NEP 2020

FOUR YEAR UNDERGRADUATE PROGRAM (NEP–2020)

Program: Bachelor in Science (2024 -28)

DISCIPLINE – ZOOLOGY

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FOUR YEAR UNDERGRADUATE PROGRAM (NEP–2020)
Program: Bachelor in Science (2024 -28)
DISCIPLINE – ZOOLOGY
Session – 2024 -25

DSC -01 to 08		DSE -01 to 12	
Code	**Title**	**Code**	**Title**
ZOSC -01T	Life on Earth and Unique Attributes of Animal Kingdom	ZOSE -01T	Parasitology
ZOSC -01P	Life on Earth and Unique Attributes of Animal Kingdom	ZOSE -01P	Parasitology
ZOSC -02T	Cell Biology and Histology	ZOSE -02T	Ecology and Wild life Conservation & Management
ZOSC -02P	Cell Biology and Histology	ZOSE -02P	Ecology and Wild life Conservation & Management
ZOSC -03T	Diversity of Invertebrates	ZOSE -03T	Biochemistry
ZOSC -03P	Diversity of Invertebrates	ZOSE -03P	Biochemistry
ZOSC -04T	Diversity of Chordates and Comparative Anatomy	ZOSE -04T	Evolutionary Biology
ZOSC -04P	Diversity of Chordates and Comparative Anatomy	ZOSE -04P	Evolutionary Biology
ZOSC -05T	Vertebrate Physiology	ZOSE -05T	Endocrinology
ZOSC -05P	Vertebrate Physiology	ZOSE -05P	Endocrinology
ZOSC -06T	Genetics	ZOSE -06T	Immunology
ZOSC -06P	Genetics	ZOSE -06P	Immunology
ZOSC -07T	Biosystematics and Taxonomy	ZOSE -07T	Biotechnology and Genetic Engineering
ZOSC -07P	Biosystematics and Taxonomy	ZOSE -07P	Biotechnology and Genetic Engineering
ZOSC -08T	Biotechniques	ZOSE -08T	Applied Zoology
ZOSC -08P	Biotechniques	ZOSE -08P	Applied Zoology
		ZOSE -09T	Basics of Computer & Biostatistics
		ZOSE -09P	Basics of Computer & Biostatistics
		ZOSE -10T	Behaviour & Chronobiology
		ZOSE -10P	Behaviour & Chronobiology
		ZOSE -11T	Developmental Biology
		ZOSE -11P	Developmental Biology
		ZOSE -12T	Molecular Biology
		ZOSE -12P	Molecular Biology
GE -01 & 02		**VAC**	
ZOGE -01T	Life on Earth and Unique Attributes of Animal Kingdom	ZOVAC-01	Public health and Hygiene
ZOGE -01P	Life on Earth and Unique Attributes of Animal Kingdom	**SEC**	
ZOGE -02T	Cell Biology and Histology	ZOSEC-01	Vermiculture
ZOGE -02P	Cell Biology and Histology		

Program Outcomes (PO):

- Demonstrate and apply the fundamental knowledge of the basic principles of major fields of Zoology and Modern tools and techniques
- Analyse complex interactions among the various animals of different phyla, their distribution and their relationship with the environment.
- Gain knowledge of small scale industries like sericulture, fish farming, bee keeping, aquaculture, animal husbandry, poultry farm.
- Apply the knowledge and understanding of Zoology to one's own life and work.
- Develops empathy and love towards the animals and consciousness for wild life conservation

Program Specific Outcomes (PSO):

- Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Behaviour, Endocrinology, Immunology, Biostatistics, Parasitology, Biochemistry, Evolution, Developmental Biology, Animal biotechnology, Tools and Techniques of Zoology.
- Understand the applications of biological sciences in Apiculture, Aquaculture, Sericulture, Animal Husbandry, Poultry Farm.
- Understand the applications of Zoology in Medicine and daily life
- Contributes the knowledge for Nation building and sustainable development

Dr. Shushgda Rahatkar 10.06.2024 Shobha Ram Yadav Dr. Nazeem Ahmed Dr. Ajit Hemant Dr. R. Rajesh Thimothy Dr. Lata Meshram

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree/Honors)*		**Semester - I**		Session: **2024-2025**
1	**Course Code**	**ZOSC-01T**		
2	**Course Title**	**Life on Earth and Unique Attributes of Animal Kingdom**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Develop an understanding of concepts, mechanisms, evolutionary significance and relevance of Origin of life. ➢ Understand General Idea about Invertebrate and Vertebrate animals with special reference and their specific qualities. ➢ Understand and appreciate diversity of life forms. ➢ Apply the knowledge about animals Sciences in daily life.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Origin of life: Theories of Origin of life:** **Ancient Theory** Theory of Special Creation (Mythological approach),Theory of Panspermia or Cosmozoic Theory, Theory of Directed Panspermia, Theory of Catastrophism, Theory of Spontaneous Generation (Abiogenesis or Autogenesis), Theory of Biogenesis: Redi's Experiment and Pasture's Experiment. **Modern Theory: Origin of Universe:** Big Bang Hypothesis in Brief, **Origin of Solar System and The Earth:** Nebular hypothesis, **Atomosphere and Eneargy Sources on Primitive Earth, Biochemical Origin of Life:** Oparin and Haldane Theory, **Chemogeny:** Formation of simple and complex organic compounds (Stanely Miller and Ure's Experiment), Formation of Coacervates, Nucleic Acids. **Biogeny:** Origin of primitive prokaryotic cell. **Evolution of modes of Nutrition:** Chemohetertrophs, Anaerobic and Aerobic Photoautotrophs. Evolution of Eukaryotes.	12
II	**Systematics & Unique attributes of Invertebrate and Vertebrate animals with special reference to Coelentrata, Mollusca and Pisces:** Definition and difference between Invertebrate and Vertebrate. **Nomenclature:** Binomial and Trinomial Nomenclature and International code of Nomenclature **Corals:** Meaning of Coral, Structure of Coral polyp, Coral Skeleton, Types of corals: Hydrozoan Coral, Example- Millipora, Octocorallian Coral, Example- Alcyonium, Hexacorallian Corals, Example- Gorgonia. **Torsion in Mollusca:** Definition, Mechanism of Torsion, Effects of Torsion, Significance of Torsion. **Pisces: Migration in fishes**: Catadromous: Eel fish and Anadromous: Salmon fish and **Parental care in fishes:** By nest formation, Coiling round eggs, Attachment to body, Integumentary cups, Shelter in mouth, Brood pouch, Mermaids purses, Viviparity.	11
III	**Unique attributes of Vertebrate animals with special reference to Amphibia & Reptilia:** **Parental care in Amphibia:** by Nest, by Nursery or Shelter and by Parents **Neoteny in Amphibia**: Definition, Partial and Total Neotony, Factors Affecting Neotony, Examples- Axolotal larva, Necturus and Siren. **Reptilia: Venomous & Non-venomous Snakes:** Identification, Poison apparatus: Poison Glands, Poison ducts and Fangs, Biting Mechanism.	11
IV	**Unique attributes of Vertebrate animals with special reference to Aves and Mammals:** **Birds:** Flight Adaptation, Migration and Perching Mechanism, Flightless Birds (Morphology and Special Characters of Emu, Ostrich and Penguins), Discuss-Birds are glorified reptiles: Archaeopteryx. **Monotremes or Egg laying mammals:** Morphology and Special Characters of Echidna and Duck bill platypus. **Aquatic Mammals:** Morphology and Special Characters of Whale and Dolphin. **Mammals: Flying Mammals:** Morphology and Special Characters of Bat.	11
Keywords	*Origin of life, Invertebrate, Vertebrate, Corals, Torsion, parental care, Neotony, Fangs, Aves, Mammals*	

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PART–C: Learning Resources

Text Books Recommended

- E. J. W. Barrington , Invertebrate structure and function, English Language Book Society UK
- Robert Barnes, Invertebrate Zoology, Robert Barnes IVth edition Holt Saunders International Edition Japan
- Park Haswell, Marshall and Williams, A textbook on Zoology Invertebrate, AITBS Publishing and Distributers, Delhi
- Park Haswell, Marshall and Williams, A textbook on Zoology Vertebrate, AITBS Publishing and Distributers, Delhi

Reference Books Recommended

- Prof R. L. Kotpal, Protozoa to Echinodermata, Rastogi Publication Meerut
- E.L. Jordan, Dr. P. S. Verma,Invertebrate Zoology , S. Chand Publications, New Delhi
- N. Arumugam, N. C. Nair S. - Invertebrate Zoology, Saras Publication.
- N. Arumugam, N. C. Nair S. - vertebrate Zoology, Saras Publication.
- Barrington E. J. W., Invertebrate Structure and Function, Nelson London
- Barnes, R. D., Invertebrate Zoology –Saunders Philadelphia
- R. L. Kotpal, Invertebrate, Rastogi Publications
- R. L. Kotpal, Vertebrate, Rastogi Publications
- H. S. Bhampah, KavitaJuneja, Recent trends in vertebrates vol 1 – 9, Anmol Publication
- S. N. Prasad, Life of invertebrates, Vikash Publication House Pvt Ltd New Delhi
- G. S. Sandhu, HarshwardhanBhagskar – Advanced invertebrate zoology –Campus books international

Online Resources–

- **https://www.coursera.org/lecture/emergence-of-life/4-5-invertebrates-successes-of-life-without-a-backbone-WQHqS**
- **https://www.shiksha.com/online-courses/introduction-to-biology-biodiversity-course-courl5385**
- **https://www.youtube.com/watch?v=k121Qv6loBA**
- **https://www.youtube.com/watch?v=uK-Xx_OCYcI**
- **https://www.youtube.com/watch?v=vybbBil5Elk**
- **https://www.youtube.com/watch?v=WxMSckEeio4**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*		**Semester - I**	Session: **2024-2025**	
1	**Course Code**	**ZOSC-01P**		
2	**Course Title**	**Life on Earth and Unique Attributes of Animal Kingdom**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ *To demonstrate comprehensive understanding of the current theories and hypotheses regarding the origin of life on Earth,* ➢ *Understand diversity of life forms* ➢ *Identify some distinctive invertebrate and vertebrate animals* ➢ *Apply this Understanding to broader context of life*		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training / performance Periods: 30 Periods (30 Hours)

Module	Topics (Course Contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Study of origin of life through chart and models ➢ Study of different Invertebrates and Vertebrates animals through models and museum specimens in the laboratory with details of biogeography and diagnostic features: Millipora, Alcyonium, Gorgonia, Hippocampus, Ichthyophis (Female), Alytes (Male), Axolotal larva, Necturus, Siren, Cobra, Viper (pit & Pitless), Sea Snake, Rattle Snake, Archaeopteryx, Emu, Ostrich and Penguins, Echidna and Duck bill platypus, Whale, Dolphin, Bat. ➢ Preparation and Demonstration of Key for Identification of Venomous and Non-venomous snakes. ➢ Study of Coral Reefs through Models, Photographs ➢ Study of Fossils through chart/ Models ➢ An "**Animal album or Practical Record**" containing sketches, photographs, cut outs, with appropriate write up about the above mentioned taxa. ➢ Study of some videos to develop understanding and acquired knowledge on the animals salient features as mentioned above. ➢ Group discussion/Viva or Seminar presentation on related topics mentioned in Theory paper.	**30**
Keywords	*Museum specimens, Invertebrates, Vertebrates, Venomous and Non-venomous, Seminar*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut,
  - New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference *Books Recommended –*

- Park Haswell, Marshall and Williams, A textbook on Zoology Invertebrate, AITBS Publishing and Distributers, Delhi
- Park Haswell, Marshall and Williams, A textbook on Zoology Vertebrate, AITBS Publishing and Distributers, Delhi

Online Resources–

- http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/gc5ua6m873i?e=3|*|||
- https://www.youtube.com/watch?v=JUdp3U6A1EA

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*			**Semester - II**	Session: **2024-2025**
1	**Course Code**	**ZOSC- 02T**		
2	**Course Title**	**Cell Biology and Histology**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Acquire knowledge of Cell membrane and function ➢ Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved. ➢ Gain Knowledge of key processes like cell division, ➢ Learn about various tissues of body their structural significance		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Cell Structure, Cell Membrane and Extra Nuclear Cell Organelles:** General structure of Prokaryotes and Eukaryotes. **Cell membrane organization: Origin,** structure (Lipid-Lipid Bilayer Model, Dannelli & Davson Model, Unit Membrane Model and Fluid mosaic model), chemical composition and function of cell membrane, Specialization of cell membrane: microvilli desmosomes, Hemidesmosome, Septate Desmosome, plasmodesmata, tight and gap junction. **Extra Nuclear Cell Organelles:** Ultra structure and functions of Endoplasmic reticulum and Golgi apparatus.	11
II	**Extra Nuclear Cell Organelles:** Ultra structure and functions of Ribosome, Lysosome, Peroxisomes, Mitochondria: Origin, structure and function.	11
III	**Nuclear Organization and Cell Division:** Size, shape, structure and functions of interphase nucleus. Ultra structure of nuclear membrane and pore complex. Nucleolus: general organization, chemical composition and functions, Chromosome Morphology, Cell cycle, Cell division- Mitosis and Meiosis. Cell division checks points and their regulation. Programmed cell death (Apoptosis).	12
IV	**Introduction to tissues.** Epithelial tissue: types, structure and characteristics. surface modifications. Basement membrane: structure and characteristics. Connective tissue cells. Structure and function of loose, dense and adipose tissue. Cartilage and bone: classification, and fine structure. Blood: plasma, blood cells, lymph– their structure and function. Bone marrow and haemopoesis. Structure and function of spleen. Muscular tissue: ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. Structure and classification of neurons.	11
Keywords	*Cell Biology, Cell Membrane, Cell organelle, Nucleus, endoplasmic reticulum and Golgi apparatus, ribosome, lysosome, peroxisomes, Mitochondria, tissues.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Gupta P.K. Cell and Molecular Biology, Himalaya Publication
2. Arumugam.N, Cell biology and Molecular Biology, Saras Publication
3. Rastogi V.B. Cell Biology, Rastogi Publication
4. Verma P.S. and Agrawal Cell Biology, S. Chand Publication

Reference Books Recommended –

5. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.
6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
7. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco. Practical

Online Resources–

1. National digital Library.- http://ndl.iitkgp.ac.in/document/Qkh4R2FGUkRNZjFicFUvWmpzQ2loY0poaUVtYlByc1BZNXk3TnZMWVFzQXpZNjhhQUplR1BTOERHelZXZUp5Nw
2. http://ndl.iitkgp.ac.in/document/Qkh4R2FGUkRNZjFicFUvWmpzQ2loZFJyVGFmaDFwbXpBS0kwNi9tbi91UGYxaFl6OC9Sb25QWUlXLzF1V3NUZw
3. https://www.youtube.com/watch?v=GYY627IeAKg
4. E-PG Pathshala. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of ZOOLOGY
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*			**Semester - II**	Session: **2024-2025**
1	**Course Code**	**ZOSC-02P**		
2	**Course Title**	**Cell Biology and Histology**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Understand ultra structure of prokaryote and Eukaryote cell, undertake microscopic study to gain knowledge ➢ learn to identify cell organelles ➢ Explain and demonstrate mitosis and meiosis division in onion root tip, Grass hopper testis, etc ➢ Gain knowledge of Microtomy		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Study of prokaryotic and eukaryotic cell types with the help of chart, slide and video. 2. Separation and isolation of cells by sedimentation velocity in unit gravity. 3. Disruption of cells, isolation and identification of subcellular components, isolation of nuclei. 4. Isolation of mitochondria by differential centrifugation and identification of succinic dehydrogenase in the mitochondrial pellet. 5. Chromosome segregation in mitosis and meiosis. 6. Preparation of chromosome squashes from Onion Root tip for observation of stages of Mitosis 7. Preparation of chromosome squashes from grasshopper/cockroach testes for the observation of stages of meiosis. 8. Isolation and estimation of DNA. 9. Study of types of tissue through permanent slides: epithelial, connective, muscular, Nervous etc. 10. Preparation of Practical Record 11. Group discussion/Viva or Seminar presentation on related topics mentioned in Theory paper	**30**
Keywords	*Prokaryote, Eukaryote, cell division, Mitosis, Meiosis, DNA Separation, Histology of Tissue, Microtomy.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Debarati Das Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual, Academic Publishers.
2. Mohan P Arora Cytogenetics:, Himalayan Publishing House

Reference Books Recommended –

3. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.

Online Resources– National Digital Library

- **http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_51296_P_1_P_o_e_51600_M_0_P_g_51604_51605?e=13|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree/ Honors)*			**Semester - III**	Session: **2024-2025**
1	**Course Code**	**ZOSC-03T**		
2	**Course Title**	**Diversity of Invertebrates**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to -** ➢ Develop understanding on Invertebrate Animals on the basis of classification and Nomenclature. ➢ Develop understanding how simple/unicellular animals changed into multicellular and diploblastic forms through their anatomy and physiology. ➢ Gain Knowledge of key processes like formation of triploblastic animals (simple to complex form of body plan). ➢ Develop understanding on parasitic adaptations and life cycle of Helminthes. ➢ Develop understanding on the diversity in Artropoda, Mollusca and Echinodermata.		
6	**Credit Value**	**3 Credits**	*Credit = 15 Hours - learning & Observation*	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**General Characters, Classification up to order and Type Study of Phylum Protozoa and Porifera with some special features: Protozoa:** General Characters and Classification of Phylum Protozoa up to order. **Type study:** Paramoecium, Protozoa and Disease. **Porifera:** General Characters and Classification of Phylum Porifera up to order. **Type study: Sycon.**	**11**
II	**General Characters, Classification and Type Study of Phylum Coelenterata, Helminthes and Annelida: Coelenterata** - General Characters and Classification of Phylum Coelenterata up to order. **Type Study:** Obelia. **Helminthes** - Classification of Phylum Helminthes up to order. **Type study:** Fasciola. **Annelida-** Classification of Phylum Annelida up to order. **Type study:** Pheretima (Earthworm).	**11**
III	**General Characters, Classification and Type Study of Phylum Arthropoda and Mollusca: Arthropoda** - General Characters and Classification of Phylum Arthropoda up to order. **Type study: Prawn. Mollusc-** General Characters and Classification of Phylum Mollusca up to order. **Type study: Pila.**	**12**
IV	**General Characters, Classification and Type Study of Phylum Echinodermata and Hemichordata:** General Characters and Classification of Phylum Echinodermata up to order. **Type Study:** Asterias (Starfish). General Characters and Classification of Phylum Hemichordata **Type Study:** Balonoglossus	**11**
Keywords	*Taxonomy, Nomenclature, Canal System, Protozoa, Balanoglossus, Torsion*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- R.L. Kotpal, Modern Textbook of Zoology Invertebrates. Rastogi Publication, Gangotri, Shivaji Road, Meerut
- V.K. Tiwari, Unified Zoology, Shivlal Agrawal and Company, Pustak Prakashak, Khajuri Bazar, Indore.
- Dr. S.M. Saxsen, Zoology, Ist Year, by a, Ram Prasad and Sons, Aagra and Bhopal.
- N. Arumugam, M.G. Ragunathan, T. Murugan, B. Ramnathan, A Textbook of Invertebrates by Saras Publication

Reference Books Recommended –

- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
- Boradale, L.A. and Potts, E.A.(1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
- Bushbaum, R. (1964). Animals without Backbones. University of Chicago Press.
- Hyman, L H. (1940-67). The Invertebrates, Vol. I-VI. McGraw-Hill, New York.
-

Online Resources–

- http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_512_96_P_0_B_o_p_51542_M_1_M_L_c_P_D_a_P_o_E_P_1_51562_51563?e=9|*|||

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in life Science *(Diploma / Degree/ Honors)*			**Semester - III**	Session: **2024-2025**
1	**Course Code**	**ZOSC-03P**		
2	**Course Title**	**Diversity of Invertebrates**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing lab course the students will be able to-** ➢ Develop understanding on the diversity of life with regard nonchordates. ➢ Gain Knowledge of grouping of animals on the basis of their morphological characteristics. ➢ Develop critical understanding how animals have changed from simple form to complex body plan. ➢ Acquired the detailed knowledge to think and interpret different animal species individually.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**List of labs to be conducted** • Study of different non-chordate taxa animals through models, slides and museum specimens in the laboratory. Emphasising classification, biogeography and diagnostic features of: Protozoa, Porifera, Coelenterata (also with special reference to Corals of Cnidarians), Helminthes, Annelida, Arthropoda, Mollusca and Echinodermata. • Histological slides of different Non chordate Taxa, slides of various larval forms of Helminthes, Crustacea and Echinodermata • **Dissection** of *Pheretima* to expose Alimentry canal and circum pharyngeal ganglia through Alternative methods of dissection. • Dissection of *Periplaneta* to expose the digestive system, salivary glands and Mouth Parts through Alternative methods of dissection. • Dissection of Prawn to expose appendages and statocyst through Alternative methods of dissection • Dissection of *Pila* to expose Nervous System through Alternative methods of dissection. • Study of Invertebrate animals in nature during a survey of a National Park/ Forest area/College campus. • **Group discussion/Viva or Seminar presentation on two related topics:** Polymorphism, Parasitic adaptations, Freshwater sponges, Biodiversity and climate change, Tree of Life, Marine zooplanktons and their ecological importance including oxygen evolution. • An "**animal album or Practical Record**" containing sketches, photographs, cut outs, with appropriate write up about the above mentioned taxa. • Study of some videos to develop understanding on the animals of different taxa.	**30**
Keywords	*Museum specimens, Histological slides, Alternative of Dissection, Animal album*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference Books Recommended-

- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
- Hyman, L H. (1940-67). The Invertebrates, Vol. I-VI. McGraw-Hill, New York.

Online Resources–

- **https://www.youtube.com/watch?v=GC5Ua6m873I**
- **https://www.youtube.com/watch?v=-qyM2Hskj84**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree/ Honors)*			**Semester - IV**	Session: **2024-2025**
1	**Course Code**	**ZOSC-04T**		
2	**Course Title**	**Diversity of Chordates and Comparative Anatomy**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Develop understanding of the characters used to classify and differentiate the organisms belonging to different taxa and the evolutionary history and relationship between the different classes of chordates. ➢ Acquire knowledge and Develop critical understanding of the comparative anatomy and functioning of complex systems of Pisces to Mammalia. ➢ Learn the comparative account of integument with its derivatives, digestive system and Skeletal and Muscular System. ➢ Understand the Digestive system and its anatomical specializations with respect to different diets and feeding habits and respiratory organs in vertebrates used in aquatic, terrestrial and aerial vertebrates. ➢ Understand the evolution of heart, aortic arches, and Learn the evolution of brain, sense organs and urinogenital system.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Diversity in Protochordates and Chordates:** General characteristics & classification of Chordata up to orders with examples. **Cephalochordates:** Type study – Amphioxus and its affinities, **Agnatha:** Comparative account of Petromyzon and Myxine	11
II	**Structure and function of integument and skeletal systems Alimentary canal:** Structure of integument from fishes to mammals with an account on epidermal and dermal derivatives and their functional significance, Anatomy of Axial skeleton from fishes to mammals. Comparative anatomy of appendicular skeleton: limbs and girdles from fishes to mammals. Comparative account with structure of alimentary canal and digestive glands in vertebrates.	11
III	**Comparative anatomy and functional Significance of, Respiratory organs, Heart Aortic Arches and Endocrine Glands:** Structure of Gills, Lungs, Air sacs and Swim bladder in Vertebrates, Structure and evolution of heart in vertebrates, Evolution of aortic arches and their significance in vertebrates. Endocrine Glands & their function. Disorders of Thyroid, Adrenal, Pancreas and Pituitary.	11
IV	**Comparative anatomy and functional Significance of Urinogenital System, Brain & Sense Organ:** Types and development of kidneys and their ducts in anamniotes and amniotes. Nephron- structure, types and their function, Comparative anatomy of Urinogenital system. Comparative anatomy of Brain of vertebrates, Structure of Ear and Eye.	12
Keywords	*Chordates, Protochordates, Petromyzon And Myxine, Comparative Anatomy,Integument Lungs, Air Sacs Aortic Arches, Kidney, Brain*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Jordan, E. L. and Verma, P. S. (2013) Chordate Zoology (14th edition).
- Saxena, R. K. and Saxena, S. (2015) Comparative Anatomy of Vertebrates (2nd edition).
- R.L. Kotpal, Modern Text Book of Zoology, Vertebrates, Rastogi Publication, Merut
- Tiwari, V.K. Unified Zoology, B.Sc. Part I, Shivlal Agarwal and Company, Indore

Reference Books Recommended –

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Weichert, C.K. (1970) Anatomy of Chordates (4th edition).

Online Resources–
e-Resources / e-books and e-learning portal

- **https://swayamias.com/zoology-optional-coaching/**
- **https://www.swayamprabha.gov.in/index.php/program/archive/9**
- **https://www.acsedu.co.uk/Courses/Environmental/VERTEBRATE-ZOOLOGY-BEN104-528.aspx**
- **https://www.nu.edu/degrees/mathematics-and-natural-sciences/courses/bio416/**
- **https://www.youtube.com/watch?v=qSY5iXHHi88**
- **https://www.youtube.com/watch?v=tz8liJXbBCQ**
  https://www.youtube.com/watch?v=mXECx3s8yEQ

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree / Honors)*			**Semester - IV**	Session: **2024-2025**
1	**Course Code**	**ZOSC-04P**		
2	**Course Title**	**Diversity of Chordates and Comparative Anatomy**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing lab course the students will be able to -** ➢ Develop understanding on the diversity of life with regard to different classes of vertebrates. ➢ Gain knowledge to identify and classify the animals on the basis of their morphological characteristics. ➢ Acquire the detailed knowledge about evolutionary history and relationship between the different classes of vertebrates through salient features some important animals. ➢ Learn comparative account of various systems in all the classes of vertebrates.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**List of labs to be conducted** ➢ Study of animals through models, slides and museum specimens in the laboratory with details on their classification, biogeography and diagnostic features of different class of Vertebrate. ➢ Study of histological slides of different class of Vertebrate. ➢ Study of Axial skeleton of Amphibia, Reptilia, Aves and Mammals. Comparative study of Appendicular skeleton Girdles and limb bones) of Amphibia, Reptilia, Aves and Mammals. ➢ Comparative study of heart of Fish, Amphibia, Reptilia, Aves and Mammals with the help of models and charts. ➢ Comparative study of Aortic Arches Fish, Amphibia, Reptilia, Aves and Mammals with the help of models and charts. ➢ Comparative study of brain of Fish, Amphibia, Reptilia, Aves and Mammals with the help of models and charts. ➢ Comparative study of Urinogenital system of Fish, Amphibia, Reptilia, Aves and Mammals with the help of models and charts. ➢ Histological study of Endocrine tissue ➢ Study of Vertebrate animals in nature during a survey of a National Park/ Forest area/College campus. ➢ **Group discussion/Viva or Seminar presentation on any one of above topics** ➢ An "**animal album or Practical Record**" containing sketches, photographs, cut outs, with appropriate write up about the above mentioned taxa. ➢ Study of some videos to develop understanding on the animals of different taxa.	**30**
Keywords	*Museum specimens, Histological slides, Alternative of Dissection, Practical Record*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- S.S. Lal, Practical Zoology, Vertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi
- Saxena, R. K. and Saxena, S. (2015) Comparative Anatomy of Vertebrates (2nd edition).
- R.L. Kotpal, Modern Text Book of Zoology, Vertebrates, Rastogi Publication, Merut
- Tiwari, V.K. Unified Zoology, B.Sc. Part I, Shivlal Agarwal and Company, Indore

Reference Books Recommended –

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Weichert, C.K. (1970) Anatomy of Chordates (4th edition).

Online Resources–

- https://www.youtube.com/watch?v=W4gQxADcryw
- https://www.youtube.com/watch?v=Ts9GsrBviI8

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in life Science *(Degree / Honors)*	**Semester - V**	Session: **2024-2025**

1	Course Code	ZOSC- 05T	
2	Course Title	Vertebrate Physiology	
3	Course Type	Discipline Specific Course	
4	Pre-requisite (if, any)	*As per Program*	
5	Course Learning. Outcomes (CLO)	**After successfully completing this course, the students will be able to-** ➢ Understand the physiological mechanism at cellular and system level. ➢ Learn the significance ofnutrients, breathing mechanism, blood coagulation. ➢ Understand the water balance in body and working of different senses response. ➢ Understand the reproductive physiology and muscles contraction. ➢ Apply this knowledge to understand working and disorders of physiological activities.	
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Cell Physiology: Cell membrane and transport mechanism:** Transport across membrane: osmosis, passive diffusion- simple and facilitated, & Active transport Mechanism of active transport Primary & secondary active transport, endocytosis and exocytosis, Vescicular Transport: Protein sorting from ER to Golgi, Retrograde transport, Transport across Mitochondrial membrane; pH and its biological significance, Buffer: buffers in biological system, Regulation of pH by Lung and Kidney.	12
II	**Physiology of Digestion Respiration and Circulation:** **Physiology of Digestion:** Biological significance of nutrients: carbohydrates, proteins, fats, vitamins and minerals. Physiology of digestion with special reference to enzyme involved, Absorption of Carbohydrate, protein and lipid. **Breathing mechanism:** Pulmonary ventilation, Respiratory volumes and capacities. Transport of Oxygen and Carbon dioxide in blood. **Composition of blood**, blood groups, Theories of blood coagulation. Conduction and Regulation of Heart beat, Cardiac cycle, Cardiac output, Integration of cardiovascular function, electrocardiogram (ECG).	11
III	**Physiology of Excretion, nerve impulse transmission and Receptor Physiology:. Physiology of excretion: Nephron:** Structure, Types and their functions Mechanism of Urine formation, Counter-current Mechanism, role of ADH and Renin-Angiotensin-Aldosterone system in Excretion, **Mechanism of Osmoregulation** in fresh water and marine and terrestrial vertebrates, Stenohalinity and Euryhalinity. **Nerve Physiology:** Structure and functions of neuron, ionic basis of resting and action potentials, nerve impulse and its transmission, synapse and synaptic transmission, Reflex action. **Receptor physiology-** Physiology of Vision, Physiology of Hearing and balancing, Mechano, chemo reception, Bioluminescence.	11
IV	**Physiology of Reproduction, Muscle Contraction and Tharmoregulation: Physiology of Reproduction:** male reproduction: hormonal control of Spermatogenesis, female reproduction: hormonal Control of Oogenesis, menstrual cycle and its hormonal control. **Muscle Contraction:** Structure and types of muscles, striated, non-striated and cardiac muscles. Molecular structure of muscles protein Actin and Myosin. Physiology of muscles contraction. **Theories of Muscles Contraction. Thermoregulation:** Mechanism in Homeotherms and Poikilotherm.	11
Keywords	*Vertebrate Physiology, Physiology of Respiration, Digestion, Circulation, Blood, Cardiac Cycle, Excretion, Nerve impulse, Thermoregulation, Muscle Contraction, Physiology of Reproduction & Endocrine Glands*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Verma P S , Tyagi B S, Agarwal VK *Animal Physiology. Author*,. Edition, illustrated. Publisher, S. Chand Publishing, 2000 - Science - 432 pages
- *Berry AK,* A Textbook of *Animal Physiology By* (Second edition Emkay publication
- Dr. C. C. Chatterjee, Human physiology, Vol. I & II, 1980, 12th Edn., Medical Applied Agency, Kolkata
- Nagabhushanam, S. V. S. Rana, S. Kalavathy Text book of Animal Physiology, 2008, 2nd Edn., Oxford University Press, India.

Reference Books Recommended –

- Ian Kay, 2000, Introduction to Animal Physiology, Bios Scientific Publishers Limited.
- Guyton A. C. & Hall J. E., 2006, Textbook of Medical Physiology, 11th Edition, Hercourt Asia Pvt. Ltd. / W. B. Saunders Company
- Tortora G. J. & Grabowski S.,Principles of Anatomy & Physiology, 2006, 11th Edition, John Wiley & sons, Inc.
- Schmidt-Nielsen, Knut, Animal Physiology: Adaptation and Environment, 1997, Cambridge University Press.
- Hoar W. S., General and Comparative Physiology, 1983, 3rd Edn., Prentice Hall, UK.7.
- Barret, K.; Brooks, H.; Boitano, S. and Barman, S. (2010) Ganong's Review of Medical Physiology (23rd edition) Lange Medical.
- Guyton, A.C. and Hall, J.E. (2006) A text book of Medical Physiology (11th edition) Saunders.
- Keele, C.A. & Neil, E. (1989) Samson Wright's Applied Physiology (13th edition) Oxford.

Online Resources–

- **E PG Pathshala: https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**
- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science *(Degree / Honors)*		**Semester - V**	Session: **2024-2025**
1	**Course Code**	**ZOSC-05 P**	
2	**Course Title**	**Vertebrate Physiology**	
3	**Course Type**	**Discipline Specific Lab Course**	
4	**Pre-requisite** (if, any)	***As per Program***	
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Perform and demonstrate some physiological exercises ➢ Learn to record Blood pressure and analyze it ➢ Calculate Oxygen Consumption in model animal ➢ Learn the structure and working of eye and ear. ➢ Apply this knowledge to identify tissues by learning Histological details	
6	**Credit Value**	**1 Credits**	***Credit = 15 Hours - learning & Observation***
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**

PART -B: Content of the Course		
Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)		
Unit	**Topics (Course contents)**	**No. of Period**
	• Hematological practical : Determine blood group, RBC and WBC counting technique, clotting time • Preparation of haemine crystal • Measurement of Blood Pressure through sphygmomanometer. • Action of salivary amylase on starch • Biochemical analysis of food • Determination of oxygen consumption with the help of Respirometer • Preparation of casein from milk • Study of permanent histological section slides of (esophagus , stomach, duodenum, ilium , pancreas ,liver trachea kidney spinal cord, bone, cartilage & blood cells) mammal, • Demonstration of technique of microtome to have hands-on experience and learning of the technique • Glycolysis, Krebs's cycle, electron transportation demonstrate through Chart / Photographs • Preparation of Practical record • group discussion /quiz / A small project report applying the knowledge	15
Keywords	*Vertebrate Physiology, Human Physiology, Physiology of Respiration, Digestion, Circulation, Blood, Cardiac Cycle, Excretion, Nerve impulse, Thermoregulation, Muscle Contraction, Physiology of Reproduction & Endocrine Glands*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Hoar W. S., General and Comparative Physiology, 1983, 3rd Edn., Prentice Hall, UK.7.
- Keele, C.A. & Neil, E. (1989) Samson Wright's Applied Physiology (13th edition) Oxford.
- Verma P S , Tyagi B S, Agarwal VK *Animal Physiology. Author*,. Edition, illustrated. Publisher, S. Chand Publishing, 2000 - Science - 432 pages
- Berry AK, A Textbook of Animal Physiology By (Second edition Emkay publication
- Pal GK & Pal Parvati, Text book of Practical Physiology, Universities Press
- V P Varshaney and Mona Bedi, Ghai's Text Book of Practical Physiology, Jaypee Brothers Medical Publication

Reference Books Recommended –

- Ian Kay, 2000, Introduction to Animal Physiology, Bios Scientific Publishers Limited.
- Guyton A. C. & Hall J. E., 2006, Textbook of Medical Physiology, 11th Edition, Hercourt Asia Pvt. Ltd. / W. B. Saunders Company
- Tortora G. J. & Grabowski S.,Principles of Anatomy & Physiology, 2006, 11th Edition, John Wiley & sons, Inc.
- Dr. C. C. Chatterjee, Human physiology, Vol. I & II, 1980, 12th Edn., Medical Applied Agency, Kolkata
- Nagabhushanam, S. V. S. Rana, S. Kalavathy Text book of Animal Physiology, 2008, 2nd Edn., Oxford University Press, India.
- Schmidt-Nielsen, Knut, Animal Physiology: Adaptation and Environment, 1997, Cambridge University Press.

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/m_zly6dppqu**
- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/y_0ag_clvw0**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree / Honors)*		**Semester - VI**		Session: **2024-2025**
1	**Course Code**	**ZOSC-06T**		
2	**Course Title**	**Genetics**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite (if, any)**	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Understand and grasp the principles of Mendelian inheritance and interaction of genes. ➢ Understand the sources and consequences of genetic variation, including mutations, genetic recombination, and gene flow. ➢ Know various methods of sex determination in animal kingdom. ➢ Analyse the cause and effect of alterations in chromosome number and structure ➢ Understand DNA structure and function, gene expression, and genetic inheritance patterns ➢ Know the Recent Assisted Reproductive Techniques		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Concept of Genes and Genomics:** Scope and importance. Elements of heredity and variation: Classical and Modern concept of Gene (Cistron, Muton, Recon), Alleles. Mendel's laws of inheritance, Chromosomal basis of inheritance and its applications. Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Multiple allelism. Ineraction of Gene- Lethal alleles, Pleiotropy, Epistasis- Dominant and Recessive, Supplimentary, Complementary, Inhibitory gene and polygene. Define Penetrance, Expressivity and Phenocopy.	12
II	**The recombination and interaction of Genes:**Linkage and crossing over, cytological basis of crossing over. Organelle inheritance (Mitochondrial), Sex Chromosomes and sexlinked Gene X-linked dominant and X-linked recessive. Sex determination: Theories of sex determination: Chromosomal Theory (XX/XO, XX/XY, ZZ/ZW, ZZ/ZO), Genetic balance theory, intersex, Haplodiploidy, Gynandromorphs. Hormonal influence on sex determination- Freemartin and sex reversal. Role of environmental factors- Bonellia and Crocodile. Eugenics. Mutation, Chromosomal and Gene Mutation, Structural and numerical alterations of chromosomes.	11
III	**Regulation of Gene expression, regulation and mapping:** Gene Expressions and regulation: One gene-one enzyme hypothesis /one polypeptide hypothesis. Concept of operon of bacteria (Lac Operon) and bacteriophages. Bacterial transposons. Vertical and horizontal gene transfer. Transformation, transfection and transduction. Genetic mapping. RNA-inheritance, FLP-FRT. Utility of the model organisms: Escherichia coli, *Drosophila melanogaster* & *Mus musculus*	11
IV	**Population Genetics and Genetic Counselling:** Human Genetics: Pedigree analysis; Karyotype, **Genetic disorders: chromosomal aneuploidy** (Down, Edward, Patau, Turner and Klinefelter syndromes), chromosome translocation (Chronic Myeloid Leukemia) and deletion ("cry of cat" syndrome). Single Gene Disorder: gene mutation (sickle cell anemia,) and Genetic counselling, Gene isolation Manipulation and techniques. Basic concept of Polymerase Chain Reaction. DNA Sequencing; Southern, Western & Northern Blots. In situ Hybridization, FISH, RFLPs and Oligonucleotide arrays. Gene Cloning vs Animal Cloning, Nuclear transplantation,	11
Keywords	*Genetics, Mendel's law, Interaction of Gene, Sex Linkage, Sex Determination, Operon, Genetic Screening, Pedigree Analysis, Aneuploidy*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Arora M.P. and Sandhu G.S. Genetics, Himalayan Publishing House
- Winter P.C. Et al, Genetics Viva Publication
- Gupta P.K., Cell and Molecular Biology Rastogi Publication

Reference Books Recommended –

- Gardner, E.J. *et al.* (2006) Principles of Genetics (John Wiley).
- Russell, P.J. (2010) Genetics (Benjamin Cumm ings).
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India.
- Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. (V edition) John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
- Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.
- Campbell, N. and Reece, J. (2014) Biology (10th edition). Benjamin Cummings

Online Resources–

- National digital Library.
- http://ndl.iitkgp.ac.in/document/Rm5qb3lqRngwWDZ2Tnl6UXl4VU9YR201R0cwYXJHV25HSHFacGxtS1h3REZGd1ByL28xcmlIeEFFZU5najlCZ1lHdXBBTzBleTBVRGlDSFhkMEtuUkE9PQ
- E-PG Pathshala.
- https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA
- eGyankosh- Genetics and Evolutionary Biology
- eGyanKosh: BZYCT-137 Genetics and Evolutionary Biology

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** **+20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree / Honors)*			**Semester - VI**	Session: **2024-2025**
1	**Course Code**	**ZOSC- 06P**		
2	**Course Title**	**Genetics**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Able to understand and explain Mendel's Law of Inheritance ➢ Capable to analyze inheritance of gene by pedigree analysis. ➢ Know laboratory culture of Drosophila. ➢ Understand and configuration for animal life. ➢ Capable to understand Human keryotype and Numerical alteration in chromosomes		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	➢ Application of probability in the law of segregation with coin tossing. ➢ Study of mode of inheritance of the following traits by pedigree charts – attached ear lobe, widow's peak. ➢ Familiarization with techniques of handling *Drosophila*, identifying males and females; observing wild type and mutant (white eye, wing less) flies, and setting up cultures. ➢ Study of human karyotypes and numerical alterations (Down syndrome, Klinefelter syndrome and Turner syndrome). ➢ Demonstration of law of segregation (monohybrid and test cross) sex-linked inheritance in Drosophila making a cross between white eye dumpy winged or sepia eyed and wild type flies (criss-cross inheritance) Explain with Model ➢ Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides/photograph ➢ Extraction of Genomic DNA from bacteria. ➢ Group discussion/ Seminar/ Quiz presentation on one or two related topics	**30**
Keywords	***Mendel's Law, Human Karyotype, Drosophila Culture, Pedigree***	
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Practical Hand Book of Genetics: Vikas Pali Kalyani Publication
- Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual Debarati Das, Academic Publishers.
- Cytogenetics:Mohan P Arora, Himalayan Publishing House

Reference Books Recommended –

- Klug, W.S., Cummings, M.R. and Spencer, C.A. (2012). Concepts of Genetics. (X edition) Benjamin Cummings.
- Carroll S.B.; Doebley J.; Griffiths, A.J.F. and Wessler, S.R. (2018) An Introduction to Genetic Analysis. W. H. Freeman and Co. Ltd.

Online Resources–

- **https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Genetics.pdf**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **50 Marks**

Continuous Internal Assessment (CIA): **15 Marks**

End Semester Exam (ESE): **35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors / Honors With Research)*		**Semester - VII**		**Session: 2024-25**
1	**Course Code**	**ZOSC-07T**		
2	**Course Title**	**Biosystematics and Taxonomy**		
3	**Course Type**	**Discipline Specific Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course the students will be able to -** ➢ Comprehend the basic concepts of Biosystematics and Txonomy. ➢ Understand and learn the Taxonomic Hierarchy in animal kingdom. ➢ Gain a basic knowledge and grasp the rules and philosophy of scientific nomenclature. ➢ Develop the critical understanding to identify the animals up to species level with the help of taxonomic keys. ➢ Learn the Newer trends in biosystematics and apply it in Research.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction to systematic and classification:** Definition & basic concepts of Biosystematics and Taxonomy. Historical resume of systematic. Taxonomic Hierarchy: Definition, Linnean hierarchy and categories. Classification: Purpose, use and basis. Theories of classification: Biological, artificial and natural classification. Levels of taxonomy: alpha, beta and gamma taxonomy. Micro and macro taxonomy. Scope and applications of biosystematics in biology. The relevance of systematics in conservation programs.	11
II	**Taxonomic Characters and Scientific Nomenclature:** Different types of taxonomic characters (morphological, physiological, ecological, ethological and geographical characters). **Zoological nomenclature:** binominal and trinomial system, Principles andrules of International Code of Nomenclature (ICN), type material, author citation, criteria for publication, types of names, principle of priority and its limitations.	11
III	**Taxonomic Keys, Taxonomic treatment and Phylogenetics:** Types of taxonomic key their merits and demerits. Type concept: Process of typification and different Zoological types and their applications. Taxonomic treatment of Allopatric variation, homology and Reproductive and geographical isolating mechanisms and their role in speciation process. **Evolutionary taxonomy:** Cladistics. **Constructing trees/ dendrograms:** Phenogram, phylogram and cladogram and turning them into classifications. Mechanism of speciation in panmictic and apomictic species. **Species concept:** different species concepts, **Species category:** sub-species and other infra species categories.	12
IV	**Taxonomic procedure and Newer trends in biosystematics:** Taxonomic Collection, curetting, preservation, identification and classification. **Newer trends in biosystematics:** Morphological, Embryological, Behavioral, Ecological, Cytological and Biochemical approach. Numerical taxonomy. Differential systematic. Molecular taxonomy. DNA bar coding for identification of species.	11
Keywords	*Systematic, classification, Linnean hierarchy, dendrograms, Nomenclature, Cladistics, Species category*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- R.C. Dalella & R.S. Sharma, (2017) Animal Taxonomy & Museology. Jai Prakashnath & Co., Meerut.
- V.C. Kapoor (2019). Theory and practice of animal taxonomy and biodiversity, 8th Edn.

Reference Books Recommended –

- E. Mayer, (1991). Principles of Systematic Zoology.
- G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India
- E.O. Wilson, (1988). Biodiversity. John Wiley & Sons.
- Futuyama, D. J. (1986). Evolution, Systematics and Animal Behaviour. Evolutionary Biology. Sinauer Associates Inc.
- Mayr, E. & Ashlock, P. D. (1991) Principles of Systematic Zoology (2nd edition) McGraw Hill Int.

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/qtrdnp2xfxe?e=0|species%20concept|||**
- **http://ndl.iitkgp.ac.in/he_document/swayam_ugc_moocs/214_21777_self_learning**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks
Continuous Internal Assessment (CIA): 30 Marks
End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors / Honors with Research)*			**Semester -VII**	Session: **2024-2025**
1	**Course Code**	**ZOSC- 07P**		
2	**Course Title**	**Biosystematics and Taxonomy**		
3	**Course Type**	**Discipline Specific Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course the students will be able to** ➢ Comprehend the basic concepts of Biosystematics and Txonomy. ➢ Understand and learn the Taxonomic Hierarchy in animal kingdom. ➢ Gain a basic grasp on the rules and philosophy of scientific nomenclature. ➢ Develop the critical understanding to identify the animals up to species level with the help of taxonomic keys. ➢ Learn the Newer trends in biosystematics and apply it in Research.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Study and sketch of museum specimens of Invertebrates and Vertebrates on the basis of systematic and Taxonomic Hierarchy • Preparation of identification keys for select specimens of non chordate (e.g., insects) and chordates (e.g., birds). • Make a record of biodiversity of college campus. • Construct the dendrograms, through Interactive software for exploring phylogeny and analyzing character • Use DNA bar coding for identification of species. • General discussion, distinguishing characters and classification of selected animals. • Generation of a character-state matrix by selecting and scoring diagnostic taxonomic characters. • Distance-based methods of phylogenetic reconstruction using manual and computermethods. • Group discussion/Viva or Seminar presentation on two related topics. • An "animal album or Practical Record" containing sketches, photographs, cut outs, with appropriate writes up about the above mentioned taxa. • Study of some videos to develop understanding on the animals of different taxa.	**30**
Keywords	*Museum specimens, dendrograms, bar coding, identification keys, phylogenetic*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- R.C. Dalella & R.S. Sharma, (2017) Animal Taxonomy & Museology. Jai Prakashnath & Co., Meerut.
- V.C. Kapoor (2019). Theory and practice of animal taxonomy and biodiversity, 8th Edn.
- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference Books Recommended –

- E. Mayer, (1991). Principles of Systematic Zoology.
- G.G. Simpson (2012). Principles of animal taxonomy. Scientific Publisher, India

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/qtrdnp2xfxe?e=0|species%20concept|||**
- **http://ndl.iitkgp.ac.in/he_document/swayam_ugc_moocs/214_21777_self_learning**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science *(Honors / Honors With Research)*		**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSC-08T**	
2	**Course Title**	**Biotechniques**	
3	**Course Type**	**Discipline Specific Course**	
4	**Pre-requisite (if, any)**	***As per program***	
5	**Course Learning Outcomes (CLO)**	***At the end of course, students will be able to -*** ➢ Have comprehensive understanding of various tools and techniques commonly employed in scientific research across disciplines ➢ Learn utilizing essential laboratory instruments such as microscopes, pH meter, spectrophotometers, chromatography systems, and centrifuges. ➢ Understand cell culture techniques ➢ Develop skills in experimental design, data acquisition, and analysis using modern software tools. ➢ Develop critical thinking on the application of various modern instruments and correlate the knowledge for better development of society.	
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Microscopy and Microtomy: Types of Microscope:** Basic Principle, configuration and working of Light Microscope (Bright and Dark Field), Magnification & Resolution, and Numerical Aperture. Phase Contrast Microscope, Fluorescence Microscope, Confocal Microscope. Electron Microscope (SEM and TEM). **Microtomy**: Permanent slide preparation through microtome: Tissue - preparation fixation, dehydration, **block** - preparation, trimming, **cutting sections (sectioning /Ribbon)** - handling, affixing on the side, labeling and storage, **staining** the microtomy slides.	11
II	**Tools and techniques in Physiology:** Principle and applications of pH meter, Centrifugation, Colorimetry and Spectrophotometry- UV, visible spectrophotometer, Infra-red spectrophotometer, NMR and ESR.	11
III	**Chromatography and Eletrophorosis: Chromatography:** Principle and Applications of Paper chromatography, Thin layer chromatography and Gel-filtration chromatography. **Electrophoresis:** Principle and Applications of Agarose gel electrophoresis, Polyacrylamide Gel electrophoresis, PAGE, 2D PAGE.	12
IV	**Cell culture and Lab Bioethics:** Cell culture and its basic requirements. **Culture media:** Nutrient and Non-nutrient media, Types of animal cell culture: Pure Culture- Pour Plate Method, Streak Plate Method and Spread Plate Method. **Media preparation** of Animal Cell culture, viability testing, cell harvesting and storage method with special reference to Lymphocytes and stem cell culture. *In Vitro* culture of Entamoeba *histolytica, Coenorhabditis elegans*. **Sterilization technique** (Physical Method: Autoclave sterilization, Hot air Sterlization, U V sterilization, filtration and chemical Method: alcohol, Formalin and Chromic acid), sterilization of glass wares, Media and laminar flow, Flow cytometery. **Lab Bioethics:** Lab safety, disposal of bio-waste.	11
Keywords	*Cell culture, Sterilization, Cryopreservation, Media, viability testing, cell harvesting, Lymphocytes, stem cell.*	
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Robert Braun, Introduction to instrumental analysis, McGraw Hill Publication
- Clark and Swizer, Experimental Biochemistry, Freeman, 2000
- Boyer, R. (2000) Modern Experimental Biochemistry (3rd edition) Benjamin-Cummings.
- Recommended readings.
- Pearse, A.G.E. (1980-1993) Histochemistry - Theoretical and applied, Volume I-III, Churchill-Livingstones.
- Plummer, D. (2017) An Introduction to Practical Biochemistry (3 rd edition) McGraw Hill.
- Wilson, K. and Walker, J. (2010) Experimental Biochemistry, Cambridge. Practical
- Swarup N, Arora S and Pathak SC, Laboratory Techniques in Modern Biology. Kalyani Publishers
- Sharma B.K., Principles of Instrumentation Goel Publishing House
- Upadhayay Upadhayay & Nath, Principles of Instrumentation, Himalaya Publishing House
- Chatwal G R & Anand Sharma , Principles of Instrumental method of Chemical Analysis, Himalaya Publishing House
- Arumugam N, Kumaresan V, Biotechniques Saras Publication
- Ghatak K L, Techniques and Methods in Biology PHI Learning

Online Resources–

- **https://www.youtube.com/watch?v=_t9Zh3PJaF4**

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Science *(Honors/ Honors with Research)*		Semester - VIII	Session: 2024-2025
1	Course Code	ZOSC-08P	
2	Course Title	Biotechniques	
3	Course Type	Discipline Specific Lab Course	
4	Pre-requisite (if, any)	*As Per Program*	
5	Course Learning. Outcomes (CLO)	**After successfully completing this course, the students will be able to:** ➢ Understand the purpose of the technique, its proper use and possible modifications/improvement. ➢ Developed skills in handling instruments. ➢ Developed skills in the performance of experiments through scientific planning. ➢ Develop critical thinking on reviewing, discussing and reporting the results. ➢ Applied and Correlate the knowledge for better development of society.	
6	Credit Value	1 Credits	*Credit =30 Hours Laboratory or Field learning/Training*
7	Total Marks	Max. Marks: 50	Min Passing Marks: 20

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**List of labs to be conducted** • Study and handling of Compound Microscope, pH meter, Colorimeter, Centrifuge, Spectrophotometer, Chromatography Chamber, Electrophorosis Unit, Microtome. • Sterilization of Lab equipments. • Determination of pH of different soil samples & water samples. • Determination of maximum absorption. • Separation of Amino acids, plant pigment and sugar by paper and thin layer chromatography • Separation of DNA and RNA through Paper & Gel Electrophoresis • Separation of particles by Centrifuge. • Preparation of Permanent slides through Microtome. • Preparation of Temporary and Permanente slides of some microscopic organisms. • Pure culture of cell. • Cell fractionation • Contour drawing through Camera Lusida • Preparation of Practical Record. • Group discussion/Viva or Seminar presentation on above mentioned and related topics.	30
Keywords	*Centrifuge, Spectrophotometer, Chromatography Chamber, Electrophorosis Unit, Microtome, Cell fractionation, Camera Lusida.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Sharma B.K., Principles of Instrumentation-
- Upadhayay Upadhayay & Nath, Principles of Instrumentation, Himalaya Publishing House
- Chatwal G R & Anand Sharma , Principles of Instrumental method of Chemical Analysis, Himalaya Publishing House

Reference Books Recommended –

- Boyer, R. (2000) Modern Experimental Biochemistry (3rd edition) Benjamin-Cummings.
- Recommended readings.
- Pearse, A.G.E. (1980-1993) Histochemistry - Theoretical and applied, Volume I-III, Churchill-Livingstones.
- Plummer, D. (2017) An Introduction to Practical Biochemistry (3 rd edition) McGraw Hill.
- Wilson, K. and Walker, J. (2010) Experimental Biochemistry, Cambridge. Practical
- Swarup N, Arora S and Pathak SC, Laboratory Techniques in Modern Biology. Kalyani Publishers
- Robert Braun, Introduction to Instrumental analysis

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/gb9ai2ctttc**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree/Honors)*			**Semester - III**	Session: **2024-2025**
1	**Course Code**	**ZOSE- 01T**		
2	**Course Title**	**Parasitology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	➢ Students should comprehend the life cycles of various parasites, including their modes of transmission, intermediate hosts, and definitive hosts. ➢ Gain insights into the interactions between parasites and their hosts; including mechanisms of host invasion, evasion of host defenses, and pathogenesis. ➢ Develop the ability to recognize clinical manifestations associated with parasitic infections ➢ Understand the epidemiology of parasitic diseases ➢ Communicate effectively about parasitic diseases, including educating the public.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Viral diseases:** General characters, Structure and Classification of virus, A brief account of pathogenic viruses. Brief history of microbiology: germ theory of disease, Host pathogen interaction: invasion, antigenic heterogeneity, toxins and enzymes secretions. Viral diseases: hepatitis, influenza, AIDS, Covid -19 with emphasis on their causative agents, pathogenesis, diagnosis, prophylaxis and chemotherapy.	12
II	**Bacterial & Fungal diseases**: General characters, Structure and Classification of bacteria. **Bacterial Diseases:** A brief account of pathogenic bacteria, discovery of penicillin, diseases caused by *Streptococcus pneumonia, Salmonella typhi, Escherichia coli, Mycobacterium tuberculosis, Rickettsia, Spirochaetes* **Fungal diseases:** Ringworm infection, *Aspergillosis, candidiasis.*	11
III	**Protozoan parasites**: An overview of protozoa & disease. Introduction to parasites and parasitic diseases. Mode of transmission, portals of entry and implications of parasitism. Parasitic adaptations. Concept of zoonotic diseases. Protozoan diseases of medical importance: Brief account of life History, pathogenicity of the following Protozoa with reference to Man, prophylaxis and treatment: *Entamoeba histolitica, Trypanosoma gambiens, Plasmodium vivex, Giardia.*	11
IV	**Helminth parasites:** An overview of Helminthic diseases. Brief account of life History, pathogenicity of the following Helminths with reference to Man, prophylaxis and treatment. *Taenia solium, Schistosoma haematobium, Ascaris lumbricoides, Wuchereria branrofti.* Vector insects.	11
Keywords	*Micrology, pathogenic bacteria, Protozoan parasites, Helminth parasites, Toxicology, toxic againts*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Agrawal Anju Principles of Toxicology
- Parija, S. C. (2013) Textbook of Medical Parasitology, Protozoology & Helminthology (Text and colour Atlas), IV Edition, All India Publishers & Distributers, New Delhi.
- Ichhpujani, R.L. and Bhatia, R. (2009) Medical Parasitology. III Edition, Jaypee BrothersMedical Publishers (P) Ltd., New Delhi
- Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor andFrancis Group.
- Chatterjee, K. D. (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBSPublishers & Distributors (P) Ltd.
- Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications andDistributors
- Chatterjee, K.D (2015) Parasitology (13th edition)

Reference Books Recommended –

- Jawetz, M. and Adelberg (2015) Medical Microbiology (27th edition)
- Noble, E.R. and Noble, G.A. (1989) Parasitology: The Biology of Animal Parasites. VIEdition, Lea and Febiger

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_51296_P_0_B_o_p_51542_M_1_M_L_c_P_D_a_P_o_E_P_1_51562_51563?e=9|*||**
- **http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_51296_P_0_B_o_p_51542_M_2_P_d_a_p_o_w_b_51594_51595?e=3|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree/ Honors)*			**Semester - III**	Session: **2024-2025**
1	**Course Code**	**ZOSE- 01P**		
2	**Course Title**	**Parasitology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**At the end of this course, the students will be able -** ➢ Identify common parasitic Protozoa and Helminth. ➢ Learn techniques for studying growth of bacteria and its staining. ➢ Learn the techniques for examine Sputum, Blood, Urine and Stool samples for pathology		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Study of permanent slides and specimens of parasitic Protozoans and Helminthes. ➢ Pathological examination of sputum, blood, urine and stool. ➢ Blood: Erythrocyte Sedimentation Rate (ESR), Haematocrit. ➢ Staining and identification of Gram positive and Gram negative bacteria. ➢ Preparation of thin and thick blood films to diagnose Plasmodium infections/ or permanent slides. ➢ Preparation of temporary and permanent slides of faecal matter by saline preparation and concentration techniques to identify cysts of parasitic Protozoans and Helminthes eggs /or parmanant slides studies. ➢ Study Kinetics of bacterial growth and staining techniques. ➢ Group discussion or Seminar presentation on one or two related topics ➢ Group discussion/quiz/seminar on topics related to theory. ➢ Preparation of practical record or Album of parasites.	**30**
Keywords	*Parasitic protozoa, helminth, ESR, Gram positive and Gram negative*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Ghosh Saugala, Panikar's Text book of Parasitology. Jaipyee Brothers
- Ananthanarayan and Paniker's Textbook of Microbiology, Twelfth Edition, Universities press

Reference Books Recommended –

- K.D. Chattargee, Parasitology . CBS Publisher

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayam_ugc_moocs/swayam_ugc_moocs/IN_S_U_M_1_U_C_17_A_D_4127_M_L_h_o_A_L_w_P_A_o_A_L_34326_34327?e=7|*|||**
- **http://ndl.iitkgp.ac.in/he_document/swayam_ugc_moocs/swayam_ugc_moocs/IN_S_U_M_1_U_C_17_A_D_4127_M_L_h_o_T_s_a_F_h_10250_10251?e=8|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Diploma / Degree/Honors)*			**Semester -IV**	Session: **2024-2025**
1	**Course Code**	**ZOSE-02T**		
2	**Course Title**	**Ecology and Wildlife Conservation & Management**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Understand the concepts of fundamental ecological principles, including energy flow, nutrient cycling, and population dynamics. ➢ Apply the knowledge of ecology to understand equilibrium of nature. ➢ Analyze the strategies of Populations to survive and sustain. ➢ Evaluate the significance of biodiversity and its conservation. ➢ Create awareness about wildlife and nature.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**An overview of Ecology and Biomes:** Aims and scope of Ecology. Difference between Auto-ecology and Synecology. Abiotic & Biotic factors. Ecosystem and Ecological Pyramids. Bio-geo chemical cycles. Energy flow in ecosystem: Trophic levels. Food Chain, Food Web, Food chain in fresh water ecosystem. Laws of limiting factor: Leibig's Law of Minimum, Shelford Law of tolerance. Major Biomes of the world. Biogeographic zones of India.	11
II	**Population ecology:** Population characteristics: Density, Measurement of Population Density (Quadrate method and tagging method) Mortality, Natality, Age Pyramids, Migration and Dispersal. Life tables. Survivorship curves. Population Growth: Types of Population Growth, Growth Curves (S shaped & J shaped), Mathematical Expression of population growth: logistic & stochastic. R and K strategies. Carrying Capacity. Population Regulation: extrinsic & intrinsic factors.	12
III	**Biotic community and Environmental degradation:** Biotic community characteristics and attributes: Stratification; Dominance, diversity, species richness, abundance, Evenness, Similarity. Ecotone and edge effect. Ecological succession. Species interaction: Positive interactions: commensalism, proto-cooperation and mutualism. Negative interactions: parasitism. Competition: Interspecific and Intraspecifi, Lotka Volterra Model, Gause's Principle. Prey-Predatator Model. **Environmental degradation:** Air, water and noise pollution and their control. Natural resources: Mineral, water and forest, their significance and conservation.	11
IV	**Biodiversity & Wildlife management:** Biodiversity: Concept and characteristics. Levels of Biodiveristy (Genetic Diversity, Species Diversity & Ecosystem Diversity), Hotspots of Biodiversity. Major National Parks of Chhattisgarh and their biodiversity. Endemic animal species of Chhattisgarh. IUCN red list categories and criteria. Conservation of Biodiversity (In Situ, & Ex Situ Conservation). Major international & national treaties, laws and regulations for conserving biodiversity. Important conservation projects undertaken in India: Project Tiger & Project Elephant. Tiger Census and Estimation (Techniques and Findings). Cheetah re-introduction plan. Captive breeding and Propagation: Founder population, rehabilitation, education, utilization, gene banks. GIS and other technologies in Forest & Wild life conservation.	11
Keywords	*Ecology, Biome, Abiotic, Biotic factors, Nutrient Cycle, Population, Wildlife conservation, In Situ & Ex Situ*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Sharma, P.D. Ecology and Environment, Rastogi Publication.
- Kumar Pranav, Meena Usha. Fundamentals of Ecology and Environment.
- Mathur Reena. Wildlife Conservation and Management, Rastogi Publication.
- Singh S.K., Text book of Wildlife Management, CBC Publishers and Distributors

Reference Books Recommended –

- Chapman, J.L.& M.J. Reiss. 1998. Ecology: Principles and Applications. Cambridge Univ. press. 2nd edition.
- Odum, E. P. (2004). Fundamentals of Ecology, Oxford and IBH Publishing Co. Pvt. Ltd.
- Smith, TM and Smith RL 2015. Elements of Ecology, Pearson Education, India.

Online Resources–

- **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000035ZO/P000891/M020617/ET/1498712980Ecosystemprocesses-IPart-1Quad1.pdf**
- **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000035ZO/P000891/M020612/ET/1498710746CommunitycharacteristicsstratificationPart4Quad1.pdf**
- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/cao2zsydjqu**

Online Resources–

- **https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1788373**
- **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000032SW/P001702/M020403/ET/14969150701-**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction

Program:Bachelor in Life Science*(Diploma / Degree/ Honors)*		Semester -IV	Session:2024-2025
1	CourseCode	ZOSE-02P	
2	CourseTitle	Ecology and Wildlife Conservation & Management	
3	CourseType	Discipline Specific Elective Lab Course	
4	Pre-requisite(if, any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	**After successfully completing this course, the students will be able to:** ➢ Understand practical fieldwork skills, including sampling techniques, data collection and methods of analysis used in ecological research. ➢ Learn to design and implement ecological experiments. ➢ Understand soil profile and characteristics. ➢ Analyse chemical parameters of various water bodies. ➢ Create awareness about local faunaand evaluate biodiversity of an area.	
6	CreditValue	1 Credits	*Credit =30 Hours Laboratory or Field learning/Training*
7	TotalMarks	Max.Marks:50	Min Passing Marks:20

PART -B: Content oftheCourse

TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)

Module	Topics(Coursecontents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Study of biodegradable and non-biodegradable pollutants in the locality. • Study of a representative type of ecosystem. • Determination of pH of water samples from various water bodies. • To determine the transparency of water of Pond ecosystem by Secchi disc. • To study the profile of soil in the field/ Soil sampling by V- cut method. • To study the zooplankton communities in a fresh water ecosystem. • To prepare a checklist of birds/Insects in and around college campus. • Estimation of ecological density, diversity and frequency of college premises by quadrate method. • Estimation of Shannon – Weiner index of a given area. • Estimation of Simpson– biodiversity index of a given area. • Study of strategy for preventing and managing human-wildlife conflicts. • Project Work / Quiz / Poster / Model preparation/Viva. • Practical Record	30
Keywords	*Density, Diversity, Frequency, Biodegradable, Non- biodegradable, Pollutants, Sechhi disc,*	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text BooksRecommended –

- Yadaw Vikas, YadawParul; 2022 Modern Practical Zoology; Kedar Nath Ram Nath.
- Verma P.S. A Manual of Practical Zoology Chordates, S.Chand.
- Lal S.S. Practical Zoology Vertebrate; Rastogi Publications.
- Jayasurya, Arumugam N.: Practical Zoology: Saras Publication.

Reference BooksRecommended –

- Odum, E.P. 1971Fundamentals of Ecology; W.B. Sounders
- Beard, J.M. 2013Environmental Chemistry in Society (2nd Edition). CRC Press.

Online Resources–

- **https://www.statology.org/simpsons-diversity-index/**
- **https://www.statology.org/shannon-diversity-index/**

Online Resources–

- **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000014ER/P000280/M026066/ET/1520505951paper10_Module27_etext.pdf**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz **+**obtained marks in Assignment shall be considered against **15** Marks

End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools& technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree/Honors)*			**Semester - V**	Session: **2024-2025**
1	**Course Code**	**ZOSE-03T**		
2	**Course Title**	**Biochemistry**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids. ➢ Understand the concept of enzyme, its mechanism of action and regulation and its kinetics. ➢ Understand the process of DNA replication, transcription and translation. ➢ Learn the preparation of models of peptides and nucleotides. ➢ Analyze properties of biomolecules through biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction to Biochemistry, Carbohydrates:** Introduction, scope and importance of Biochemistry. Carbohydrates: Classification and Chemical structure of: Reducing and non-reducing sugars: monosaccharides, Oligosaccharides, polysaccharides, Physical and Chemical properties, biological importance. Metabolism of carbohydrates and ATP production: Glycolysis, Krebs cycle, Electron transport chain and ATP synthesis, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis Glycogenesis and Cori cycle.	12
II	**Lipids: Structure and Biological significance:** Lipids: Structure and Biological significance. Fatty acids: Types and nomenclature (saturated and unsaturated). Classification: Triglycerides, Phospholipids, Sphingolipids, Cholesterol, β-oxidation and omega-oxidation of saturated fatty acids with even and odd number of carbon atoms. Biosynthesis of palmitic acid, Ketogenesis.	11
III	**Protein structure and metabolism: Proteins: Composition and Biological significance:** Amino acids: Structure, classification and properties. Primary, secondary, tertiary and quartnary structure of protein. Physiological importance of essential and non-essential amino acids. Catabolism of amino acids: Transamination, Deamination, Urea cycle. Enzymes: Nomenclature and classification, general properties, specificity. Mechanism of enzyme action (ES complex and lowering of activation energy, chemical catalysis). Regulation of enzyme activity, inhibition, allosteric regulation.	11
IV	**Nucleic acids and mechanisms of replication, transcription and translation:** Structure: Bases, nucleosides and nucleotides. DNA structure: Conformation (A, B and Z), DNA double helix (Watson and Crick model). DNA and RNA as genetic material. Organization of nucleosomes and higher order structure. DNA replication: Machinery and Basic mechanism (Prokaryotes). Transcriptional unit and basic mechanism of transcription (Prokaryotes). Genetic code and basic mechanism of translation (Prokaryotes).	11
Keywords	*Biomolecuules, Carbohydrates, Protein, Lipids, enzymes, Nucleic Acids*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Deb A.C.,Fundamentals of Biochemistry, New Central Book Agency
- Jain J.L., Jain N, Jain s., Fundamentals of Biochemistry, S.Chand Publication

Reference Books Recommended –

- Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition)Worth.
- Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman.
- Zubay, G. (2017) Biochemistry (4th edition) McGraw-Hill.
- Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry(5th edition) Wiley.

Online Resources–

- http://ndl.iitkgp.ac.in/he_document/swayam_prabha/clbszfhqwd0
- http://ndl.iitkgp.ac.in/he_document/aklectures/4_1_1_2888

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree/ Honors)*			**Semester - V**	Session: **2024-2025**
1	**Course Code**	**ZOSE- 03P**		
2	**Course Title**	**Biochemistry**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Learn qualitative analysis of bio molecules ➢ Students will use current biochemical and molecular techniques to plan and carry out experiments. ➢ They will undertake experiments to understand enzyme activity, ➢ Prepare models for biomolecules		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	• Qualitative analysis of nutrients: Carbohydrate, Proteins, Lipids. • Preparation of models of amino acids and dipeptides. • Ninhydrin test for α-amino acids. • Preparation of models of nitrogenous bases, nucleosides and nucleotides. • Qualitative test for DNA & RNA. • Determination of the activity of enzyme (Urease). • Determination of pK and pI values of glycine • Group discussion/ Quiz/Seminar presentation on related topics. • Preparation of practical record.	**30**
Keywords	*Carbohydrates, lipids, Proteins, Nucleic acids, qualitative, quantitative analysis*	
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Swaroop, Pathak and Arora. Laboratory technique
- Deb A.C.,Fundamentals of Biochemistry, New Central Book Agency
- Jain J.L., Jain N, Jain s., Fundamentals of Biochemistry, S.Chand Publication

Reference Books Recommended –

- Nelson, D.L. & Cox, M.M. (2017) Lehninger Principles of Biochemistry (7th edition)Worth.
- Berg, J.M.; Tymoczko, J.L. and Stryer, L. (2012) Biochemistry (7th edition) Freeman and Co.
- Zubay, G. (2017) Biochemistry (4th edition) McGraw-Hill.
- Conn, E.E.; Stumpf, P.K.; Bruening, G. and Doi, R.H. (2006) Principles of Biochemistry(5th edition) Wiley.

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayam_prabha/pe9ddsufpck**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/dsajwjhnmf8?e=8|*|||**

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz **+** obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Degree/Honors)*		**Semester - VI**	Session: **2024-2025**	
1	**Course Code**	**ZOSE-04T**		
2	**Course Title**	**Evolutionary Biology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course the students will be able to-** ➢ Understanding the historical concept of Evolution. ➢ Develop an understanding on the Evolutionary Concept and theories in evolution. ➢ Understanding on the different interacting evolutionary process by various examples. ➢ Learn animal phylogeny and adaptations. ➢ Develop an interest in the debates and discussion taking place in the field of evolutionary biology.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Historical review of evolutionary concept:** Evidences in favor of Evolution: Evidences from morphology and comparative anatomy (Homology, Analogy and Vestigial organs), Evidences from Paleontology, Connecting Links, Embryology, Taxonomy, Cytology, Biochemistry & physiology and from Genetics. Theories of Evolution: Lamarckism, Neo-Lamarckism and Darwinism (Basic Postulates of Darwinism, Supplementary theories of Darwin, Support & Criticism of Darwinism) Modern Synthetic theory of Evolution: Gene and Chromosomal Mutation.	12
II	**Evolutionary forces:** Natural Selection, Genetic variation, Genetic drift (mechanism, founder's effect, bottleneck phenomenon), Gene Migration. Hardy-Weinberg Law, Molecular clock (example of globin gene family) rRNA/cyt c). Isolation: Pattern & mechanism of isolation.	11
III	**Products of evolution: speciation mechanisms:** Quantitative traits, Species Concept: Morphological, Biological, Genetical and phylogenetic species concept. Species Categories: Geographical races, Demes, Clines, Ecological races, Semi species, Speciation: Phyletic speciation, Gradual speciation: Allopatric, sympatric, peripatric, parapatric, Alloparapatric. Theories of speciation: Classical theory of Gradualism, Founder flush speciation theory. Mimicry: Protective, Aggressive, Batesian & Mullerian mimicry and significance of mimicry, Aposematic coloration, Thanatosis, Extinctions: massextinctions (causes and effects), detailed example of K-T extinction.	11
IV	**Basic patterns of Evolution:** Micro & Macro Evolution. Phylogenetic Tree: Its construction and Interpretation. Fossils and fossilization, dating and significance of fossil. Geological Time Scale, Evolution of Man and Evolution of Horse.	11
Keywords	*Homology, Analogy, Natural Selection, Genetic variation, Genetic drift, Speciation, Mimicry.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Rastogi, Veerbala, Organic Evolution (2018). Third Revised Edition. MEDTECH.
- Singh, S.P., Tomar, B.S., Evolutionary Biology, Rastogi Publication
- Verma P.S., Agrawal V.K., Cell Biology, Genetics, Evolution & Ecology, S.Chand Publication

Reference Books Recommended –

- 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.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
- Campbell, N.A. and Reece J.B (2011) Biology (9th edition) Pearson, Benjamin,Cummings
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8thedition) Lippincott Williams andWilkins, Philadelphia.

Online Resources–

- **Egyankosh-**
- **https://egyankosh.ac.in/bitstream/123456789/16425/1/Unit-10.pdf**
- **National Digital Library**
- **http://ndl.iitkgp.ac.in/he_document/libretexts/libretexts/2f661e95fc3f32dd7204f7188addec22?e=17|EVOLUTION|||**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/1o8mxiahue8?e=1|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction			
Program: Bachelor in Life Science *(Degree/Honors)*		**Semester - VI**	Session: **2024-2025**
1	**Course Code**	**ZOSE-04P**	
2	**Course Title**	**Evolutionary Biology**	
3	**Course Type**	**Discipline Specific Elective Lab Course**	
4	**Pre-requisite** (if, any)	***As per Program***	
5	**Course Learning. Outcomes (CLO)**	**After successfully completing lab course the students will be able to-** ➢ Understanding on the process evolutionary biology by the study of some animals. ➢ Learn the different interacting evolutionary process by various examples. ➢ Understand evolution through fossils Acquire an in-depth knowledge on the diversity and relationships in animal world through evolutionary process.	
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	• Study of homology (forelimbs, heart, brain in vertebrates) through models and charts. • Study of Analogy (wings of insect, birds and bat) through models and charts. • Study of Serial homology in appendages of *Palaemon.* • Study of Virus, Euglena, Peripatus, Balanoglossus, Chimaera, Lung fish, Archeopteryx, and Echidna on the basis of Evolution (connecting link). • Study of adaptive radiations in vertebrates and mouth parts of insects. • Exercise based on Hardy-Weinberg Law. • Demonstration of role of natural selection and genetic drift in changing allelefrequencies using simulation studies. • Construction of phylogenetic trees and its interpretation. • Phylogenetic tree of Man and Horse • Study of fossils from models/pictures • Preparation of Practical Record • Group Discussion/Quiz/Seminar/Project on related topics.	
Keywords	*Evolution, Homology, Analogy, Phylogenetic tree, Adaptive radiation*	
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Rastogi, Veerbala, Organic Evolution (2018). Third Revised Edition. MEDTECH.
- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut, New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference Books Recommended –

- 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.

Online Resources–

National Digital Library

- **http://ndl.iitkgp.ac.in/he_document/libretexts/3d7e9973648c332bee5336b05c6cf84f**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction

Program: Bachelor in Life Science *(Honors/ Honors with Research)*		Semester - VII	Session: 2024-25
1	Course Code	ZOSE- 05T	
2	CourseTitle	Endocrinology	
3	CourseType	Discipline Specific Course	
4	Pre-requisite(if,any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	**After successfully completing this course, the students will be able to:** ➢ Understand characters of hormones, their biochemical origin, functions and their role in physiology. ➢ Learn about the organization of endocrine glands and mechanism of hormone action. ➢ The learners will understand the hormonal disorders, and diseases. ➢ Comprehend about the role of hormone in healthy lifestyle. ➢ Develop insights on advancements in endocrinology.	
6	CreditValue	3 Credits	*Credit = 15 Hours - learning & Observation*
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40

PART -B: Content oftheCourse

Total No. of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Chemical Regulators and Gene action:** General characters, chemical structure & properties of Hormones. Comparison between hormone and enzymes. Types of chemical regulators: Hormone, Neurotransmitters, Parahormones, Semiochemicals: Pheromones, Lumones & Chalones. Hormone Receptors: Mechanism of hormone action and cell signaling, Second messengers: types and features. Gene & Hormone Action, Hormone Responsive Element. Feedback system in Hormone action, hormone delivery. The Lesser Known Regulatory Substances (Somatomedins, Prostaglandin, Eicosanoids, Thromboxane etc.) Analytical techniques of Hormone Assay: Radioimmuno assay, Enzyme linked immune sorbent assay, Immune histochemistry. Hormone Replacement Therapy.	10
II	**Neuro-endocrine system:** Hypothalamus: Origin, Location, Gross Anatomy, and Structure. The Endocrine Hypothalamus: Hypothalamic Hormones, Hypothalamic Nuclei, General Functions of Hypothalamus, Hypothalamo-hypophysial portal system, Hypothalamo-hypophysisal-gonadal axis. Pituitary Gland: Origin, Location, Structure, Hormones, Control of secretion & disorders. Regulation of pigmentation by Pars Intermedia in vertebrate chromatophores. Pineal Gland: Origin, Location, Structure, Hormones & Control of secretion, Overview of Biological Rhythm. Role of Oxytocin, Endorphin, Serotonin and Dopamine in temperament stability (Happiness Hormones & Mental Health). Neuro-endocrine system in Insects and its physiology.	11
III	**Endocrine System & Physiology I:** Thyroid Gland: Organization of Mammalian Thyroid Gland, Biosynthesis of Thyroid Hormones, Metabolism of Thyroid Hormones, Regulation of Thyroid hormone secretion, Physiological & Metabolic Roles of Thyroxine, disorders of Thyroid Functions. Parathyroid Gland and Calcium Regulation. Calcium and Phosphate homeostasis. Adrenal Gland: Organization of Mammalian Adrenal Gland. The Adrenal Steroid Hormones (Synthesis Pathway & Physiological Roles), The Renin Angiotensin System, The Adrenal Medulla & Catecholamines (Synthesis Pathway and Mechanism of action of Catecholamines). Disorders of Adrenal Gland.	12
IV	**Endocrine System & Physiology II:** The Endocrine Pancreas: Origin, Islet Cell Structure & cell types, Hormones of the endocrine pancreas, Insulin: Biochemistry, Synthesis, Mechanism of action and physiological role, Glucose Transporters in Mammals & Diabetes mellitus. Insulin Resistance. Hormones of Gonads: Gonadal steroid hormones, Biosynthesis, transport, metabolism and physiological effects. Role of hormones in ovarian cycle & Menopause. Hormones in Birth Control. Role of hormones in sex determination. Hormones of Gastrointestinal Tract: Action of Gastrointestinal Peptides in mammals. Hormonal control of feeding behaviour. Hormones and lifestyle disorders: Chronic stress, Blood Pressure & Obesity.	12
Keywords	*Hormone, Pheromones, Biosynthesis, Thyroid Gland, Adrenal Gland, Pancreas, Catecholamines, Sex Determination, Diabetes, Obesity.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Chandra S. Negi: Introduction to Endocrinology, 2009, PHI
- Shastri V.K., Endocrinology and Reproductive Biology, Rastogi Publicatio

Reference Books Recommended –

- Hadley: Endocrinology (6th ed. 2009, Prentice Hall)
- Lodish et al :Molecular Cell Biology, W.H.Freeman& Co Ltd.
- Turner &Bagnara: General Endocrinology, 6th ed.1984, Saunders)
- Norris: Vertebrate Endocrinology, Fourth Edition, 2007, Academic Press

Online Resources–

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**
- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/cec/_gFN1zyU718_PLNsppmbLKJ8KYPKIeHeF3oC4jZYt8zBe4**
- **https://egyankosh.ac.in/bitstream/123456789/33320/1/Unit-4.pdf**
- **https://www.ncbi.nlm.nih.gov/books/NBK441576/**

PART -D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment(CIA):	**30 Marks**
EndSemester Exam(ESE):	**70 Marks**

Continuous InternalAssessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Life Science *(Honors / Honors with Research)*			**Semester - VII**	**Session: 2024-25**
1	**CourseCode**	**ZOSE-05P**		
2	**CourseTitle**	**Endocrinology**		
3	**CourseType**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	➢ Develop understanding of histological study of endocrine glands ➢ Learn the role anatomical aspects of various endocrine glands. ➢ Attain the fundamentals of applied endocrinology. ➢ Explore the operation of basic medical kits of routine usage. ➢ Create awareness towards lifestyle disorders related to hormones.		
6	**CreditValue**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**TotalMarks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content oftheCourse

TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)

Module	Topics (Course contents)	No.ofPeriod
Lab./Field Training/ Experiment Contents of Course	• Study of histological slides of the endocrine glands. • Demonstration of Endocrine Glands of Cockroach. (Alternative Methods) • Demonstration of Endocrine Glands in Rat (Alternative Methods) • Study of Glucose Tolerance Test. • Principle of HbA1c Test. • General procedures and demonstration of glucometer operation. • Study of working principle / demonstration of Urine Pregnancy Tests (UPT). (Principle, Procedure, Interpretation and Limitations) • General Study of Normal Blood Parameters of different hormones (From Pathological Reports) • Group discussion/ Seminar/ Quiz/ Projects on Endocrinology • Preparation of Practical Record.	**30**
Keywords	***Endocrine Glands, Glucose Tolerance Test, HbA1c, Glucometer, Pregnancy***	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text BooksRecommended –

- Lal S.S. Practical Zoology Vertebrates; Rastogi Publications
- Islam Mofidul, DasViblab Kumar : Endocrinology with Practicals; Mahaveer Publications
- Verma P.S : A Manual of Practical Zoology Chordates; S.Chand Publications
- Arumugam N : Practical Zoology; Saras Publications.

Reference Books Recommended –

- Hadley: Endocrinology (6th ed. 2009, Prentice Hall)
- Lodish et al :Molecular Cell Biology, W.H.Freeman& Co Ltd.

Online Resources–

- **https://egyankosh.ac.in/bitstream/123456789/33320/1/Unit-4.pdf**

Online Resources–

- **https://www.ncbi.nlm.nih.gov/books/NBK532915/**
- **https://laboratorytests.org/urine-pregnancy-test/**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools& technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Life Sciences *(Honors / Honors with Research)*			**Semester -VII**	**Session: 2024-2025**
1	**Course Code**	**ZOSE – 06T**		
2	**Course Title**	**Immunology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite**(if, any)	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	**After successfully completing this course, the students will be able to:** ➢ Understanding **of** fundamental concepts of immunology. ➢ Gain knowledge on various immune cells, antigens and cytokines. ➢ Understand the structure and functions of Immunoglobulins and antibodies. ➢ Students will be able to describe the processes involved in immune system. ➢ Students will analyse the pathogenesis, clinical manifestations, and therapeutic approaches of various immune disorders and diseases and experimental techniques in Immunology.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours -learning & Observation***	
7	**Total Marks**	**Max. Marks:**	**100**	**Min Passing Marks:40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Understanding of Immunological Concepts:** Immune System: Brief history of Immunity, Concept & Types of Immunity (Innate and Acquired or Adaptive), Origin and Evolution of Immune System. Primary and Secondary lymphoid organs, lymphoid tissues. Thymic Selection: Self and non-self-recognition. Inflammation. Lymphocyte trafficking. Hematopoiesis.	10
II	**Components of Immune System- I:** Cells of Immune System: Structure and functions of macrophages, granulocytes, NK cells, T and B lymphocytes and Antigen presenting cells. T & B Cell receptors, maturation, activation and differentiation of T& B Cell. Antigen: Antigenicity v/s immunogenicity, Factors affecting Immunogenicity, immunogen, haptens, super antigen, epitope, paratope. Adjuvants: Freund's complete and incomplete. Processing and presentation of Ag. Major histocompatibility complex (MHC) and HLA. Cytokines.	12
III	**Components of Immune System- II:** Immunoglobulins: Nature, Primary structure of immunoglobulins. Enzymatic fragmentation of Ig. Domain structure of Ig and its significance. Types and subtypes of Ig and its characteristics. Membranous antibody. Antigenic determinants: isotype, allotype, idiotype. Abzymes. Theories of Antibody Formation: Instructive, selective, clonal selection theories and evidences; Immunological memory. Complement System. Hypersensitivity (Type I to IV with example) CMI & humoral immune response. Antigen-Antibody interaction: affinity & avidity.	13
IV	**Immune disorders & Immuno-techniques: Auto-immunity:** Auto-recognition, classes of auto-immuno diseases. (Hashimoto disease, Thyrotoxicosis, Systemic lupus erythematosus, Rheumatoid arthritis).Transplantation: Autograft, Isograft, Allograft, Xenograft, Immunological basis of transplantation reactions. Immune Deficiencies: Primary and secondary immune deficiencies. T-cell, B-cell and SCID, AIDS. Vaccination and types of vaccines (First, Second & Third generation vaccines). Immunological techniques: Precipitin curve, Immuno-diffusion, one and two dimensional, single radial immuno-diffusion, Double (Ouchterlony) immune-diffusion. Immuno-electrophoresis: Rocket immuno-electrophoresis; CIE, Graber and William technique.Radio-immunoassay: ELISA–Principle, Methodology and applications. Immuno-fluorescence: Direct, indirect and Sandwich, in situ localization by techniques:FISH and GISH. Hybridoma, Monoclonal antibodies.	10
Keywords	*Immunity, lymphocytes, Antigens, Immunoglobulins, Auto-immunity, Vaccination &Immuno-techniques.*	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Pravash Sen. Gupta, Clinical Immunology. Oxford University Press. 2003.
- N Arumugam, Immunology, Saras Publication. 2014.
- Fatima D, Arumugam, Immunology, Saras Publication

Reference Books Recommended –

- Janis Kuby, Immunology, II edition. W. H. Freeman and Company, New York. 1993.
- Ivan M. Roitt, J. Brostoff and D. K. Male, Immunology, Gower Medical Publishing, London.1993.

Online Resources–

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/hdc5c5m6hkq?e=1|immunology|||**
- **https://xvivo.com/examples/the-innate-immune-system/**
- **https://xvivo.com/examples/the-adaptive-immune-system/**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 100 Marks
ContinuousInternal Assessment(CIA):30 Marks
EndSemesterExam(ESE):70 Marks

Continuous InternalAssessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF LIFE SCIENCE
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-06P**		
2	**Course Title**	**Immunology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	**At the end of this course, the students will be able -** ➢ Gain practical knowledge on various immune cells, antigens and antibodies. ➢ Identify the major cellular and tissue components which comprise the innate and adaptive immune system. ➢ Students will experimental techniques in Immunology. ➢ Understand how does the immune system distinguish self from non-self. ➢ Gain experience at reading and evaluating the scientific literature in the area.		
6	**Credit Value**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Study of permanent slides of organs of immune system • Enumeration of total leucocytes from human blood samples • Enumeration of differential leucocytes from human blood samples • Demonstration of agglutination reaction using human RBC • Demonstration of Ag-Ab precipitation by immunodiffusion technique • Antigen detection by radial immunodiffusion technique (RID) • Estimation of total serum protein • Estimation of serum gamma globulins/Separation of γ-globulin by salt precipitation. • Estimation of A/G ratio • Isolation of lymphocyte by using density gradient centrifugation • Paper and gel immuno-electrophoresis • Rocket immunoelectrophoresis • Counter current immunoelectrophoresis • ELISA • Group discussion/Quiz/ Seminar presentation on related topics. • Making of Practical record.	**30**
Keywords	*Leucocytes, Rocket immunoelectrophoresis, ELISA, A/G ratio, RID*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Talwar G.P. and Gupta S.K, A Handbook Of Practical And Clinical Immunology Volume 1, CBS Publication
- Zane, Immunology: Theoretical And Practical Concepts In Laboratory Medicine, ELSEVIER

Reference Books Recommended –

- Goldsby, R.A.; Kindt, T.J. and Kuby, J. (2006) Immunology (6th edition).
- Roitt, I.; Brostoff, J. and Male, D. (2012) Immunology (8th edition).

Online Resources–

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/hdc5c5m6hkq?e=1|immunology|||**
- **https://xvivo.com/examples/the-innate-immune-system/**
- **https://xvivo.com/examples/the-adaptive-immune-system/**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction

Program: Bachelor in Life Science *(Honors/Honors with Research)*		Semester - VII	Session: 2024-2025
1	CourseCode	ZOSE- 07T	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective	
4	Pre-requisite(if,any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	**After successfully completing this course, the students will be able to-** ➢ Define the concept of recombinant DNA and genetic engineering. ➢ Understand the molecular techniques and their proficiencies. ➢ Apply the knowledge of gene manipulation techniques. ➢ Analyze different prospects and applications of genetic engineering and bioinformatics. ➢ Develop understanding of ethical, social and legal implications of genetic engineering.	
6	CreditValue	3 Credits	*Credit = 15 Hours -learning & Observation*
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course Contents)	No. of Period
I	**Introduction to Biotechnology:** An overview of Biotechnology: History, Definition, scope, applications and ethical issues in biotechnology. Recombinant DNA, Restriction Enzymes, Application of different enzymes in Recombinant DNA technology, Restriction and modification system, Linkers & Adaptors, Restriction mapping. Vectors (Cloning and Expression Vectors). Gene Recombination and Gene transfer: Transfection, Transduction, Microinjection, Electroporation and Ultrasonication. Antibiotic Resistant Gene and their mode of action. Polymerase chain reaction (PCR): Principle and applications of different types of PCR. DNA and RNA Purification.	11
II	**Elementary Genetic Engineering:** Preparation and comparison of Genomic and cDNA library, screening of recombinants, Genome: organization, coding and non-coding sequences & genome mapping, Comparative genome hybridization. Whole genome shotgun sequencing, Chromosome Banding. Gene tagging, DNA Cloning, DNA Sequencing methods, DNA profiling. Genetic Markers, Molecular markers: Types & Features. Stem Cells: Embryonic Stem Cells, Adult Stem Cells and Induced Pluripotent Stem Cells, Formation and selection of recombinant ES cells, Role of ES cells in gene targeting in mice, Gene Probe, Colony Hybridization, Blotting Techniques (Southern, Northern, Western and Eastern Blotting), Animal Cell Culture (Primary Cultures, Cell line, Transformation characteristics, Culture Media & Growth Cycle).	11
III	**Advancements in Genetic Engineering:** Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis. Gene Editing, Gene shuffling, Genetic Manipulation of Animal Cells (Transgenesis and transgenic animals), Gene Knockout, Nuclear Transfer Technology and Animal Cloning, Gene Therapy, Gene Delivery System (Virus mediated transduction & non-viral transduction methods). Molecular Farming (Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines), Microarraysand next generation sequencing technologies.	12
IV	**Applications of Genetic Engineering & Bioinformatics:** Cord blood banking, Genetically Modified Organism (GMO), Animals as bioreactors: Genetically engineered animals for research. Conditional knock outs using cre-loxP recombination; tissue specific promoters, CRISPR-Cas9 and its applications in treating genetic disorders. Genetic modification of livestock for improved productivity and disease resistance. Ethical, Legal, and Social Implications (ELSI) of genetic engineering. Bioinformatics: Overview and its relation with molecular biology. Biological Databases: Overview, Applications & Prospects. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software (RASMOL, Ligand Explorer), Data generation; Generation of large scale molecular biology data. (Through Genome sequencing) File Format (Genbank, DDBJ, FASTA, PDB, Swiss Prot). Sequence Alignments and Visualization, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum).	11
Keywords	*Recombinant DNA, Genome, Gene, Mutagenesis, Microarray, Techniques, Biological Database.*	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lehninger – Principles of Biochemistry, WH Freeman.
- Satyanarayan U - Biotechnology, Saras Publication
- Gupta P.K. – Elements of Biotechnology, Rastogi Publications.
- Gupta P.K. –Biotechnology and Genomics, Rastogi Publications.
- Kumar Pranav, Verma Praveen, Meena Usha – Biotechnology: A problem approach- Pathfinder Publications.
- Rastogi S.C., Rastogi P., MendirattaN :Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI Learning.
- Bosu Orpita, Thukral S.K.- Bioinformatics: Experiments, Tools, Databases, and Algorithms – Oxford University Press

Reference Books Recommended –

- Lodish H et al., - Freeman
- Watson JD et al.-Macmillan - Recombinant DNA: Genes and Genomes, A Short Course.
- Alberts B et al., Molecular Biology of the Cell, - Garland
- Brown TA – Genomes, Garland

Online Resources–

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=31BI+Y/JyQo+vtlwaZoj+g==**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/ksrdg67pyn8?e=1|bioinformatics|||**
- **http://ndl.iitkgp.ac.in/he_document/nptel/nptel/courses_102_106_102106065_video_lec66?e=3|bioinformatics|||**
- **http://ndl.iitkgp.ac.in/he_document/cec/cec/0F_oDrArwTU_PLNsppmbLKJ8K5HAWhRVvEHrBSI1XVO-oE?e=0|biotechnology%20:%20genome%20editing%20tools%20-%203%20(crispr/cas9)|||**

Online Resources–

- **https://vlab.amrita.edu/?sub=3&brch=274&sim=1428&cnt=1**
- **http://ndl.iitkgp.ac.in/he_document/cec/PRwJGpzUSYM_PLNsppmbLKJ8K5HAWhRVvEHrBSI1XVO-oE**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 100 Marks
ContinuousInternal Assessment(CIA):30 Marks
EndSemesterExam(ESE):70 Marks

Continuous InternalAssessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction

Program:Bachelor in Life Science *(Honors/Honors with Research)*		Semester - VII	Session: 2024-2025
1	CourseCode	ZOSE- 07P	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective Lab Course	
4	Pre-requisite(if,any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	**After successfully completing this course, the students will be able to:** ➢ Learn to prepare aseptic techniques in laboratory for biotechnology experiments. ➢ Understand the fundamental experiments &techniques of biotechnology &genetic engineering. ➢ Develop practical skills in genetic engineering techniques and laboratory procedures. ➢ Learn characteristics of genetic material. ➢ Analyze applications of diverse genetic engineering protocols.	
6	CreditValue	1 Credits	*Credit =30 Hours Laboratory or Field learning/Training*
7	TotalMarks	Max.Marks:50	Min Passing Marks:20

PART -B: Content oftheCourse

TotalNo.oflearning-Training/performancePeriods:30 Periods (30 Hours)

Module	Topics(Coursecontents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	• Sterilisation of glassware, media and laboratory. • Working principle and applications of- Hot Air Oven, Autoclave & Laminar flow hood. • Demonstration of cell culture techniques. • Demonstration of gene library and cDNA library. • Isolation of DNA from plant sample. • Isolation of plasmid DNA from E. coli cells. • Isolation of genomic DNA from whole blood. • Demonstration of Gel electrophoresis techniques. • Separation and visualization of DNA fragments using agarose gel electrophoresis. • Spectrophotometric estimation of isolated DNA. • Restriction digestion of plasmid DNA and genomic DNA. • Study related to working principle of PCR machine. • Preparation of Minimal Essential Growth medium. • Staining the cultured cells using dyes such as hematoxylin and eosin (H&E), and observe them under a light microscope to study cell morphology and structure. • Bioinformatics: Analyse DNA or protein sequences using online tools and databases. • Demonstration of online data bases for bioinformatics-based studies. • Demonstration of DNA band visualization techniques (e.g., Ethidium bromide staining, DNA intercalating dyes) • Group discussion/ Quiz/Project/Seminar presentation on related topics. • Practical Record ***Note:*** *Virtual mode of demonstration can be opted if required.*	30
Keywords	***Sterlization, Autoclave, Electrophoresis, Restriction, PCR, Plasmid, Genomic, Bioinformatics***	

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PART–C:Learning Resources

Text Books Recommended -

- Aneja K.R.; Laboratory manual of microbiology and biotechnology; Medtech.
- Ramdass P; Practical Biotechnology; JaypeeBrothers Medical Publishers; First Edition.

Reference Books *Recommended* -

- Wilson, K., & Walker, J. Principles and Techniques of Biochemistry and MolecularBiology (8th ed.). Cambridge University Press.
- Kurian K. Noble; A complete lab manual for Biotechnology; Notion Press.
- Borah Debajit; Biotechnology Lab Practices;Global Vision Publishing House.
- Portner Ralph; Animal Cell Biotechnology: Methods and Protocols: Humana Press Springer Protocols

Online Resources–

- **https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf**
- **https://webstor.srmist.edu.in/web_assets/downloads/2021/20BTC502J-lab-manual.pdf**

Online Resources–

- **https://learn.genetics.utah.edu/content/labs/**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment(CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks **-15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks	
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools& technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**		**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction

Program: Bachelor in Life Science *(Honors/ Honors with Research Degree)*		Semester -VII	Session: 2024-2025
1	Course Code	ZOSE- 08T	
2	Course Title	Applied Zoology	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	*As per Program*	
5	Course Learning. Outcomes (CLO)	**After successfully completing this course, the students will be able to:** ➢ Understand the culture techniques of prawn, pearl and fish, Lac culture. ➢ Understand silkworms rearing and their products. ➢ Understand the Bee keeping equipments and apiary management. ➢ Understand dairy animal's management. ➢ Learn thetesting of egg and milk quality. ➢ Apply this knowledge for Setting up a self-employment venture in the field.	
6	Credit Value	3 Credits	*Credit = 15 Hours - learning & Observation*
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Aquaculture: Prawn culture:** Culture of fresh water prawn and marine prawn. Preparation of farm for Prawn culture. Preservation and processing of prawn. Export of prawn. **Pearl Culture**: pearl formation, protocol followed, **Fresh Water Fish Culture:** Qualities or Characters of Cultivable Fishes, Construction of Fish Farm. **Fish Breeding:** bundh and induced. **Fish Seed:** Types, **Seed collection:** Benchi jal (Shooting net), hatching Hapa. **Transport of Seed:** Open and closed system, Causes of mortality in transport. **Use of chemicals in live fish transport:** Anesthetic drugs. Antiseptics and Antibiotics. Harvesting of fish: By hooks and nets (Triangular net, Dip net and Cast net). Fish preservation. Fish diseases and their control.	12
II	**Apiculture and Sericulture: Apiculture:** Species of honey bees. Morphology and life cycle of *Apis indica.* Social behaviour of honey bees: Colony organization, division of labour and communication. Methods of Bee keeping: Indigenous and Modern method, appliances used for bee keeping, management of honey bees and their hives, Extraction of honey from the comb and processing, bee Products and their economic importance. Natural enemies & diseases of Bee and their management. **Sericulture:** Types of silk, Silkworms and their host plants, Life history of *Bombyx mori* Rearing of *Bombyx mori*: Rearing racks and trays, disinfectants, rearing appliances, black boxing, Chawki rearing, bed cleaning, mountages. Harvesting of cocoons, Silkworm diseases and their control: Pebrine, Flacherie, Grasserie, Muscardine and Aspergillosis. Silkworm pests and parasites and their management: Uzi fly, Dermestid beetles. Silk reeling techniques. Quality assessment of silk fibre.	11
III	**Lac Culture and Vermiculture: Lac Culture** History of lac. Cultivation of lac: Host plants, Lac insect and its life cycle. Control of lac insect pests processing and collection of lac. Lac composition, products and uses. **Vermiculture:** Biology of *Eisenia foetida*. Rearing of earthworms. Equipments, devices used in vermiculture. Vermicompost Technology: Methods and products, Vermiwash Collection, Composition and use.	11
IV	**Dairy management and Poultry farming: Dairy:** Introduction to common dairy animals. Techniques of dairy management: System of housing. Milk and milk products. Cattle Diseases and control measures. **Poultry:** Types of breeds. Methods of brooding and Rearing. Housing and Equipment, Deep litter System, Laying cages, Debeaking, Incubation and hatching of eggs. Management of growers, Layers, Broilers. Feed formulations for chicks, Diseases and control measures. Nutritive value of egg and meet.	11
Keywords	*Aquaculture, Apiculture, Sericulture, Poultry farming, Dairy Farming, Vermiculture*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Srivastava, C. B. L. (1999). *Fishery Science and Indian Fisheries*. Kitab Mahal publications, India.
- Sardar Singh, *Beekeeping in India*, Indian council of Agricultural Research, New Delhi.
- Dhyan Singh Bisht, *Apiculture*, ICAR Publication.
- Shukla G.S., Upadhyay V.B. Economic Zoology, Rastogi Publication
- Ahasan J, Sinha,S.P.(2010) Handbook of Economic Zoology, S Chand Publication
- Jabde, P. Text book of Applied Zoology (2008), Discovery Publishing Pvt. Ltd

Reference Books Recommended –

- Prost, P. J. (1962). *Apiculture*. Oxford and IBH, New Delhi.
- Sericulture, *FAO Manual of Sericulture.*
- Hafez, E. S. E. (1962). *Reproduction in Farm Animals*, Lea and Fabiger Publishers.
- Knobil, E. and Neill, J. D. (2006). *The Physiology of Reproduction*, Vol. 2, Elsevier Publishers.

Online Resources–

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf
- https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf
- https://kvk.icar.gov.in/API/Content/PPupload/k0160_11.pdf
- https://dahd.nic.in/sites/default/filess/Excerpts%20of%20Poultry%20Farmn%20Manual.pdf

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-08P**		
2	**Course Title**	**Applied Zoology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Know common species of carps, prawn, oyster. ➢ Understand and learn the culture techniques of prawn, pearl, fish, honey bee, silkworm, lac, vermicompost. ➢ Understand and Learn division of labor and identification of Honey bees ➢ Identify Lac insect, male female morphology,. ➢ Understand dairy management, breeds of Cow & diseases and learn to analyze to good quality of milk, egg and vermicompost.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Morphological characterization of common edible fish species. ➢ Identification of major carps. ➢ Morphology of Freshwater and Marine Prawn ➢ Pearl oyster, pearl forming species ➢ Identification of castes of Honey bee and life cycle (through charts/specimens). ➢ Mounting of the sting apparatus. ➢ Worker honey bee with emphasis on leg modifications (through specimens/charts) and whole mount preparation of the 3 pairs of legs, Mouth parts. ➢ Life cycle of mulberry silkworm, *Bombyx mori* (model/chart/specimens) and life cycle of tasar silkworm, *Antheraea mylitta*. ➢ Identification of dairy animals ((model/chart/Photographs). ➢ Milk testing: Qualitative test of milk, Determination of the specific gravity of milk by using a mercury lactometer. ➢ External morphology of poultry birds (model). ➢ Test for good quality eggs (Floating test, cracking test) and for fertilized and unfertilized eggs (Light test, Cracking test). ➢ Project report on visit to Fish farm/dairy farm/ Poultry farm/.etc ➢ Group discussion/quiz/seminar on related topics. ➢ Preparation of practical record or Album.	**30**
Keywords	*Aquaculture, Apiculture, Sericulture, Poultry farming, Dairy Farming*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Upadhyay, Economic Zoology
- Salvamani B R, & Mahadevan R K, Aquaculture Trends and Issues
- Jabde V, Applied Zoology Pradeep
- Shukla Prasad Economic Zoology, Biostatistics and Animal Behaviour

Online Resources–

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1608.pdf
- https://egov.uok.edu.in/elearning/tutorials/1011020512BR15103CR15Apiculture%20Lac%20culture%20and%20%20sericultureapiculture%20lac%20culture%20and%20%20sericulture%20upload.pdf

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE- 09T**		
2	**Course Title**	**Basics of Computer and Biostatistics**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Understand the computer, its applications and use in biostatistics. ➢ Understand collection of biological data and analysis of the data. ➢ Learn about how the statistical data present. ➢ Developed critical thinking to analyze and represent the significance of the statistical data. ➢ Apply the knowledge in future for Research.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Unit-I: Computer structure and Applications:** History of Computers, Structure of Computers, Classification of Computers, Introduction to digital computer- basic knowledge of hardware & software, CPU, Input and Output devices, Computer Codes: Decimal System, Binary number system, hexadecimal system, octal system, conversion of numbers. Introduction to MS Office- MS Word, MS Excel, MS Power point, Introduction of Internet, web-mail, various search engine, Plagiarism, Artificial Intelligence (AI).	12
II	**Unit-II: Data collection, presentation, and Measures of central tendency:** Collection and classification of data. Presentation of data: by Tables - rules for making tables, use of tables, Types of tables, By Graphs: rules for making graph & it's uses, Pie chart, Bar diagram, Histogram, Frequency polygon, Cumulative frequency curve (Ogive and Polygon). Measures of central tendency: Arithmetic Mean, Median, Mode.	11
III	**Dispersion Correlation and Regression:** Measures of dispersion: Standard deviation and Standard error. Correlation: Types, significance and application of correlation, calculation of correlation in continuous data and ordinal data. Regression: Linear regression, regression coefficient.	11
IV	**Probability and Analysis of Significant Test:** Probability: normal, binomial distribution and Poisson distributions. Hypothesis testing, Test of significance: Paired and unpaired t-test and Chi square test. Analysis of Variance (one & two way ANOVA).	11
Keywords	*Computer, MS Word, MS Excel, MS Power point, web-mail, central tendency, ANOVA, Hypothesis testing*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Balagurusamy, E. (2011) Fundamentals of Computers, McGraw Hill Education, Rajaraman, V.: Fundamentals of Computers, 5th edition, PHI Learning Pvt. Ltd., 2010
- Sinha, P., Sinha, P.K. (2004), Computer Fundamentals: Concepts, Systems and Applications, 8th edition, BPB Publications.
- Khanal, A.B. (2015), Mahajan's Methods in Biostatistics, The Health Sciences Publishers,

Reference Books Recommended –

- Daniel, W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences(10th edition) John Wiley.
- Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and HealthSciences (2nd edition) McGraw Hill.
- Zar, JH, (2010), Biostatistical Analysis, Prentice-Hall/Pearson, 2010.

Online Resources–

National Digital Library

- **https://drive.google.com/file/d/1EaBH4SfE4AcdmoDzQ7iFwMSJkmSfIQet/view**
- **http://ndl.iitkgp.ac.in/he_document/swayam_ugc_moocs/swayam_ugc_moocs/IN_S_U_M_1_P_C_3_B_a_M_B_233_234?e=2|biostatistics|||**
- **http://ndl.iitkgp.ac.in/he_document/bharat_skills/bharat_skills/01_2434?e=0|basic%20computer|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-09P**		
2	**Course Title**	**Basics of Computer and Biostatistics**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing lab course the students will be able to** ➢ Understand the computer, its applications and use in biostatistics practically. ➢ Understand and learn collection of biological data and analyzes them. ➢ Learn to present and interpret the analyzed data. ➢ Developed critical thinking to assess the significance of the statistical data and discuss the result. ➢ Apply the knowledge in future for Research.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min Passing Marks: 20**

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	**List of labs to be conducted** ➢ Exercise based on Microsoft word. ➢ Study of hardware & software. ➢ PPT Slide preparation using Microsoft Power Point. ➢ Data collection. ➢ Analyzing Data manually and through computer: Mean, Median, Mode, SD, SE, Correlation and regression and its interpretation. ➢ Tabular & Graphical presentation of data manually and using excel. ➢ Hypothesis testing by *t*-test, Chi-square test and ANOVA. ➢ Group discussion/Quiz/Seminar presentation on related topics. ➢ Practical Record or Lab assignment.	**30**
Keywords	*Graphical presentation, hardware & software, Microsoft Power Point, Microsoft word.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Balagurusamy, E. (2011) Fundamentals of Computers, McGraw Hill Education, Rajaraman, V.: Fundamentals of Computers, 5th edition, PHI Learning Pvt. Ltd., 2010
- Sinha, P., Sinha, P.K. (2004), Computer Fundamentals: Concepts, Systems and Applications, 8th edition, BPB Publications.
- Khanal, A.B. (2015), Mahajan's Methods in Biostatistics, The Health Sciences Publishers,

Reference Books Recommended –

- Daniel, W.W. (2012) Biostatistics: A Foundation for Analysis in Health Sciences(10th edition) John Wiley.
- Milton, J.S. & Tsokos, J.O. (1992) Statistical Methods in the Biological and HealthSciences (2nd edition) McGraw Hill.
- Zar, JH, (2010), Biostatistical Analysis, Prentice-Hall/Pearson, 2010.

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/libretexts/libretexts/ee0516013368a11b75812bda4e208fc6?e=0|MEAN%20MODE%20MEADIAN|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with research)*		**Semester - VIII**	Session: **2024-2025**	
1	**Course Code**	**ZOSE- 10T**		
2	**Course Title**	**Behaviour and Chronobiology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	*As per Program*		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Learn a wide range of theoretical knowledge about the animal behavior. ➢ Develop skills, to understand the responses of animal according to stimuli. ➢ Objectively understand and evaluate information about animal behaviour and ecology encountered in our daily lives. ➢ Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the wild. ➢ Consider and evaluate behaviour of all animals, including humans, in the complex ecological world, including the urban environment.		
6	**Credit Value**	**3 Credits**	*Credit = 15 Hours - learning & Observation*	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Behaviour and the response invoking stimuli:** Animal behavior: Scope and importance of study. Ethology: history & branches. Ethogram: analysis of behavior. Causation of Behaviour: Proximate and ultimate causes of behavior. Stimulus: Definition, Types of stimuli invoking response: internal and external. Patterns of behaviour: Foraging behaviour, Aggressive behavior, Territorial behaviour. Allelomimetic behavior. Stereotyped Behaviors: Taxis and Reflexes: Taxis: Phototaxis, Geotaxis, Thermotaxis, Thigmotaxis, Galvanotaxis, Chemotaxis and Rheotaxis, Klinotaxis and Telotaxis. Reflexes: Definition, Kinds- Localized, Tonic & Phasic, Types of reflex action unconditioned reflexes and Conditioned reflexes	12
II	**Innate and Learning Behavior: Innate or Instinct Behaviour:** Fixed action Pattern: Definition and Characteristics: Constancy, Resistance to Phylogenetic Changes, Concept of Sign, Innate Releasing Mechanism (IRM) and Action Specific Energy (ASE). Bird migration, Navigation and Orientation. Learning Behavior: Classical conditioning (Pavlov Experiment), Types of Conditioning: Forward, Backward, Simultaneous and Temporal conditioning. Properties of Conditioning: Generalization, Discrimination, Extinction, Recovery from Extinction, Acquisition, Reinforce, Positive and Negative conditioning. Habituation. Instrumental learning / trial and error. Imprinting: types of imprinting: filial and sexual. Reasoning and Insight learning. Neural mechanism of learning.	11
III	**Social behavior and Evolutionary aspects of Behavior:** Social organization in honey bee & Primates. Elements of Socio-biology: Eusociality, Selfishness, cooperation, altruism, kinship, reciprocation and inclusive fitness. Communication: chemical, visual, light, tactile and audio. Evolutionary aspects of behavior: feeding strategies, Mimicry and Colouration, Evolution of reproductive behavior: Theory of Sexual Selection, secondary sex characteristics, Parental care in Fish and Amphibia.	11
IV	**Chronobiology:** Biological Rhythm: Types of biological rhythm: Ultradian, Circadian and Infradian. Characteristics of rhythm: mesor, amplitude, acrophase, period and phase. Patterns of biological rhythm: Exogenous and Endogenous rhythm; Entrained and Free run rhythm. Advantages of biological rhythms. Biological clock: components of clock, functions of biological clock. Applications of chronobiology.	11
Keywords	*Ethogram, Mimicry, Reflexes, biological rhythm, Parental care, Imprinting, Biological clock*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Reena Mathur (2021) Animal Behaviour, 6th Edition, Rastogi Publication.
- Kumar, V. (2002). Biological Rhythms: Narosa Publishing House, Delhi/ Springer -Verlag, Germany.

Reference Books Recommended –

- McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited,London, UK.
- Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6thedition) Cambridge, University Press, UK
- Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA.
- Sherman, P. W. and Alcock, J. (2013) Exploring Animal Behaviour (6th edition)Sinauer Associate Inc., Massachusetts, USA.
- Dunlap, J. C.; Loros, J.J. and DeCoursey, P. J. (2009) Chronobiology BiologicalTimekeeping (1st edition) Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.

Online Resources–

- **https://g.co/kgs/TGgyveE**
- **https://www.researchgate.net/profile/Atanu-Pati/publication/278157972_Chronobiology_The_Dimension_of_Time_in_Biology_and_Medicine/links/557c8b1208aec87640db4e73/Chronobiology-The-Dimension-of-Time-in-Biology-and-Medicine.pdf**
- **https://jmpas.com/admin/assets/article_issue/1643653535JMPAS_JANUARY_-_FEBRUARY_2022.pdf**
- **https://www.amazon.in/Concise-Book-Animal-Behaviour-Chronobiology/dp/819580571X**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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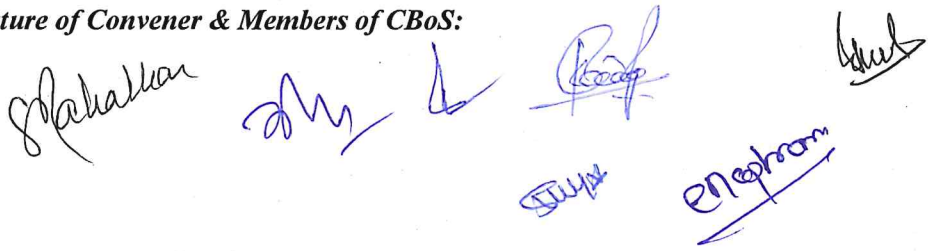

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-10P**		
2	**Course Title**	**Behaviour and Chronobiology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Learn a wide range of practical knowledge about the animal behavior. ➢ Develop skills, to understand the response of animals according to stimuli in lab. ➢ Objectively understand and evaluate information about animal behaviour and learn to form the ethogram. ➢ Understand and be able to objectively evaluate the role of behaviour in the protection and conservation of animals in the surroundings. ➢ Consider and evaluate behaviour of animals, including Human in the nature.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	➢ Orientation of an animal in response to stimulus: To study geotaxis in earthworm and phototaxis in insect larvae. ➢ Constructing an Ethogram. ➢ Demonstration of learning behaviour in wasps to locate their burrow by using landmarks. ➢ Chemical communication in ants. ➢ Study of selective predation of coloured prey items through video/charts. ➢ Predatory behaviour of a carnivorous animal. ➢ Nests and nesting habits of the birds and social insects. ➢ Study the behavioural responses of wood lice to dry and humid conditions. ➢ Study of mimic animals in nature and take photographs. ➢ Study of circadian functions in humans (daily eating, sleep and temperature patterns). ➢ Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report. ➢ Group discussion or Seminar presentation on related topics. ➢ An "Animal album or Practical Record" containing sketches, photographs, cut outs, with appropriate write up about the above mentioned behavioural patterns.	**30**
Keywords	*Phototaxis, geotaxis, Predatory behavior, wood lice, circadian functions, temperature pattern, ethogram*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Reena Mathur (2021) Animal Behaviour, 6th Edition, Rastogi Publication.
- Kumar, V. (2002). Biological Rhythms: Narosa Publishing House, Delhi/ Springer - Verlag, Germany.

Refernce *Books Recommended –*

- McFarland, D. (1999) Animal Behaviour (3rd edition) Pitman Publishing Limited,London, UK.
- Manning, A. and Dawkins, M. S. (2012) An Introduction to Animal Behaviour (6thedition) Cambridge, University Press, UK
- Alcock, J. (2005) Animal Behaviour (8th edition) Sinauer Associate Inc., USA.
- Sherman, P. W. and Alcock, J. (2013) Exploring Animal Behaviour (6th edition)Sinauer Associate Inc., Massachusetts, USA.
- Dunlap, J. C.; Loros, J.J. and DeCoursey, P. J. (2009) Chronobiology BiologicalTimekeeping (1st edition) Sinauer Associates, Inc. Publishers, Sunderland, MA, USA.

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/1fvtujeiyjw?e=0|*|||**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/7j0mtol4jrc?e=11|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*		**Semester - VIII**	Session: **2024-2025**	
1	**Course Code**	**ZOSE-11T**		
2	**Course Title**	**Developmental Biology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite (if, any)**	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Understand of the fundamental processes involved in embryonic development, including cell differentiation, morphogenesis, and patterning ➢ Explain mechanisms underlying developmental processes, ➢ Learn reproductive techniques commonly used in developmental biology ➢ Aware of current trends and advances in developmental biology research, including emerging technologies. ➢ Understand the relevance of developmental biology in medicine or its role in development of diseases.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Gametes Biology:** Biology of sex determination and differentiation, Origin of primordial germ cells. Morphology of different types of gametes: Male gamete and female gamete. Formation of Gametes: Process of Spermatogenesis, Biochemical changes in spermatogenesis and control of spermatogenesis, Semination. Process of Oogenesis, Biochemical changes in Oogenesis and control of Oogenesis, Vitellogenesis: Structure and composition of yolk. Ovulation and ovum transport in mammals. Infertility in Male and female: Causes and Cure. Fertilization: external and internal fertilization, Recognition of gametes, capacitation, acrosome reaction, activation of egg metabolism, migration of pronuclei, amphimixis and post fertilization changes in the egg cytoplasm. Block to polyspermy. Parthenogenesis.	11
II	**Embryology:** Cleavage: pattern and mechanism of cleavage, physiology of cleavage. Mosaic and regulative development, Direct and indirect development, Body plan and symmetries. Germ layer differentiation. Tubulation. Morphogenesis: Epiboly, E mboly/invagination, involution and ingression. Fate maps: Methods of construction of fate map, fate map of Amphioxus, Amphibians and Chick. Formative movements, Metamorphosis: In Insect and in frog. Hormonal regulation of metamorphosis. Cell signaling, cell adhesion during tissue organization,lateral inhibition, induction, and recruitment. Organogenesis: formation of gut, heart, kidney and muscles, molecular mechanism involved. Pleuropotency.	11
III	**Developmental Biology: Organizer concept:** Types, characteristics & mechanism of organizer. Extra embryonic membranes: Development and functions in chick. Axis Formation in Drosophila, Metamorphosis in insect and in Frog. Hormonal regulation of metamorphosis. Placenta: Structure, functions and its types. Regeneration: Types- epimorphosis, morphollaxis and compensatory regeneration, mechanisms and physiological processes involved in regeneration, ability of regeneration in invertebrates and vertebrates, difference between embryogenesis and regeneration and tissue repair. Concept of competence, determination and differentiation and growth. Ageing and apoptosis.	11
IV	**Reproductive Technology and Reproductive Health: *In vitro* fertilization:** Artificial insemination (AI); Gamete intra-fallopian transfer (GIFT), Intra-cytoplasmic sperm injection (ICSI), Zygote Intra Fallopian Transfer (ZIFT), Test tube baby. Causes of Infertility. Multiple ovulation and embryo transfer technology (IVF and IVET), Pre implantation genetic diagnosis (PGD). Ethics in surrogacy. Teratology & teratogens: wound healing, birth defects, developmental brain disorders. Neuro degeneration. Endocrine Disruptors & Cancer. Causes of Sexually transmitted diseases: HIV/AIDS & Human Papilloma virus (HPV), Syphilis. Menstrual Disorders, Polycystic Ovarian Disease & Polycystic Ovarian Syndrome (PCOD & PCOS).	12
Keywords	*Spermatogenesis, Oogenesis, Gametes, Fertilization, Development, Cleavage, Fate maps, Organizers, Teratology*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Agrawal V K, Evolution and Developmental Biology, S Chand Publication
- Verma P S, Agrawal V K, Chordate Embryology, S Chand Publication
- Arumugam N, Embryology , Saras Publication
- Shasrti K V, Shukla Vinita, Developmental Biology, Rastogi Publication

Reference Books Recommended –

- Gerhart, J. et al. (1997) Cells, Embryos and Evolution. Blackwell Science
- Gilbert, S.F. (2010) Developmental Biology (9th edition). Sinauer
- Wolpert, L. (2007) Principles of Developmental Biology (3rd edition). Oxford University Press

Online Resources–

- **https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==**
- **http://ndl.iitkgp.ac.in/he_document/aklectures/aklectures/4_3_2_1638?e=15|*|||**
- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/cnqxwmzey1w?e=1|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-11P**		
2	**Course Title**	**Developmental Biology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Acquire knowledge of the fundamental processes involved in embryonic development, Types of eggs ➢ Explain developmental processes and identify various stages of development through study of permanent slides , ➢ Learn experimental techniques commonly used in developmental biology ➢ Aware of current trends and advances in developmental biology research, including emerging technologies.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min Passing Marks: 20**

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Types of eggs based on quantity and distribution of yolk: sea urchin, insect frog, Chick. ➢ Comparative study of cleavage patterns in Frog and Amphioxus models. ➢ Study of cell movement, shape and size during morphogenetic movement of Blastulation, Gastrulation in Frog, Amphioxus, Chick through models and charts. ➢ Study of whole mounts and sections of developmental stages of frog through permanent slides: blastula, gastrula, neurula (Neural plate, Neural fold and Neural tube stages), tail-bud stage, tadpole (external and internal gill stages) ➢ Study of whole mounts of developmental stages of chick through permanent slides -18 hours, 24 hours, 33 hours, 48 hours, 72 hours and 96 hours of incubation ➢ Extra embryonic membranes of chick through models and charts. ➢ In vivo study of chick embryo development by windowing and candling methods. (Demonstration only) ➢ Some videos to develop understanding on the process of development. ➢ Group Discussion / Quiz /Seminar / Project related topics ➢ Prepare practical record	**30**
Keywords	*Types of eggs, Cleavage, frog, Chick Embryology, Chick Embryo Development Windowing*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- ***Lal S S, Vertebrate Practical***
- ***Phukan LunaDevelopmental Biology Practical, Mahaveer Publication***

Online Resources–

- **http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/pttau909f8a?e=0|living%20chick%20embryos%20%E2%80%93%20observations|||**
- **https://egyankosh.ac.in/bitstream/123456789/16460/1/Unit-26.pdf**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-12T**		
2	**Course Title**	**Molecular Biology**		
3	**Course Type**	**Discipline Specific Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Develop an understanding of concepts, mechanisms and evolutionary significance and relevance of molecular biology in the current scenario. ➢ Get well versed in recombinant DNA technology which holds application in biomedical & genomic science, agriculture, environment management, etc. Therefore, a fundamental understanding of Molecular Biology will help in career building in all these fields. ➢ Apply their knowledge in problem solving and future course of their career development in higher education and research. ➢ Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Chromosomes and Nucleic Acids:** Chromosomes structure: Chromatin (Euchromatin and heterochromatin), Types of chromosomes. Histones, Histone-modifications. Structure of Nuclic acids: Structure and functions of DNA, DNA forms: Plasmid DNA, Genomic DNA and Repetitive DNA. DNA polymorphisms. DNA modifications. Structure and Function of RNA: Ribosomal RNA (rRNA), Transfer RNA (tRNA), Messenger RNA (mRNA), Noncoding RNA. RNA Induced Silencing Complex and CRISPR Technology. Mutation: Chromosomal and gene mutation.	11
II	**Central dogma and DNA replication:** Central dogma of Molecular Biology. DNA methylation. DNA-Protein interaction. DNA Replication, plasmid DNA replication and genomic DNA replication, Centromeric and Telomeric DNA replication, DNA replication and cell cycle regulation. DNA polymerases. DNA-damaging agents. DNA repairing.	11
III	**Transcription:** Concept of Transcription, RNA polymerase I, II, III, transcription factors. RNA processing, splicing of hnRNA into mRNA, 5'-capping and 3'-polyadenylation of mRNA, rRNA and tRNA modifications and processing. RNA editing, alternative splicing, trans- splicing, miRNA, siRNA, piRNA, lncRNA, RNA-protein complex.	11
IV	**Translation:** Structure of Ribosomes, Genetic Code, triplet codons, Wobble base, synonymous codons, degeneracy of codon. Translation in prokaryotic and Eukaryotic cells (Aminoacylation of tRNA, initiation, elongation, peptide bond formation, translocation, termination, recycling of ribosome). Post-translational modifications and processing of proteins, large protein-protein complexes and protein trafficking Reregulation of protein synthesis in prokaryotic and eukaryotic cell.	12
Keywords	*Chromosomes, Nucleic Acids, CRISPR, tRNA, Transcription, Translation, Central dogma*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Chaudhari K, Molecular Biology Text book IFAS Publication
- Verma P.S., Agrawal V.K., Molecular Biology S Chand

Reference Books Recommended –

- Watson, J.D. *et al.* (2013) Molecular Biology of the Gene (7th edition) CSHL Press Pearson.
- Green, M. R and Sambrook, J. (2012) Molecular Cloning: a Laboratory Protocol (4th edition) CSHL Press.
- Walter, P. (2007) Molecular Biology of the Cell (5th edition) Garland Science.
- Cell Biology by De Roberties
- Gene by Lewine 7th to 11th edition

Online Resources–

- https://tripurauniv.ac.in/Page/SubjectWiseOnline_EBooks_Cell_Molecular_Biology,
- https://www.tezu.ernet.in/Library/index.php/e-journals/55-microbiology-and-molecular-biology-education-oa

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Honors/ Honors with research)*			**Semester VIII**	Session: **2024-2025**
1	**Course Code**	**ZOSE-12P**		
2	**Course Title**	**Molecular Biology**		
3	**Course Type**	**Discipline Specific Elective Lab Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning. Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Mastery of fundamental laboratory techniques used in molecular biology, such as DNA extraction, PCR (Polymerase Chain Reaction), gel electrophoresis, DNA sequencing, and cloning. ➢ Ability to design experiments, including selecting appropriate methodologies, controls, and troubleshooting potential issues that may arise during experiments. ➢ Proficiency in analyzing experimental data, including interpreting ➢ Development of critical thinking skills to evaluate experimental results.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course		
Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)		
Module	**Topics (Course contents)**	**No. of Period**
Lab./Field Training/ Experiment Contents of Course	➢ Preparation of ball and stick model for B-DNA molecule (A=T and G=C base pairs). ➢ Preparation of RNA model for tRNA, mRNA and rRNA molecule (A=U and G=C base pairs) ➢ Preparation of Central dogma model with reference to Replication, Transcription and Translation i.e., Linear flow of genetic information. ➢ Isolation of genomic DNA by ethanol precipitation method. ➢ Preparation of model pBR322 ➢ Agarose gel electrophoresis of the plasmid DNA and the genomic DNA. ➢ Chromosomal staining ➢ Temporary slide preparation of Salivary gland chromosome from drosophila larva. ➢ Group discussion/Quiz/Seminar presentation on related topics. ➢ Practical Record or Lab assignment.	**30**
Keywords	*Molecular Biology, DNA model, Central Dogma, Agrose Gel electrophoresis, chromosome, salivary gland chromosomes of Drosophila*	
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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Sarma. PVGK, Molecular Biology Practical Mannual, MJP Publisher
- Pranav Kumar, Fundamentals and Techniques of Biophysics and Molecular Biology, Pathfinder Publication

Reference Books Recommended

- Green, M. R and Sambrook, J. (2012) Molecular Cloning: a Laboratory Protocol (4th edition) CSHL Press.

Online Resources–

- http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_51296_P_1_M_c_b_51376_51377?e=16|*|||
- http://ndl.iitkgp.ac.in/he_document/swayam_prabha/ke040dcj_84

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree/ Honors)*		**Semester - I**		Session: **2024-2025**
1	**Course Code**	**ZOGE - 01T**		
2	**Course Title**	**Life on Earth and Unique Attributes of Animal Kingdom**		
3	**Course Type**	**General Elective**		
4	**Pre-requisite** (if, any)	*As per program*		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Develop an understanding of concepts, mechanisms, evolutionary significance and relevance of Origin of life. ➢ Understand General Idea about Invertebrate and Vertebrate animals with special reference and their specific qualities. ➢ Understand and appreciate diversity of life forms. ➢ Apply the knowledge about animals Sciences in daily life.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks: 40**

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Origin of life: Theories of Origin of life:** **Ancient Theory** Theory of Special Creation (Mythological approach),Theory of Panspermia or Cosmozoic Theory, Theory of Directed Panspermia, Theory of Catastrophism, Theory of Spontaneous Generation (Abiogenesis or Autogenesis), Theory of Biogenesis: Redi's Experiment and Pasture's Experiment. **Modern Theory: Origin of Universe:** Big Bang Hypothesis in Brief, **Origin of Solar System and The Earth:** Nebular hypothesis, **Atomosphere and Eneargy Sources on Primitive Earth, Biochemical Origin of Life:** Oparin and Haldane Theory, **Chemogeny:** Formation of simple and complex organic compounds (Stanely Miller and Ure's Experiment), Formation of Coacervates, Nucleic Acids. **Biogeny:** Origin of primitive prokaryotic cell. **Evolution of modes of Nutrition:** Chemohetertrophs, Anaerobic and Aerobic Photoautotrophs. Evolution of Eukaryotes.	12
II	**Systematics & Unique attributes of Invertebrate and Vertebrate animals with special reference to Coelentrata, Mollusca and Pisces:** Definition and difference between Invertebrate and Vertebrate. **Nomenclature:** Binomial and Trinomial Nomenclature and International code of Nomenclature **Corals:** Meaning of Coral, Structure of Coral polyp, Coral Skeleton, Types of corals: Hydrozoan Coral, Example- Millipora, Octocorallian Coral, Example- Alcyonium, Hexacorallian Corals, Example- Gorgonia. **Torsion in Mollusca:** Definition, Mechanism of Torsion, Effects of Torsion, Significance of Torsion. **Pisces: Migration in fishes**: Catadromous: Eel fish and Anadromous: Salmon fish and **Parental care in fishes:** By nest formation, Coiling round eggs, Attachment to body, Integumentary cups, Shelter in mouth, Brood pouch, Mermaids purses, Viviparity.	11
III	**Unique attributes of Vertebrate animals with special reference to Amphibia & Reptilia:** **Parental care in Amphibia:** by Nest, by Nursery or Shelter and by Parents **Neoteny in Amphibia**: Definition, Partial and Total Neotony, Factors Affecting Neotony, Examples- Axolotal larva, Necturus and Siren. **Reptilia: Venomous & Non-venomous Snakes:** Identification, Poison apparatus: Poison Glands, Poison ducts and Fangs, Biting Mechanism.	11
IV	**Unique attributes of Vertebrate animals with special reference to Aves and Mammals:** **Birds:** Flight Adaptation, Migration and Perching Mechanism, Flightless Birds (Morphology and Special Characters of Emu, Ostrich and Penguins), Discuss-Birds are glorified reptiles: Archaeopteryx. **Monotremes or Egg laying mammals:** Morphology and Special Characters of Echidna and Duck bill platypus. **Aquatic Mammals:** Morphology and Special Characters of Whale and Dolphin. **Mammals: Flying Mammals:** Morphology and Special Characters of Bat.	11
Keywords	*Origin of life, Invertebrate, Vertebrate, Corals, Torsion, parental care, Neotony, Fangs, Aves, Mammals*	

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PART–C: Learning Resources

Text Books Recommended

- E. J. W. Barrington , Invertebrate structure and function, English Language Book Society UK
- Robert Barnes, Invertebrate Zoology, Robert Barnes IVth edition Holt Saunders International Edition Japan
- Park Haswell, Marshall and Williams, A textbook on Zoology Invertebrate, AITBS Publishing and Distributers, Delhi
- Park Haswell, Marshall and Williams, A textbook on Zoology Vertebrate, AITBS Publishing and Distributers, Delhi

Reference Books Recommended

- Prof R. L. Kotpal, Protozoa to Echinodermata, Rastogi Publication Meerut
- E.L. Jordan, Dr. P. S. Verma,Invertebrate Zoology , S. Chand Publications, New Delhi
- N. Arumugam, N. C. Nair S. - Invertebrate Zoology, Saras Publication.
- N. Arumugam, N. C. Nair S. - vertebrate Zoology, Saras Publication.
- Barrington E. J. W., Invertebrate Structure and Function, Nelson London
- Barnes, R. D., Invertebrate Zoology –Saunders Philadelphia
- R. L. Kotpal, Invertebrate, Rastogi Publications
- R. L. Kotpal, Vertebrate, Rastogi Publications
- H. S. Bhampah, KavitaJuneja, Recent trends in vertebrates vol 1 – 9, Anmol Publication
- S. N. Prasad, Life of invertebrates, Vikash Publication House Pvt Ltd New Delhi
- G. S. Sandhu, HarshwardhanBhagskar – Advanced invertebrate zoology –Campus books international

Online Resources–

- **https://www.coursera.org/lecture/emergence-of-life/4-5-invertebrates-successes-of-life-without-a-backbone-WQHqS**
- **https://www.shiksha.com/online-courses/introduction-to-biology-biodiversity-course-courl5385**
- **https://www.youtube.com/watch?v=k121Qv6loBA**
- **https://www.youtube.com/watch?v=uK-Xx_OCYcI**
- **https://www.youtube.com/watch?v=vybbBil5Elk**
- **https://www.youtube.com/watch?v=WxMSckEeio4**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*			**Semester - I**	Session: **2024-2025**
1	**Course Code**	**ZOGE - 01P**		
2	**Course Title**	**Life on Earth and Unique Attributes of Animal Kingdom**		
3	**Course Type**	**General Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ *To demonstrate comprehensive understanding of the current theories and hypotheses regarding the origin of life on Earth,* ➢ *Understand diversity of life forms* ➢ *Identify some distinctive invertebrate and vertebrate animals* ➢ *Apply this Understanding to broader context of life*		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min Passing Marks: 20**

PART -B: Content of the Course

Total No. of learning-Training / performance Periods: 30 Periods (30 Hours)

Module	Topics (Course Contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Study of origin of life through chart and models ➢ Study of different Invertebrates and Vertebrates animals through models and museum specimens in the laboratory with details of biogeography and diagnostic features: Millipora, Alcyonium, Gorgonia, Hippocampus, Ichthyophis (Female), Alytes (Male), Axolotal larva, Necturus, Siren, Cobra, Viper (pit & Pitless), Sea Snake, Rattle Snake, Archaeopteryx, Emu, Ostrich and Penguins, Echidna and Duck bill platypus, Whale, Dolphin, Bat. ➢ Preparation and Demonstration of Key for Identification of Venomous and Non-venomous snakes. ➢ Study of Coral Reefs through Models, Photographs ➢ Study of Fossils through chart/ Models ➢ An "**Animal album or Practical Record**" containing sketches, photographs, cut outs, with appropriate write up about the above mentioned taxa. ➢ Study of some videos to develop understanding and acquired knowledge on the animals salient features as mentioned above. ➢ Group discussion/Viva or Seminar presentation on related topics mentioned in Theory paper.	**30**
Keywords	*Museum specimens, Invertebrates, Vertebrates, Venomous and Non-venomous, Seminar*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- S.S. Lal, Practical Zoology, Invertebrate. 12th Edition Rastogi Publications, Meerut,
  - New Delhi.
- A manual of practical Zoology. Dr. P.S Verma, S. Chand Publication, New Delhi

Reference *Books Recommended –*

- Park Haswell, Marshall and Williams, A textbook on Zoology Invertebrate, AITBS Publishing and Distributers, Delhi
- Park Haswell, Marshall and Williams, A textbook on Zoology Vertebrate, AITBS Publishing and Distributers, Delhi

Online Resources–

- http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/gc5ua6m873i?e=3|*|||
- https://www.youtube.com/watch?v=JUdp3U6A1EA

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*			**Semester - II**	Session: **2024-2025**
1	**Course Code**	**ZOGE - 02T**		
2	**Course Title**	**Cell Biology and Histology**		
3	**Course Type**	**General Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Acquire knowledge of Cell membrane and function ➢ Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved. ➢ Gain Knowledge of key processes like cell division, ➢ Learn about various tissues of body their structural significance		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Cell Structure, Cell Membrane and Extra Nuclear Cell Organelles:** General structure of Prokaryotes and Eukaryotes. **Cell membrane organization: O**rigin, structure (Lipid-Lipid Bilayer Model, Dannelli & Davson Model, Unit Membrane Model and Fluid mosaic model), chemical composition and function of cell membrane, Specialization of cell membrane: microvilli desmosomes, Hemidesmosome, Septate Desmosome, plasmodesmata, tight and gap junction. **Extra Nuclear Cell Organelles:** Ultra structure and functions of Endoplasmic reticulum and Golgi apparatus.	11
II	**Extra Nuclear Cell Organelles:** Ultra structure and functions of Ribosome, Lysosome, Peroxisomes, Mitochondria: Origin, structure and function.	11
III	**Nuclear Organization and Cell Division:** Size, shape, structure and functions of interphase nucleus. Ultra structure of nuclear membrane and pore complex. Nucleolus: general organization, chemical composition and functions, Chromosome Morphology, Cell cycle, Cell division- Mitosis and Meiosis. Cell division checks points and their regulation. Programmed cell death (Apoptosis).	12
IV	**Introduction to tissues.** Epithelial tissue: types, structure and characteristics. surface modifications. Basement membrane: structure and characteristics. Connective tissue cells. Structure and function of loose, dense and adipose tissue. Cartilage and bone: classification, and fine structure. Blood: plasma, blood cells, lymph– their structure and function. Bone marrow and haemopoesis. Structure and function of spleen. Muscular tissue: ultrastructure of smooth, skeletal and cardiac muscles. Muscle-tendon attachment. Structure and classification of neurons.	11
Keywords	*Cell Biology, Cell Membrane, Cell organelle, Nucleus, endoplasmic reticulum and Golgi apparatus, ribosome, lysosome, peroxisomes, Mitochondria, tissues.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Gupta P.K. Cell and Molecular Biology, Himalaya Publication
2. Arumugam.N, Cell biology and Molecular Biology, Saras Publication
3. Rastogi V.B. Cell Biology, Rastogi Publication
4. Verma P.S. and Agrawal Cell Biology, S. Chand Publication

Reference Books Recommended –

5. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.
6. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
7. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
8. Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco. Practical

Online Resources–

1. National digital Library.- http://ndl.iitkgp.ac.in/document/Qkh4R2FGUkRNZjFicFUvWmpzQ2loY0poaUVtYlByc1BZNXk3TnZMWVFzQXpZNjhhQUplR1BTOERHelZXZUp5Nw
2. http://ndl.iitkgp.ac.in/document/Qkh4R2FGUkRNZjFicFUvWmpzQ2loZFJyVGFmaDFwbXpBS0kwNi9tbi91UGYxaFl6OC9Sb25QWUlXLzF1V3NUZw
3. https://www.youtube.com/watch?v=GYY627IeAKg
4. E-PG Pathshala. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**
Continuous Internal Assessment (CIA): **30 Marks**
End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** +**20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of ZOOLOGY
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree / Honors)*			**Semester - II**	Session: **2024-2025**
1	**Course Code**	**ZOGE -02P**		
2	**Course Title**	**Cell Biology and Histology**		
3	**Course Type**	**General Elective**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to-** ➢ Understand ultra structure of prokaryote and Eukaryote cell, undertake microscopic study to gain knowledge ➢ learn to identify cell organelles ➢ Explain and demonstrate mitosis and meiosis division in onion root tip, Grass hopper testis, etc ➢ Gain knowledge of Microtomy		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	1. Study of prokaryotic and eukaryotic cell types with the help of chart, slide and video. 2. Separation and isolation of cells by sedimentation velocity in unit gravity. 3. Disruption of cells, isolation and identification of subcellular components, isolation of nuclei. 4. Isolation of mitochondria by differential centrifugation and identification of succinic dehydrogenase in the mitochondrial pellet. 5. Chromosome segregation in mitosis and meiosis. 6. Preparation of chromosome squashes from Onion Root tip for observation of stages of Mitosis 7. Preparation of chromosome squashes from grasshopper/cockroach testes for the observation of stages of meiosis. 8. Isolation and estimation of DNA. 9. Study of types of tissue through permanent slides: epithelial, connective, muscular, Nervous etc. 10. Preparation of Practical Record 11. Group discussion/Viva or Seminar presentation on related topics mentioned in Theory paper	**30**
Keywords	*Prokaryote, Eukaryote, cell division, Mitosis, Meiosis, DNA Separation, Histology of Tissue, Microtomy.*	

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PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Debarati Das Essential Practical Handbook of Cell Biology & Genetics, Biometry & Microbiology, A Laboratory Manual, Academic Publishers.
2. Mohan P Arora Cytogenetics:, Himalayan Publishing House

Reference Books Recommended –

3. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.

Online Resources– National Digital Library

- **http://ndl.iitkgp.ac.in/he_document/inflibnet_epgp/inflibnet_epgp/IN_I_e_P_P_1_Z_51296_P_1_P_o_e_51600_M_0_P_g_51604_51605?e=13|*|||**

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**50 Marks**
Continuous Internal Assessment (CIA):	**15 Marks**
End Semester Exam (ESE):	**35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of BoS :



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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction				
Program:Bachelor *(Certificate / Diploma / Degree)*			**Semester – I/III/V**	Session: **2024-2025**
1	**Course Code**	**ZOVAC-01**		
2	**Course Title**	**Public Health and Hygiene**		
3	**CourseType**	**Value Added Course**		
4	**Pre-requisite**(if, any)	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	➢ Understand the importance of hygiene. ➢ Identify current national and global public health problems. ➢ Aware about the issues of food safety, water safety, vaccination, and obesity. ➢ Create general medical awareness in daily life. ➢ Analyze the measures to live a healthy life.		
6	**CreditValue**	**2 Credits**	***Credit = 15 Hours -learning & Observation***	
7	**TotalMarks**	**Max.Marks:50**	**Min Passing Marks:20**	

PART -B: Content oftheCourse

Total No. of Teaching–learning Periods (01 Hr. per period) - 30 Periods (30 Hours)

Unit	Topics (Course Contents)	No. of Period
I	**Maintenance of personal hygiene:** Introduction to public health and hygiene: determinants and factors. Pollution and health hazards: Water and air borne diseases. Radiation hazards: Network Towers and electronic gadgets (recommended levels, effects and precaution). Personal hygiene: Oral hygiene, Menstrual Hygiene, Ideal hand washing methods, Ideal food keeping methods.	07
II	**Nutrition and Health:** Classification of food into micro and macro nutrients. Balanced diet. Importance of dietary fibres. Significance of breast feeding. Malnutrition anomalies: Anaemia (Iron and B12 deficiency), Kwashiorkar, Marasmus, Rickets, Goiter (cause, symptoms, precaution and cure).	07
III	**Communicable/Contagious and Non-Communicable Diseases: Communicable viral diseases:** measles, chicken pox, swine flu (their causal agents, symptoms and prevention). **Communicable bacterial diseases:** tuberculosis, typhoid, cholera (their causal agents, symptoms and prevention). **Sexually transmitted diseases:** AIDS, Syphilis (their causal agents, symptoms and prevention). **Non-communicable diseases:** hypertension, arthritis, Diabetes, peptic ulcer, obesity, depression and anxiety (their causal agents, symptoms and prevention).	09
IV	**Public Health Management & General Medical Awareness:** Vaccination, Benefits of institutional deliveries, Deworming drive: Use of Albendazole. First Aid: Electrocution, Road Accident, Burn, Lightning Strike, Envenomation. Importance of Cardiopulmonary resuscitation (CPR). Blood Donation: Eligibility, Health Screening. Road Safety: Good Samaritan, General safety precautions on Road and Motion Sickness. Fire Safety: Fire Control and Fire Extinguisher Categories.	07
Keywords	*Health, Hygiene, Nutrition, Disorders, Vaccination, Safety, Fire, Blood, Medication.*	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text BooksRecommended –

- Mary Jane Schneider (2011) Introduction to Public Health.
- Muthu, V.K. (2014) A Short Book of Public Health.

Reference Books Recommended

- Detels, R. (2017) Oxford Textbook of Public Health (6th edition).
- Gibney, M.J. (2013) Public Health Nutrition.
- Wong, K.V. (2017) Nutrition, Health and Disease.

Online Resources–

- **https://www.fda.gov/drugs/investigational-new-drug-ind-application/general-drug-categories**
- **https://www.nfpa.org/news-blogs-and-articles/blogs/2023/08/01/fire-extinguisher-types**
- **https://www.redcross.org/take-a-class/cpr/performing-cpr/what-is-cpr#:~:text=What%20Is%20the%20Purpose%20of,healthcare%20workers%20and%20emergency%20responders.**
- **https://unesdoc.unesco.org/ark:/48223/pf0000226792**

Online Resources–

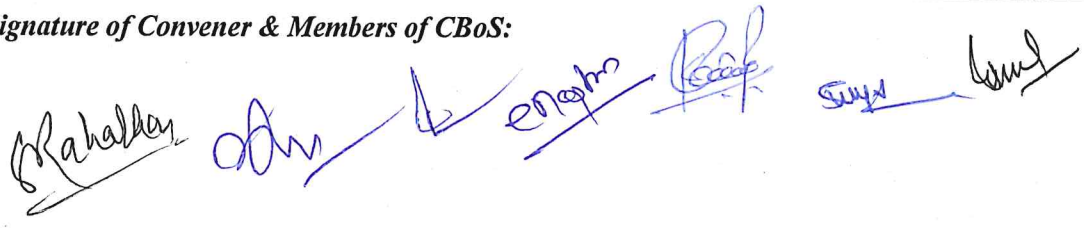
- **https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S001827/P001833/M029447/ET/15245666876.21Q1.pdf**
- **https://www.nhm.gov.in/images/pdf/programmes/mhs/Training_Materials/PDF_English/reading_material.pdf**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz+obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Two section – A & B** Section **A**: **Q1**. Objective – **05 x1= 05** Mark; **Q2**. Short answer type- **5x2 =10Marks** Section **B**: Descriptive answer type qts.,**1out of 2** from each unit-**4x05=20Marks**	

Name and Signature of Convener & Members of CBoS:



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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Life Science *(Certificate / Diploma / Degree)*		**Semester – II/IV/V/VI**		**Session: 2024-2025**
1	**Course Code**	**ZOSEC-01**		
2	**Course Title**	**Vermiculture and Vermicomposting**		
3	**Course Type**	**Skill Enhancement Course**		
4	**Pre-requisite** (if, any)	***As per Program***		
5	**Course Learning Outcomes (CLO)**	**After successfully completing this course, the students will be able to:** ➢ Learn the identifiable features of earthworm species for vermiculture and vermicomposting. ➢ Cultivate the skills of vermiculture. ➢ Understand the challenges in vermiculture and vermicomposting. ➢ Analyze the features of different vermicomposting methods. ➢ Create entrepreneurial prospects in this field.		
6	**CreditValue**	**2 Credits (1C + 1C)**	***Credit = 15 Hours –Theoretical learning and = 30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content of the Course

Total No. of Teaching–learning Periods:
Theory–15 Periods (15 Hrs) and Lab. or Field learning/Training 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Theory Contents	**General Introduction:** Distribution and habit, habitat. Food: Phytophagous and Geophagous earthworm. Morphology of earthworm. Ecological categories: Epigeic, Endogeic and Anecic earthworms. Ecological requirements: moisture, temperature, light, pH and, organic matter. Ecosystem services: role played by earthworms in soil ecosystem. Difference between vermiculture and vermicomposting. Role of earthworm and vermicompost in growth of plants. **Vermiculture:** Definition and features. Selective features of earthworms for vermiculture. Vermiculture methods: Wormery, breeding techniques: indoor and outdoor cultures, monoculture and polyculture, merits and demerits. Obstacles in Vermiculture: Preventention and Management. **Vermicomposting:** Definition and features. Scientific names and distinguishing features of native and exotic vermicomposting earthworms (Native Indian earthworms. *Perionyx excovatus, Perionyx ceylanensis*, European earthworms. *Eisenia fetida, Eisenia andrei*, South African earthworms. *Eudriluseugeniae*), Principle of vermicomposting, Methods of vermicomposting: Low-cost Floor beds, Grow bags & Tank system. Management during vermicomposting (Physical and Biological). Products of vermicomposting, physiochemical features and their utility: earthworm biomass (vermiprotein), vermicompost and vermiwash. Harvesting the vermicompost & storage. Marketing prospects of Vermicomposting in Chhattisgarh and India.	**15**
Lab./Field Training Contents	➢ Key to identify different types of earthworms. ➢ Identification of materials/waste products for vermiculture and vermicomposting. ➢ Study of systematic position, habits, and habitat & External characters of *Eisenia fetida.* ➢ Study of Life stages & development of *Eisenia fetida.* ➢ Culture of earthworms in Grow Bags. ➢ Study of devices and instruments of Vermiculture and Vermicomposting. ➢ Preparation of vermibed, maintenance of vermicompost & management of climatic conditions. ➢ Study the effects of vermicompost & vermiwash on any two short duration plants. ➢ Study of different methods of vermicomposting (NADEP Composting, Bangalore Method, Coimbatore Method & Indore Method). ➢ Creation of set up for vermiwash collection. ➢ Field Visit to Vermiculture & Vermicomposting sites and interaction with self help groups/ personnel engaged in these activities. ➢ Projects/ Assignments/ Chart/ Model preparation. ➢ Practical Record	**30**
Keywords	***Earthworm, Vermiculture, Vermicomposting, Vermiwash, Grow Bags, NADEP.***	
Signature of Convener & Members (CBoS):		

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Chauhan, A. (2012) Vermitechnology, Vermiculture, Vermicompost and Earthworms: Vermiculture, Vermicomposting, Vermitechnology and Mirobes, Lambert Academic Publishing, Germany.
- National Institute of Industrial Research, (2010): The Complete Technology Book on Vermiculture and Vermicompost, Published by National Institute of Industrial Research, Delhi-7, India.
- Kumar, A. (2005) Verms and Vermitechnology, APH Publishing.
- Bhatnagar & Patla,2007. Earthworm vermiculture and vermin-composting, Kalyani Publishers,New Delhi.
- Sultan Ahmed Ismail, 2005. The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.
- Panda Himadri: The Complete Technology Book on Vermiculture and Vermicompost (Earthworm) with Manufacturing Process, Machinery Equipment Details & Plant Layout; Asia Pacific Business Press Inc.
- EIRI Board : Hand Book Of Biofertilizers & Vermiculture.

Online Resources–

- **https://agritech.tnau.ac.in/org_farm/orgfarm_composting.html#:~:text=In%20the%20Bangalore%20method%20of,laid%20over%20the%20moistened%20layer.**
- **https://www.thepharmajournal.com/archives/2021/vol10issue12/PartAR/11-5-248-926.pdf**

Online Resources–

- **https://megbrdc.nic.in/publications/fliers-Pamphlets/nadep-composting-english.pdf**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
MaximumMarks: 50 Marks
ContinuousInternal Assessment(CIA):15 Marks
EndSemesterExam(ESE):35Marks

Continuous InternalAssessment(CIA)(By Course Coordinator)	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks - **15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
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Name and Signature of Convener & Members of CBoS:

Dr. Shubhada Rahalkar

Dr. Nazeem Ahmed Mesavi

Dr. Ajit Hemdeo

Shobha Ram Yadav

Dr. Lata Meshram

10.6.24

(Dr. R. K. Tambat)

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