbohydrates in given samples.
9. To perform the qualitative estimation of proteins in given samples.
10. To perform the qualitative estimation of lipids in given samples.
11. To separate different dyes by circular paper chromatography and calculate the R_f
12. To separate different amino acids/ carbohydrates by thin layer chromatography.