Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)

Scheme and Syllabus

Of

M. Sc. (Zoology)

Program Code: MSCZOOLR128

Semester system for affiliated college

(As per LOCF and credit system)

w.e.f. 2024-2025

As approved AC and EC meeting held on 16.08.2023 and 18.04.2023 respectly

अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर–रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009
Website : www.bilaspuruniversity.ac.in

Scheme of M.Sc. (Zoology) under Semester System
Program Code: MSCZOOLR128

Third	MSCZOOLT301	General and Comparative Endocrinology of Vertebrates	3	-	1	4	80	20	100	36
	MSCZOOLT302	Quantitative Biology	3	-	1	4	80	20	100	36
	MSCZOOLT303	Immunology and Developmental Biology	3	-	1	4	80	20	100	36
	MSCZOOLT304	Population Genetics and Evolution	3	-	1	4	80	20	100	36
	MSCZOOLP301	Lab Course-I	-	2	-	2	100	-	100	36
	MSCZOOLP302	Lab Course-II	-	2	-	2	100	-	100	36
Subtotal			**12**	**4**	**4**	**20**	-	-	600	

No change
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	Compulsory									
	MSCZOOLT401	General Physiology and Neurophysiology	3	-	1	4	80	20	100	36
	MSCZOOLT402	Biochemistry and Metabolic Regulation and Cell Function	3	-	1	4	80	20	100	36
	MSCZOOLP401	Lab Course-I	-	2	-	2	100	-	100	36
	Optional Group-I									
	MSCZOOLT403	Fish (Ichthyology) Structure and Function	3	-	1	4	80	20	100	36
	MSCZOOLT404	Applied Fisheries	3	-	1	4	80	20	100	36
	MSCZOOLP402	Lab Course-II	-	2	-	2	100	-	100	36
	Optional Group-II									
Fourth	MSCZOOLT405	Cell Biology	3	-	1	4	80	20	100	36
	MSCZOOLT406	Cellular Organization and Molecular Organization	3	-	1	4	80	20	100	36
	MSCZOOLP403	Lab Course-II	-	2	-	2	100	-	100	36
	Optional Group-III									
	MSCZOOLT407	Entomology	3	-	1	4	80	20	100	36
	MSCZOOLT408	Applied Entomology	3	-	1	4	80	20	100	36
	MSCZOOLP404	Lab Course-II	-	2	-	2	100	-	100	36
	Optional Group-IV									
	MSCZOOLT409	Wildlife Conservation	3	-	1	4	80	20	100	36
	MSCZOOLT410	Environment and Diversity Conservation	3	-	1	4	80	20	100	36
	MSCZOOLP405	Lab Course-II	-	2	-	2	100	-	100	36
Subtotal			12	4	4	20			600	
Total			**48**	**16**	**16**	**80**			**2400**	

Abbreviations used:

ESE: End Semester Exam
IA: Internal Assessment

Part A: Introduction			
Program:M.Sc Zoology	Semester: III	Year: 2024-25	w.e.f.: 2024-25
• Course Code	MSCZOOLT301		
• Course Title	Paper- I, General and Comparative Endocrinology of vertebrates		
• Course Type	Theory		
• Pre-requisite (if any)	As per University rule.		
• Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know the structure of endocrine system in vertebrates. • Know the function biosynthesis as well as metabolic activity of endocrine system. • Learn and understand mechanism of hormone action, homeostatic mechanism • Understand effect of hormone on human health • Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.		
• **Credit Value**	L-3 + T-1		
• **Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	Aims and Scope of Endocrine glands-Discovery of hormones Classification of endocrine glands and hormones, **Comparative study of endocrine gland**, Structure of pituitary gland, Thyroid gland, Adrenal gland, Gastrointestinal gland, Juxta-glomerular apparatus(kidney)	12 Hours
II.	**Biosynthesis Of Hormones** Biosynthesis of simple peptide hormone, Biosynthesis of amino acid hormone, Biosynthesis of steroids hormone, Concentration and transport of hormone in the blood and Hormone delivary, **General mechanism of hormone action**- Plasma membrane hormone receptor and its action, cytosolic hormone receptor and its action Termination of hormone action	12 Hours
III.	**Function, control and disorder of following endocrine gland hormone** Pituitary hormone, Adrenal hormone, Thyroid and parathyroid hormones, Gastro-intestinal hormones, Pancreas	12 Hours
IV.	**Role of hormones in metabolic activity** Role of Hormones in Carbohydrate metabolism especially Glucose metabolism, Protein metabolism, Fat metabolism, Hormone and Homeostasis, Calcium metabolism, Role of hormones in osmoregulation, Role of hormones in fasting,	12 Hours

V.	**Role of hormones in different activities** Hormones and behaviour, Role of hormone in growth and development, , Role of hormones in Gametogenesis **Neuroendocrine system**- Types of Neuro-hormones, synthesis and function of endorphins, enkephalin and Hypothalamic hormone	12 Hours

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. General & comparative endocrinology: E.J.W. Barrington, oxford, Clarendon Press
2. Text book of Endocrinology : R.H. Williams, W.B Saunders
3. Endocrine Physiology : C.R Martin, Oxford Univ. Press
4. Comparative endocrinology : A. Gorbman et al, john Wiley and sons
5. Medical Physiology : W.F. Ganong(1981) :10° edition Lange Medical Publications
6. Principles of anatomy and physiology: Torota Grabowski, 9th edition, John Wiley & sons
7. Reproductive Physiology of vertebrates: Van Tienhoven, A, (1983) 2nd edition ComellUniv.Press,NY
8. The pituitary gland :Imura. H(1994)2nd editionCompreshensive Endocrinology revised series Raven, NY
9. Comparative vertebrate endocrinology: Bentley, PJ. (1976), Cambridge Univ. press, Cambridge
10. Comparative vertebrate endocrinomental: Bentley, P.J(1976) Cambridge Univ. press, Cambridge
11. Endocrinology : Hardley
12. Endocrinology : Negi

E-Resources:

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

Member of Board of Studies (Zoology): Name	Signature and Mobile No.
1. Dr. Shubhada Rahalkar , Professor , Govt. Bilasa Girls PG College, Bilaspur	9893303023
2. Shri A. K. Kesharwani ,Asstt. Professor Govt. Minimata Girls College, Korba	9425223212
3. Dr. Anju Tiwari, Professor Govt. Bilasa Girls PG College, Bilaspur	9424140171
4. Shri Krishan Kumar Chaudhary, Asstt. Professor Govt. Gramya Bharti College, Hardibazar, Korba	9039969973
5. Dr. Ranju Gupta, Asstt. Professor Dr. J.P. Mishra Govt. Science College, Mungeli	9424146424
6. Shri Anand Kumar Sao, Asstt. Professor Govt. NiranjanKesharwani College, Kota	7987493377
7. Dr. Deshraj Singh, Professor Himachal Pradesh Vishwavidyalaya, Shimla	9418480248
8. Dr. V.K. Gupta, Retd. Professor C.M.D. PG College, Bilaspur	9424153429

Part A Introduction				
Program - M.Sc. Zoology		**Semester III**	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	**MSCZOOLT302**		
2.	Course Title	**Quantitative Biology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As Per University Rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know basic concepts of probability and statistics. • Describe statistical methods and probability distributions relevant for biological data. • Know the applications and limitations of different statistical methods. • Know basic concept of mathematical modeling and its application. • Students will enhance their communication skills by effectively conveying their understanding of Biostastics through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to Quantitative biology. • Perform and interpret statistical analyses with real biological data.		
6.	**Credit Value**	**3L+1T = 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Introduction to Biostatistics** Statistical Application in some specific area in biology Collection of data, Tabulation, presentation of data, diagrammatic and graphical presentation	*12*
II.	General idea about normal, binomial and Poisson distribution Measures of Central tendencies –Mean, Median ,Mode, relation between mean median and mode , Variance	*12*
III.	Probability theory, distribution and their properties Correlation Regression Analysis of Variance	*12*

IV.	Measures of dispersion -range, Mean deviation, Standard deviation and coefficient of variance Hypothesis testing-t test, chi-square test, f test Matrices and vectors Exponential functions	*12*
V.	**Mathematical Modeling** Types of models-statistical, empirical and mechanistic , simulation Properties of models- generality, precision and realism Detailed treatment of model of cycling of nutrients in an ecosystem	*12*

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Batschelet, E. Introduction to mathematics fr site scientist , springer-verlag , Berling
2. Jorgenser, S.E. Fundamental of Ecological Modelling E. sevier New York
3. Lenderen D Modelling in behavioural ecology, chapman & Hall London U.K
4. Sokal, R.R and F.J Rohit Biometry Freeman San Fransisco
5. Snedecor, G. W and W.G Cochran, Statistical methods, AffliatedEast , West Press New Delhi (Indian ed.)
6. Murray, J.D Mathematical Biology, Springer Verlag Berlin
7. Pranav Kumar Banerjee , Introduction to Bio statistics, S Chand Publication

E-Resources:

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+u3y6UdbIvOJ97LFeSCmHQ==

Biostatistics and mathematical Biology- https://onlinecourses.swayam2.ac.in/cec23_bt10/preview

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Part A: Introduction				
Program - M.Sc. Zoology		**Semester III**	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	**MSCZOOLT303**		
2.	Course Title	**Immunology and Developmental Biology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per university rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand common procedures for culturing, purifying and diagnostics of micro-organisms understand the disease-causing potential of bacteria and viruses, and the responses of the immune system • Understand how does the immune system distinguish self from non-self. • Identify the major cellular and tissue components which comprise the innate and adaptive immune system. • Understand how are immune responses by CD4 and CD8 T cells, and B cells, initiated and regulated. • Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis. • Students will enhance their communication skills by effectively conveying their understanding of Immunology & Developmental biology through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to Immunology & Developmental biology. • Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms		
6.	**Credit Value**	**3L+1T =04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I	Overview of Immune System-Historical perspective of Immunology, Early theories of Immunology Innate and Acquired immunity Cells and Organs of Immune System Hematopoiesis, Lymphocyte traffic, Nature of Antigens - Antigenicity and Immunogenicity, Factor influencing immunogenicity, Antigenic determinates/epitopes and heptane	*12*
II	Antibodies (Immunoglobulin's) - Structure & Function of antibodies Immunoglobulin Classes & Subclasses Antigen- Antibody interaction, B Cell Maturation, Activation and Differentiation ,B- Cell Receptors ,B- Cell Activation and Proliferation , Humeral Immune Response , T- Cell maturation activation and differentiation ,T- Cell Receptors , T- Cell Activation and Proliferation ,T- Cellular Immune Response	*12*
III	Compliment System ,Complement Component , Regulation of Compliment System ,Consequence of Compliment Activation Major Histo- compatibility Complex ,Inheritance of HLA System, Location and Function ,Structure of MHC molecule ,Peptide interaction with MHC molecule Cytokines-Properties and functions, Hyper sensitivity - Gel and Combs' classification and Brief description of various types of hypersensitivities	*12*
IV	Basic concept of development, Gametogenesis, Fertilization and early development - Potency, commitment, Specification , Induction ,competence , determination and differentiation, cell fate and cell lineage, stem cell. Production of gamete, Types and structure of gamete, Fertilization, Cleavage, Blastulation , Gastrulation and formation of germ layers in animal.	*12*

V	Morphogenesis and organogenesis in animals Basic Feature of Vertebrate Morphogenesis Tabulation and extension of the Major Organ- forming Areas: The development of Primitive Embryonic form, Development of Primitive body form.axes and pattern formation in Drosophila, Vulva formation in Caenorhabditiselegans , Eye -lens induction, limb development and regeneration in vertebrate. Histogenesis and Morphogenesis of the Organ System The cardio vascular system , nervous system	*12*

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Kuby, W. H. Froeman , Immuniology WH FreemanUSA
2. W. Paul , Fundamental of Immunology Lippincott Williums and Wilkins Publications
3. M. Roitt, Essential Immunology Wiley BlackwelELBs Edition
4. Richard M. Hyde, Robert A. Patnode, Immunology A Wiley Medical Publications
5. Gayton,ATetBookof Medical Physiology, Saunders Publisher
6. S. Fatima, Immunology, Saras publication

E-Resources:

Immunology-

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

Immunology- https://onlinecourses.swayam2.ac.in/cec23_bt13/preview

Developmental Biology-

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

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Part A: Introduction				
Program - M.Sc. Zoology		**Semester III**	Year: 2024-25	w.e.f.: 2024-25
1	Course Code	**MSCZOOLT304**		
2	Course Title	**Population Genetics and Evolution**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	As per university rules		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand how morphological change due to change in environment helps drive evolution over a long period of time. • Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic tree. • Understand how evolutionary processes and gene function within a particular organism can provide insight into function of other organism. • Examine the evolutionary history of the texa based on developmental affinities. • Understand the causes and effect of alteration in chromosome number and structure. • Students will enhance their communication skills by effectively conveying their understanding of Evolution and Genetics through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to Population genetics and evolution. • Learn different aspects to Qunatify genetic variability.		
6	**Credit Value**	**3L+1T = 04**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

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Part B: Content of the Course

Unit	Topics	Total Hours
I	Concept of Evolution and theories of Organic Evolution with an emphasis on Darwinism, Neutral Theory of Evolution Neo-Darwinism - Hardy-Weinberg Law of genetic equilibrium. A detailed account of destabilizing forces – (i) Natural Selection (ii) Mutation (iii) Genetic drift (iv) Migration (v) Meiotic drive.	*12*
II	Genetics of speciation. Models of speciation (Allopatric, Sympatric and Parapatric). Patterns and mechanisms of reproductive isolation. Genetics of Quantitative traits in population. Analysis of quantitative traits. Inbreeding depression and heterosis.	*12*
III	Molecular Evolution Gene Evolution Origin of Higher categories Major trends in origin of higher categories. Macro and micro Evolution	*12*
IV	Molecular phylogenetics. How to construct Phylogenetic trees ? Amino acid sequence and phylogeny Molecular Clock. Molecular population Genetics Patterns of change in nucleotide and amino acid sequence	*12*
V	Quantifying genetic variability Genetic structures of natural population Phenotypic variation Emergence of non Darwinism- Neutral theory Genotype environment interaction Population Genetics and ecology Metapopulations Why small populations become extinct Conservation of genetic resources in diverse texa	*12*

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Dobzhansky, Th. Genetics and Origin of Species. Columbia University Press.
2. Dobzhansky, Th., F.J.Ayala, G.L.Stebbines and J.M.Valentine. Evolution. Surjeet Publication, Delhi.
3. Futuyama, D.J. Evolutionary Biology, Suinaer Associates, INC Publishers, Dunderland.
4. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates Inc., Massachusetts.
5. Jha, A.P. Genes and Evolution, John Publication, New Delhi.
6. King, M. Species Evolution - The role of chromosomal change. Cambridge University Press, Cambridge.
7. Merrel, D.J. Evolution and Genetics. Holt, Rinchart and Winston Inc.
8. Smith, J.M. Evolutionary Genetics. Oxford University Press, New York.
9. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston, London
10. A.P. Jha, Genes and Evolution, John Publication

E-Resources:

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=Vu+b7LQyc9e/jifd2gmpPA==

Principles of Genetics- https://onlinecourses.swayam2.ac.in/cec23_bt07/preview

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: III	Year: 2024-25	w.e.f. 2024-2025
1.	Course Code	MSCZOOLP301		
2.	Course Title	Lab course-I [General and Comparative Endocrinology of vertebrates & Quantitative Biology]		
3.	Course Type	**Practical**		
4.	Pre-requisite (if any)	As per university rule		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know the structure of endocrine system in vertebrates. • Understand histological peculiarities of endocrine glands • Know the function biosynthesis as well as metabolic activity of endocrine system. • Apply quantitative methods and statistical techniques in animal research: Students will learn to use mathematical models, statistical analysis, and computational tools to analyze experimental data. • Students will develop the ability to communicate quantitative biological concepts and research findings through written reports, oral presentations, and visual representations. using appropriate visual aids and clear, concise language.		
6.	**Credit Value**	**P-02**		
7.	**Total Marks**	**Marks: 100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Exercise	**Topics**	**Total Hours**
	General & Comparative endocrinology of vertebrates 1. Dissection of various endocrine glands of vertebrates (Fishes, Amphibians, Reptiles, Birds, Mammals, any available animals/ Virtual) 2. Dissection or various endocrine glands of insects (Cockroach/any other insect, any availableanimals/study through alternative methods of dissection virtual or methods any other method) 3. Study of microscopic slides of endocrine and related structures- T.S. pituitary, T.S. of Thyroid, T.S. of Parathyroid, T.S. of Adrenal, T.S. of Testes, T.S. of Ovary, T.S. Thymus, T.S. of Kidney, T.S. of Heart, T.S. of Stomach, T.S of Intestine	30

4. Effect of epinephrine on chromatophores of fishes
5. Biochemical estimation of cholesterol content in adrenal tissue, glycogen in uterine tissue
6. Microtomy-block preparation, section cutting, stretching and straining

Quantitative Biology

1. Collection methods of different types of data
2. Data analysis- tabulation
3. Different graphical and diagrammatic methods of data presentation
4. Calculation of central tendencies based on given data,
5. Application of parametric and non-parametric tests
6. ANOVA
7. Study of model types
8. Exercises based on regression
9. Exercise based on correlation

Distribution of marks in practical exam

Time : 06 Hours Max. Marks : 100

1. Dissection of Endocrine glands/Virtual. (10)
2. Spotting (Endocrine glands& Embryology). (16)
3. Microtomy (14)
4. Exercise based on biostatistics (Three) (30)
5. Viva (10)
6. Sessional (20)

Total = 100

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Dr. P.S. Verma, "A manual of practical zoology Chordates", S. Chand Publication.
2. Dr. K. Saravanan, Prof. M.P. Santhi, Dr. S. Elavarasi, Mr. R. Thangamani , "A manual of practical zoology: Chordata, Cell and Molecular Biology", Raja publication.
3. E. L. Jordan, Dr. P.S. Verma. " Revised and Enlarged edition CHORDATE ZOOLOGY", S. Chand publication.
4. S.S. Lal, "Practical zoology VERTEBRATE", Rastogi publication.
5. PranavBanarjee, Biostatistics , S. Chand publication

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: III	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	MSCZOOLP302		
2.	Course Title	Lab course-II [Immunology & developmental biology and population genetics & Evolution]		
3.	Course Type	**Practical**		
4.	Pre-requisite (if any)	As per university rule		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn to the internal anatomy and function of Primary and Secondary immune organs. • Learn to distinguish the difference between antigen and antibody. • Analyze the importance of immune system and understand how to develop monoclonal as well as polyclonal antibody. • Get new avenues of joining research in areas such as vaccines development, antibody development, organ transplant, etc. • To understand ABO Blood group system with Rh factor and evaluate that who can donate blood to whom. • Understand the diversity and evolutionary history of a taxon by comparing similarities and differences within a strata • Understand and analyze evolution through learning construction of a basic phylogenetic tree. • Analyze gene frequencies with hardy Weinberg law • Students will enhance their communication skills by develop collaborative skills by working in teams to conduct research or solve problems related to Immunology , developmental biology , population genetics & Evolution. • Learn new ideas and new techniques as well as can also create new ideas and new techniques in fields immunology and developmental biology.		
6.	**Credit Value**	**P-02**		
7.	**Total Marks**	**Marks: 100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Exercise	**Topics**	**Total Hours**
	Immunology and Developmental Biology 1. Dissection of primary and secondary immune organ from mice: a. Preparation of single suspension from bone marrow. b. Cell counting and viability testing of the spleenocytes prepared. 2. Preparation and study of phagocytosis by spleenic peritoneal macrophage. 3. Raising polyclonal antibody in mice, serum collection and	30

estimating antibody titre in serum by following method.
a. Ouchterlony (double diffusion) assay for antigen-antibody specificity and titre.
b. ELISA

4. Antibody purification from the serum collected from immunized mice, affinity purification chromatography.
5. Blood group testing A, B, O, AB & Rh factor.
6. Induced breeding in frog.
7. Culture of chick embryo in Vitro.
8. Study of chick embryos by vital staining.
9. The technique for the whole mount preparation of chick embryo.
10. Demonstration of cell death.
11. Study of meiosis:
    a. Techniques for chromosomes preparation.
    b. Preparation of meiotic chromosomes from Grasshopper testis.
    c. Auto radiography.

Population Genetics and Evolution

12. a. an experiment related to quantitative genetica, genotypic frequencies in light of hardy Weinberg law.
    b. ABO blood group data.
13. Numeric exercise related to-
    a. Natural selection
    b. Changing gene frequency
14. Chromosomal polymorphism

Distribution of Marks in Practical Exam

Time : 06 Hours Max. Mark : 100

1. Dissection showing primary and secondary immune organ of mice virtual / other method (10)
2. Exercise related to immune response (20)
3. Exercise related to developmental biology / Preparation of egg window and Blastodisc. (10)
4. Exercise related to Quantitative genetics / Hardy Weinberg law. (20)
5. Exercise related to natural selection (10)
6. Viva (10)
7. Sessional (20)

Total = 100

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Frank C. Hay, Olwyn M.R. Westwood, " Practical immunology".
2. SenthilkumarBalakrishan, KarthikKaliaperumal, SenbagamDuraisamy, " Practical immunology A Laboratory Manual"

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Part A: Introduction			
Program: M.Sc Zoology	Semester: IV	Year: 2024-25	w.e.f.: 2024.25

1.	Course Code	**MSCZOOLT401**
2.	Course Title	General Physiology & Neurophysiology (Compulsory)
3.	Course Type	**Theory**
4.	Pre-requisite (if any)	As per University rules
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the structure of brain and improved methods to study it. • Understand the structure of different lobes of the brain and their corresponding functions. • Understand intricacies of nerve impulse conduction. • Understand how cells, tissues, and organisms function at different levels. • Communicate effectively about Physiology through oral presentations, written reports, and scientific discussions, using appropriate terminology and evidence-based arguments. • They will also develop collaborative skills by working in teams to conduct research or solve problems related to Physiology • Develop an understanding of the related disciplines, such as physiology, neurophysiology, pharmacology, biochemistry etc.
6.	**Credit Value**	**3L+1T = 04**
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80** **Min Passing Marks:36**

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Central Nervous System Gross Anatomy of Brain & Spinal Cord-** Histological structure and Origin of Nervous tissue Neurons and Neurogalia& its function. The Meninges, Neurotrophins&Cerebro spinal Fluid (CSF) and its function. Physiological Properties of nerve fibres and mechanism of conduction of Nerve pules in Non-medullated and medullated Nerve fibre. Electrical activity of Brain (EEG) (Electic Encephalography) and its Physiological basis. Nerve endings (Bio-Analyzers)	12
II.	**The Cranial and spinal Nerves, Autonomic Nervous system:** Sympathetic and parasympathetic system with special comparison to hormonal mechanism of transmission through autonomic nerves system Reflex action and sensation. Sense organs- Eye & Physiology of Vision and Ear & mechanism of Hearting	12
III.	**Neuromuscular junctions, synapse and synaptic transmission-** Synaptic potential and synaptic integration [Electrical and Chemical Synaptic Potential], Excitatory Post Synaptic Potential (EPSP), Inhibitory Post Synaptic Potential (IPSP). Neurotransmitters–Different types– catecholamines, amino acidergic and peptidergic	12

	neurotransmitters and their biosynthesis. Physiological role and pharmacological significance of neurotransmitters. Agonist and antagonist for neurotransmitters: Acetylcholine, Dopamine, GABA and Glutamate, Neuropeptide (Endorphin and Enkephalin).	
IV.	**Feeding Mechanism and comparative Physiology of Digestion**- Various digestive juices, its composition, function and mechanism of secretion-Physiology of digestion for carbohydrate, Protein, fat & Nucleic acid and its absorption **Circulation of Body Fluid and its regulation**- Structure of Heart, Structure function, synthesis & composition of Blood & lymph. Blood group system. Blood Coagulation & De-fibrinisation. Cardiac cycle and pressure and volume changes in heart and blood vessels during Cardiac Cycle. Heart sound and ECG. **Respiratory system and Physiology of Respiration** - Structure of respiratory track. Breathing Physiology. Transport of Gases- Oxygen carriage; Carriage of Carbon di-oxide. Tissue Respiration . Respiratory diseases: Asphyxia, Hyperpnea, Anoxia etc.	12
V.	**Contractile elements and its Physiology**- Properties of Skeletal, Smooth & Cardiac Muscle. Structure of Muscle. Ultra & Molecular of Structure of Muscle. Structure of Sarcoplasmic reticulum & its role in Muscle Contraction. Physiology of muscle contraction- Changes during muscle contraction. Enzyme used in muscle contraction. **Pattern of Nitrogen Excretion and its Physiology-** Excretory Substance, Physiology of liver for excretion. Structure of kidney and its Excretory Physiology. Formation of Urine and Micturition. **Regulation of body temperature**- Pyraxia , Hypothermia.	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. The Brain : Our Nervous System by Seymour Simon, Collins Publication
2. Mass Action in the Nervous system by Walter J. Freeman, Elsevier Publisher
3. Human Anatomy and Physiology with Interactive physiology 10-system Suite, 8th Edition by Elaine N. Marieb and Katja N. Hoehn (jan 10, 2010)
4. Neuroanatomy by II. G. Snell, LippancottWilliums and Wilkins Publication
5. Clinical Neurophysiology- Guide for Auther- Slsevier
6. Foundations of cellular Neurophysiology (Bradford Books) Daniel Johnston
7. Medical physiology by Ganong, Saunders Publishers
8. Human Anatomy and Physiology by Tor Tora John Wiley and Sons
9. Human Physiology by G. C. Chatterji
10. DalelaVerma, Animal Physiology and Biochemistry
11. Goel and Shastry, Physiology,Rastogi Publication

E-Resources:

Neurophysiology-

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

General Physiology-

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==

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Part A: Introduction				
Program:M.Sc. Zoology		Semester: IV	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	MSCZOOLT402		
2.	Course Title	Biochemistry, Metabolic Regulation & Cell Function (Compulsory)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	As per University Rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know about the importance and scope of biochemistry. • Learn 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. • Understand the process of DNA replication, transcription and translation • Learn the preparation of models of peptides and nucleotides. • Analyze biomolecular components through biochemical tests for amino acids, carbohydrates, proteins and nucleic acids • Learn measurement of enzyme activity and its kinetics. • Communicate effectively about Biochemistry through oral presentations, written reports, and scientific discussions, using appropriate terminology and evidence-based arguments. • They will also develop collaborative skills by working in teams to conduct research or solve problems related to Biochemistry and Metabolic Regulation.		
6.	**Credit Value**	**3L +1T =04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Water the solvent of life**: Chemistry of water, Function and regulation of water balance **Minerals**-Macro &Micro Minerals **Lipids** - General Structure& Classification, Triglycerides, Phospholipids, Sphingolipids, Cholesterol, Biological Significance and function of Lipids, βoxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Metabolism of Glycerol, Ketogenesis	11
II.	**Carbohydrates**- General Structure of Monosaccharide: Nomenclature, Definition and Classification Formation of Monosaccharide – Formation of glucose: Linear form , Ring form, Hawarth perspective formate Occurrence, Chemistry, Properties & hydrolysis of Oligosaccharides (Sucrose, Lactose, Maltose, Cellobiose, Isomaltose&Trehalose)	13

	Structure of Polysaccharides (Starch, Glycogen, Cellulose, Hyaluronic acid, Chondroitin and Heparin) Metabolism of Carbohydrate	
III.	**Biosynthesis of Amino Acids and Structure & Properties**- Chemical bond – Peptide Bond, Secondary bond – Disulfide ,Hydrogen, Non polar or hydrophobic and Ionic or Electrostatics bond , Characteristic of Chemical bond Protein Configuration: Primary Structure (b) Secondary Structure (c) Tertiary Structure (d) Quaternary Structure Biological function and metabolism of Protein, Metabolism of Inorganic elements	12
IV.	**Nucleic Acid**- Chemistry of DNA & RNA, Nucleo Proteins, Metabolism of Nucleic Acid (Anabolism & Catabolism), Biological importance of Nucleic Acid **Eicosanoids** **Vitamin:** Water & Fat Soluble Vitamin, Chemistry, Occurrence and Physiological role of Vitamins	12
V.	**Enzymes-** Nomenclature and Classification, Co- enzyme, Isoenzyme or Isozyme& Lysozyme, Biological role of enzyme, Properties and Characteristics of enzyme, Three Dimensional Structure of enzyme, Enzyme Inhibitors and activators, Mechanism of enzyme action Biological Oxidation: Mitochondrial Electron Transport Chain, Oxidative Phosphorylation , Utilization of Krebs Cycle, Enzyme & Co – enzyme involved in oxidation & reduction	12

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Reference Books:

1. David L. Nelson, Michael M. Cox Lehninger Principles of Biochemistry, Fourth Edition Publisher : W. H. Freeman
2. Donald Voet, Biochemistry: Publisher : Wiley, 3rd Edition
3. Reginald H. Garrett, Charles M. Grisham Principles of Biochemistry with a Human Focus Publisher : Brooks Cole
4. Gray S. Stein (Editor), Renato Baserga, Antonio Giordano, David T. Denhardt, The Molecular Basis of Cell Cycle and Growth Control ,Publisher : Wiley- Liss
5. Harper"s Illustrated Biochemistry;McGraw Hill Publication
6. Fundamentals of Biochemistry, J L Jain , S. Chand Publication
7. Jain J.L. Biochemistry, S. Chand & Company
8. Gupta P.K., Cell and Moleular Biology, Rastogi Publication
9. Experiments in Biochemistry : A Hands – on ApproachShawn o. Farrell, T. Ranallo Publisher : Brooks Cole
10. Analysis of CD Effect on liver, Stomach and Intestine of Carp Fish by Hundet, A.
11. Histological and Histochemical staining techniques by Homason

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Part A: Introduction				
Program:M.Sc.		Semester:IV	Year: 2024-25	w.e.f..2024 - 25
1.	Course Code	MSCZOOLP401		
2.	Course Title	Lab Course I – General Physiology and Neurophysiology & Biochemistry, Metabolic Regulation and Cell Function		
3.	Course Type	Practical		
4.	Pre-requisite (ifany)	As Per University rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn to identify biomolecules by Chemical testing • Learn and practice Separation of molecules through Chromatography • Learn Quantitative analysis of Biomolecules • Learn and practice Haematologial exercises • Get new avenues of joining research in areas such as molecular separation, Enzymology, etc. • Understand principles of immunology through experiments • Students will enhance their communication skills & collaborative skills by working in teams to conduct research or solve problems related to Cytology.		
6.	**Credit Value**	**P-2**		
7.	**Total Marks**	**Marks: 100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Exercises	**Topics**	**Total Hours**
	Practical based on Paper I and Paper II as per Theory 1. Estimation of Protein by the Biuret, Lowry, Brad ford and Eosine-a comparasion 2. Determination of N-terminal Amino acids by the Sangers reagent (FDND) 3. Paper chromatographic separation of Amino acids 4. Quantitative estimation of Protein, carbohydrate, Mucosaccharide, Lipids and Enzyme (Bromphenol blue, PAS, Alcian blue, aldehyde fucsin, Acetylcholinestrase technique) 5. Identification of hypothalamic nuclei histological, hystochemical and Immunocytochemical method 6. Isolation and characterization of Pituitary cell 7. Estimation of MAC, MCH and MCHC 8. Total count of WBC and RBC 9. Differetial count of WBC 10. Haemoglobin estimation and PCV estimation or ESR estimation 11. Quantitative estimation of blood serum by Colorimetry (I) Blood Urea (II) Blood glucose (III) Blood Calcium (IV) Blood Creatine (V) Blood cholesterol (VI) Blood Protein (VII) Blood Albumin 12. Blood clotting time 13. ECG Recording	30

	14. Blood Pressure estimation 15. EEG	
	Distribution of marks in practical exam **Time: 06 Hours** **Max. Marks : 100** 1. Estimation of Protein (10) 2. Estimation of Carbohydrate, Mucosaccharides, Lipids and Enzymes (Two exercise) (20) 3. Exercise based on Histochemical and immune-cytochemical method (10) 4. Exercise based on Haematology (Two exercise) (20) 5. Exercise based on ECG/EEG (10) 6. Viva (10) 7. Sessional (20) Total = 100	

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. K. V. Chaitanya, "Cell and Molecular biology"a lab manual.
2. Farida Safadi-Chamberlain, "Cell Biology" Laboratory manual.
3. Dr. K. Saravanan, Prof. M.P. Santhi, Dr. S. Elavarasi, Mr. R. Thangamani , "A manual of practical zoology: Chordata, Cell and Molecular Biology", Raja publication.

E-Resources:

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Part A: Introduction				
Program:M.Sc Zoology		Semester: IV	Year: 2024-25	w.e.f.:2024-25
1.	Course Code	MSCZOOLT403		
2.	Course Title	Fish (Ichthyology) structure and function (Optional Group-I)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	As per University rule.		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the various organ systems of the fishes. • Understand physiology of fishes • Special adaptations in various ecological conditions in fishes. • Learn the evolution of fishes • Known about locomotory organ in fishes. • Learn about sexual cycle in fishes.		
6.	**Credit Value**	**3L +1T = 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	Origin and evolution of fishes, Classification of fishes as proposed by Berg, Fish integument, Locomotion, Aortic arches in fishes	12 Hours
II.	Accessary respiratory organs, Air bladder and its functions, Weberianossicles there, homologies and functions, Acoustic-lateral line system, Type of tales in fishes	12 Hours
III.	Luminous organs, Colouration in fishes, Sound producing organs, Deepsea adaptions, Hill stream adaptions	12 Hours
IV.	Migration in fishes, Sexual cycle and fecundity, Parental care in fishes, Early development and hatching, Poisonous fishes.	12 Hours

V.	Alimentary canal and digestion, Excretion and osmoregulation, Induced breeding, Cranial nerves in fishes, Larvivores fish	12 Hours

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

• Induced breeding

Suggested reading materials

- Zingron-Fish and fisheries in India
- Gavelander-Fish biology
- KarkLegler-Fresh water fisheries
- Nikolaski-Fish. biology
- Identification of fishes-Days fauna
- E.Khanna-Introduction to fish
- Parihar-Fish biology
- Norman-Introduction to fishes
- Mishra-Identification of fishes in India

E-Resources:

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

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Part A: Introduction				
Program:M.Sc Zoology		Semester: IV	Year: 2024-25	w.e.f..2024-25
1.	Course Code	MSCZOOLT404		
2.	Course Title	Applied Fisheries (Optional Group-I)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	As per University rule.		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • By learning this topic the students know about overviews of commercial fishing and sports fishing. • Useful to know the character of streams , riverine system in India and their fisheries. • By learning the students can easily identify the locomotion activities of the fishes. • Deals with different species of fish required different habit and food source for survival • Known about the disease and their cure in fish • Useful to know the costal and deep-sea fisheries		
6.	**Credit Value**	**3L+ 1T = 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	Colouration in fishes, Common diseases of fishes and their care, Economic importance and byproduct of fishes, Luminous organ, Drugs useful in induced breeding of fishes.	12 Hours
II.	Fresh water fishes of Chhattisgarh and their culture, Maintenance of nursery rearing and stocking Pond, Deep-sea fisheries, Coastal fisheries, Riverine and coldwater fisheries	12 Hours
III.	Reservoir fisheries, Lacustrine fisheries, Estuarine fisheries, Fish farming, composite fish culture, Types of ponds required for fish culture farms.	12 Hours
IV.	Cultivable fishes in India, Larvivorous fishes, Exotic and transplanted fishes, Planktons-it's role in pollution of water and fisheries, Role of fisheries in rural development, Sewage fed fisheries	12 Hours

V.	Fishing method in sea coast, Preparation and maintenance of aquarium. Impact of climate change in fisheries and aqua culture, Management practices on field of rural fish farmers, Method of fish preservation.	12 Hours

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

Reference Books:

1. JR. Norman - The History of fishes.
2. NagarajaRao - An introduction to fisheries.
3. Lagler Ichthyology.
4. Herclen Jones Fish migration.
5. Marshal The life of fishes.
6. Thomas - Diseases of fish.
7. Greenwood - Inter relationship of fishes.
8. Gopalji, Srivastava - Freshwater fishes of U.P. and Bihar.
9. Brown -Physiology of fishes Vol. I & II.
10. Hoar and Randall -Fish physiology of fishes Vol. 1 & IX.
11. Gunther Sterba C.N.H.-Freshwater fishes of the world
12. W. Lanharn - The Fishes.
13. G.V. Nikolsky -The ecology of Fishes,
14. Borgstram -Fish as food Vol. I & II.
15. Nilsson -Fish physiology -Recent Advances.
16. P.B. Myle and J.J. Cech Fishes An Introduction to Ichthyology.
17. Carl E. Bond -Biology of fishes.
18. M. Jobling -Environmental Biology of fishes.
19. Santosh Kumar &ManjuTernbhre -Fish and Fisheries.
20. S.K. Gupta -Fish and Fisheries
21. K.P. Vishwas -Fish and Fisheries.
22. Jhingaran -Fish and Fisheries.

E-Resources:

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

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7. Dr. Deshraj Singh, Professor Himachal Pradesh Vishwavidyalaya, Shimla	9418480248
8. Dr. V.K. Gupta, Retd. Professor C.M.D. PG College, Bilaspur	9424153429

Part A: Introduction			
Program:M.Sc Zoology	Semester: IV	Year: 2024-25	w.e.f.:2024-2025
• Course Code	MSCZOOLP402		
• Course Title	Lab Course II- Fish structure and Applied Fisheries Group I		
• Course Type	Practical		
• Pre-requisite (if any)	As per University rule.		
• Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • By learning this topic the students know about overviews of commercial fishing and sports fishing. • Learn the character of streams , riverine system in India and their fisheries. • By learning the students can easily identify the locomotion activities of the fishes. • Deals with different species of fish required different habit and food source for survival • Useful to know the costal and deep-sea fisheries • Students will enhance their communication skills by effectively conveying their understanding of Fish structure and Applied Fisheries through oral presentations, scientific writing, and discussions. • They will also develop collaborative skills by working in teams to conduct research or solve problems related to Zoology.		
• **Credit Value**	P-2		
• **Total Marks**	**100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
	1. **Anatomy of different systems of Fresh water Fishes through dissections** 2. **Osteology of Fishes** 3. **Microscopic Preparation** 4. **Taxonomic study of Fishes through Museum specimen and collection** 5. **Identification of Fresh water Fishes of Chhattisgarh up to species level** 6. **Field work/ Industry visit and preparation of Record**	30 Hours
	Distribution of marks in practical exam **Time : 06 Hours** **Max. Marks : 100** 1. Dissection of fresh water fish /Virtual. (10)	

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	2. Spotting (1 to 10).	(20)	
	3. Slide preparation.	(10)	
	4. Identification of fresh water fishes.	(20)	
	5. Project Report and field visit.	(10)	
	6. Viva.	(10)	
	7. Sessional.	(20)	
		Total : 100	

Part C - **Learning Resource**
Reference Books, E-Resources

Part C - **Learning Resource**
Text Books, Reference Books, E-Resources

Reference Books:

1. JR. Norman - The History of fishes.
2. NagarajaRao - An introduction to fisheries.
3. Lagler Ichthyology.
4. Herclen Jones Fish migration.
5. Marshal The life of fishes.
6. Thomas - Diseases of fish.
7. Greenwood - Inter relationship of fishes.
8. Gopalji, Srivastava - Freshwater fishes of U.P. and Bihar.
9. Brown -Physiology of fishes Vol. I & II.
10. Hoar and Randall -Fish physiology of fishes Vol. 1 & IX.
11. Gunther Sterba C.N.H.-Freshwater fishes of the world
12. W. Lanharn - The Fishes.
13. G.V. Nikolsky -The ecology of Fishes,
14. Borgstram -Fish as food Vol. I & II.
15. Nilsson -Fish physiology -Recent Advances.
16. P.B. Myle and J.J. Cech Fishes An Introduction to Ichthyology.
17. Carl E. Bond -Biology of fishes.
18. M. Jobling -Environmental Biology of fishes.
19. Santosh Kumar &ManjuTernbhre -Fish and Fisheries.
20. S.K. Gupta -Fish and Fisheries

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: IV	Year: 2024-25	w.e.f.:2024-2025
1.	Course Code	MSCZOOLT405		
2.	Course Title	CELL BIOLOGY (Optional Group-II)		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As per University rules.		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanism involved. • Acquire the detail knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer. • Develop an understanding how cells work in healthy and diseased states and to give a health 'forecast' by analyzing the genetic database and cell information. • Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development , human fertility programme, organ transplant, etc. • Students will enhance their communication skills by effectively conveying their understanding of Cell Biology through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to Cell Biology. • Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor.		
6.	**Credit Value**	**3L+ 1T= 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Molecular organization of eukaryotic chromosomes:** Structure of nucleosome particles and higher order compaction of mitotic chromosomes, chromatin re-modeling. **Specialized chromosomes:** Structural organization and functional significance of polytene chromosomes, Structural organization and functional significance of lamp brush chromosome, DNA methylation on specialized chromosomes	12
II.	**Structural organization of :** Eukaryotic genes, interrupted genes and overlapping genes and their evolution. **Gene families :**Organization, Evolution, Significance.Transposable genetic elements of Prokaryotes and Eukaryotes. Organization of eukaryotic transcriptional machinery: promoter, enhancer, transcription factors, polymerase, activators and repressors. DNA binding domain of transcription apparatus: zinc finger, steroid receptors, Homeodomains, helix loop helix, helix turn helix and Leucine Zipper.	12

III.	Eukaryotic transcription and Environmental control. Environmental modulation of gene activity: DNA rearrangement, Amplification during development, Molecular basis of : Thalassemia, Muscular dystrophy, Cystic fibrosis.	12
IV.	**Dictyostelium development:** Cell aggregation, Differentiation ***Caenorhabditiselegans* development:** Cell specification, Dorsal-Ventral axis specification and P-Granules, Right-Left axis specification,.Vulva formation	12
V.	**Drosophila development:** Cleavage, Gastrulation, Axis specification :Matternal effect genes, Anteriar-Posteriar axis development and Dorsal-ventral axis development, Pattern formation: Segmentation genes, Homeotic genes, Realisator genes. Basic ideas of mutation of maternal effect genes , segmentation genes & Homeotic genes and their significance.	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Robertis, De Roberties, Cell and molecular biology.
2. Watson, Baker, Bell, Gann, Levine, Losick : Molecular Biology of the Gene .
3. Bruce alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson : Molecular biology of the cell.
4. James D. Watson, Michael Gilman: Recombinant DNA.
5. Gerald Karp, Cell Biology.
6. Krebs, Goldstein, Kilpatrick :Lewin's GENE XII.
7. DrB.King, Modern view in Cell Biology.
8. Pollard, Earnshaw, Schwartz, Johanson , Cell Biology.
9. Hard, Jones : Genetics principles and analysis.
10. Punt, Stranford, Jones, Owen :Kuby Immunology.
11. Roitt, Brostoff, David male, David Roth :Immunology.
12. Gilbert, Barresi, Developmental Biology.
13. Nelson and Cox ,Lehninger Principles of Biochemistry.

E-Resources:

1. Molecular Cell Biology

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

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: IV	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	MSCZOOLT406		
2.	Course Title	Cellular and molecular organization (Optional Group-II)		
3.	Course Type	Theory		
4.	Pre-requisite (if any)	As per University rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Develop an understanding of concepts, mechanism and evolutionary significance and relevance of molecular biology in the current scenario. • Get well versed in recombinant DNA technology which holds application in biomedical and genomic science, agriculture, environment, 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. • Understanding the disease at genetic and molecular level and finding their cures. • Students will enhance their communication skills by effectively conveying their understanding of Cellular organization and Molecular Biology through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to Cellular organization and Molecular Biology. • Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.		
6.	**Credit Value**	**3L+ 1T= 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	**Viruses (Examples SV40 & HIV):** General organization and characters **Bacteria (E. coli):** Structure and chromosomal organization,Basic ideas of its applications as vectors for gene cloning, Regulation of gene activity in *lac* and *trp* operon, Basic ideas of Cell division, Biochemistry of Gram +ve and Gram-ve bacteria.	12
II.	**Yeast:** Structure, reproduction and chromosomal organization, Basic ideas of its applications as vectors for gene cloning. Molecular organization of respiratory chain assemblies in eukaryotes . Cell cycle, cell cycle control in **mammalian cells** and***Xenopus***. Cytochemistry of Golgian complex and its role in cell secretion.	12
III.	**Peroxisomes** and training of peroxysomal proteins.**Nucleolus:** Structure, biogenesis and function.**Lysosome:** Structure, biogenesis and function, intracellular digestion. Synthesis and targeting of **mitochondrial proteins.**Secretary pathway and translocation of secretory proteins across the **Endoplasmic Reticulum membrane.**	12

IV.	**Genome complexity:** C-value [paradox and cot value], DNA sequences of different complexity. **Difference between normal cells and cancer cells:** Biochemical changes, Cytoskeleton changes, Cell surface change. **Genetic basis of human cancer.**	12
V.	Chromosomal abnormalities in **human cancer,**General idea of **proto-oncogenes and oncogenes, Oncogenes and cancer,Transforming agents, Tumor suppressor genes.**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. E. D. P. De Roberties and E. M. F.DeRobertis , Cell and Molecular Biology , Lea and Febiger.
2. Watson, Hopkin, Roberts, Steitz, Weiner : Molecular biology of the gene : the Benjamin / Cummings Publishing company Inc.
3. Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson : Molecular Biology of the cell : Garland publishing inc.
4. P. K. Gupta : Molecular cell biology : Rastogi publication.
5. James D. Watson, Michael Gilman, Jan Witkowski, Mark Zoller : Recombinant D.N.A : scientific American book.
6. Gerald Karp: Cell Biology.
7. Benjamin Lewin : Genes VII
8. King, Barry : Cell Biology.
9. Baniel L. Hartl, Elizabeth W. Jones : Genetics Principles and analysis: Jones and Bartlett Publisher.
10. Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell: Molecular cell biology: W.H. Freeman and company.
11. Janeway-Travers: Immuno Biology: current biology limited.
12. Kubey : Immunology : W.H. Freeman and Company.
13. Snustad, Simmons : Principle of genetics : John Weley and sons Inc.

E-Resources:

1. Molecular cell biology

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

2. Cell Biology- https://onlinecourses.swayam2.ac.in/cec23_bt12/preview

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Part A: Introduction				
Program: M.Sc. Zoology		Semester:IV [Optional Group-II]	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	MSCZOOLP403		
2.	Course Title	Lab course II- Cell Biology & Cellular and Molecular Organization [Cytology] Group II		
3.	Course Type	**Practical**		
4.	Pre-requisite (if any)	As per university rule		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • To understand structure and function of different cell of vertebrate tissue. • To understand the use of contrast microscope and photomicrograph. • Identify of Giant chromosome, golgy body, mitochondria, Nucleus, DNA & RNA. • Learn to preparation temporary & permanent slides of cytology. • Application of Microbial culture for analysis of different mutants. • Get new avenues of joining research in areas such as molecular separation, Genomic study, Enzymology, etc. • Students will enhance their communication skills by develop collaborative skills by working in teams to conduct research or solve problems related toCytology. • Learn new ideas and new techniques as well as can also create new ideas and new techniques in fields of Cell biology and cellular organization and molecular organization.		
6.	**Credit Value**	**P-02**		
7.	**Total Marks**	**Marks: 100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Exercise	Topics	Total Hours
	1. **Examination of different cell types in vertebrate tissue.** 2. **Contrast Microscopy.** 3. **Photomicrography.** 4. **Study of permanent cytological preparation.** 5. **Squash preparation of chromosomes and preparing karyotype.** 6. **Preparation of giant chromosomes and demonstration of puffs.** 7. **Golgi material and Mitochondrial preparation.** 8. **Demonstration of Barr body and drum stick.** 9. **Histochemical demonstration of RNA, DNA phospholipid and enzyme.** 10. **Microbial culture media preparation and microbial growth.**	30

11. Molecular separation by chromatography and electrophoresis.

Distribution of marks in practical exam.

Time: 06 hours **Max. Marks : 100**

1. Spotting (1-10).	(20)
2. Exercise based on cytological preparation	(10)
3. Exercise based on Histochemical preparation.	(10)
4. Molecular separation by Chromatography and electrophoresis.	(20)
5. Exercise based on Microbiology / Karyotype study.	(10)
6. Viva.	(10)
7. Sessional.	(20)
Total : 100	

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. K. V. Chaitanya, "Cell and Molecular biology"a lab manual.
2. Farida Safadi-Chamberlain, "Cell Biology" Laboratory manual.
3. Dr. K. Saravanan, Prof. M.P. Santhi, Dr. S. Elavarasi, Mr. R. Thangamani , "A manual of practical zoology: Chordata, Cell and Molecular Biology", Raja publication.

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Part A: Introduction				
Program - M.Sc. Zoology		**Semester IV**	Year: 2024-25	w.e.f.: 2024-2025
1	Course Code	**MSCZOOLT407**		
2	Course Title	**Entomology : Morphology and Physiology of Insects (Optional Group- III)**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	As per university rules		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn general organization of insects. • Learn to identify various insect orders and their morphological characters. • Understand morphology and physiology of various organ systems. • Undertake research in any aspect of insect physiology in future. • Learn the development of insects thus integrating structure function and interplay of endocrine system. • Students will enhance their communication skills by effectively conveying their understanding of Morphology, Physiology and behavior of insect through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to entomology. • Develop skills, concepts and experience to understand all aspect of insect life.		
6	**Credit Value**	**3L+1T = 04**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Machadkar

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I	Cephalization and theories about cephalization Head capsule, types of antennae and types of mouth parts Thorax, legs in locomotion and functional modification of legs Integument- Sclerotization and moulting	12
II	Wing venation- General and in the orders- Lepidoptera, Diptera, Hymenoptera, Coleoptera and Hemiptera Digestive system and Physiology of digestion Respiratory structure and respiration Respiratory adaptation in aquatic and endoparasitic insects	12
III	Excretory organs, excretion and osmoregulation Circulation, Haemocytes and blood coagulation Nervous system- Principle modifications Internal and external organization of reproductive organs	12
IV	Photoreception, mechanoreception chemoreception Sound producing structure and functions Bioluminescence, Diapause	12
V	Endocrine control of reproduction, Metamorphoses and Diapause Development- Embryonic and Post embryonic Types of Larvae Types of Pupae	12

Part C- Learning Resource

Reference Books, E-Resources

Reference Books:

1. V.B. Wigglerworth, Springer, Insect Physiology :
2. F. Chapman, The Insect structure and function : RCambridge University Press
3. R.E. Snodross, Principles of Insect Morphology : Cbs Publisher
4. Fox and Fox, Introduction to Comparative Entomology : Von Nostrand Reinhold Inc. U.S
5. D.B. Tembhare, A Text book of Insect Morphology, Physiology & Endocrinology : S Chand
6. A.D. Imms Revised by Richards & Davies, Springer,
7. A General Text book of Entomology 1 volumes :
8. H.H. Ross, A Text book of Entomology :

E-Resources:

Applied Entomology- https://onlinecourses.swayam2.ac.in/cec23_bt06/preview
Applied and Economic Zoology- https://swayam.gov.in/explorer?searchText=zoology

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Part A: Introduction				
Program - M.Sc. Zoology		**Semester IV**	Year: 2024-25	w.e.f.: 2024-25
1	Course Code	**MSCZOOLT408**		
2	Course Title	**Entomology :Taxonomy, Economic Entomology and Pest Control (Optional Group- III)**		
3	Course Type	**Theory**		
4	Pre-requisite (if any)	As per University Rules		
5	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Develop an understanding of the characters used to classify besides being able to differentiate insects belonging to different order. • Understand the culture techniques and rearing of beneficial insects. • Learn the seasonal occurrence of insect pest on different crops especially regional crops. • Learn to analyse extend of damage and loses caused by insect pest on different crops. • Knowledge about the various types of infestation caused by insect pest on different crops. • Students will enhance their communication skills by effectively conveying their understanding of Applied entomology through oral presentations, scientific writing, and discussions. They will also develop collaborative skills by working in teams to conduct research or solve problems related to applied and economic entomology. • Recent advances in the field of chemical, biological and cultural control of insect pests with special reference to knowledge about integrated pest management.		
6	**Credit Value**	**3L+1T = 04**		
7	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I	History of Insect classification, Basis of classification Brief concept of all insect orders Characters and classification upto principal families of following orders- a. Thysanura b. Collembola c. Orthroptera d. Hemiptera e. Mallophaga f. Lepidoptera g. Diptera h. Hymenoptera & i. Coleoptera (Insect classification as per Essigs's College entomology)	12
II	Classification, life cycle, Control measures, and Economic Importance of the following- Important pests of Paddy Important pests of Sugarcane Important pests of Pulses in the field eg Gram, Pea, Arhar, Important pests of Vegetables- Bringel, Cabbage, Cauliflower,Lady finger and cucumber	12
III	Classification, Life cycle, economic importance and control measures of stored grain pests- namely: Sitophilousoruzae, Corcyrecephalonica, Tregedermagranarium, Triboliumcasfeneum, Callosobruchuschinensis, Stotrogacerellela Life cycle Bionomics, Damage potential and control measures of Aphids and its phases	12
IV	Phases of Locust- Schistocerca gregarine, Phase theory of locust Social life in Insects Parasitism in Insects	12
V	Pest Control Physical and cultural control Chemical control Biological control Integrated pest control	12

Part C - Learning Resource

Reference Books, E-Resources

Reference Books:

1. V.B. Wigglerworth ,Insect Physiology :, Springer
2. R.F. Chapman, The Insect structure and function :, Cambridge University Press
3. R.E. Snodross, Principles of Insect Morphology : Cbs Publisher
4. Fox and Fox ,Introduction to Comparative Entomology : Von Nostrand Reinhold Inc. U.S
5. D.B. Tembhare, A Text book of Insect Morphology, Physiology & Endocrinology : S Chand publication
6. A.D. Imms Revised by Richards & Davies, Springer, A General Text book of Entomology 2 volumes :
7. H.H. Ross , A Text book of Entomology :

E-Resources:

Applied Entomology- https://onlinecourses.swayam2.ac.in/cec23_bt06/preview
Applied and Economic Zoology- https://swayam.gov.in/explorer?searchText=zoology

अटलबिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

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7. Dr. Deshraj Singh, Professor Himachal Pradesh Vishwavidyalaya, Shimla	9418480248
8. Dr. V.K. Gupta, Retd. Professor C.M.D. PG College, Bilaspur	9424153429

Part A: Practical Introduction				
Program: M.Sc. Zoology		Class: **M.Sc. IV Sem**	Year: 2024-25	w.e.f.: 2024-25
1	Course Code	**MSCZOOLP404**		
2	Course Title	**Lab Course II- Optional Paper - Entomology GroupIII**		
3	Course Type	Practical		
4	Pre-requisite (if any)	As per university rules		
5	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn to identify local fauna and different types of beneficial and harmful insect. • Understand to use basic equipment used in entomological studies. • Learn field techniques used in studies of biodiversity of insect. • Get exposure to field study and collection of local insect fauna. • Learn various concept of culture techniques of beneficial insects. • Understand the relative position of individual organs and associated structures through model/alternative of dissection of the representative insect. • Learn the maintenance of laboratory, field, equipment/tools safety hazards and precaution.		
6	Credit Value	**P2**		
7	Total Marks	**Max. Marks: 100**	**Min Passing marks: 36**	

Part B:Lab Course 02		
Total No. of lecture (1hour/ week): 30		
Exercises	**Topics (Tentative List of the Lab Work is provided, the lab work may be changed by the department/ teacher concerned)**	**Total Hours**
	Practical (Special Paper – Group III Entomology) 1. Collection, Preservationand classification of the insects of order :- Thysaneura, Collembola, Orthoptera, Hemiptera, Lepidoptera, Mallophaga, Diptera, Hymenoptera and Coleoptera 2. Dissection of Grasshopper, Cockroach, Cricket, wasp, and honey bee, with special reference to their Nervous system, Salivary gland, Endocrine gland, Sting apparatus, of honey bee, reproductive organs of Grasshopper and cockroach. 3. Whole mounts of small insects eg. Collembola, Thysaneura, bedbug, louse, stored grain pests 4. Whole mount of different types of legs, antennae, wings, mouth	30

	parts, salivary glands and scales 5. Microtomy of Insect materials 6. Simple experiment on Insect Physiology 7. Identification of common insect pests 8. Collection of life cycle of the pest of any economic crop	
	Distribution of Marks in practical exam **Time : 06 Hours** — **Max, Marks :100** 1- Dissection of available insect pests/virtual (10) 2- Spotting 1-10 (20) 3- Micro preparation (10) 4- Experiment based on insect physiology (10) 5- Identification of common insect pets (10) 6- Project report and field visit (10) 7- Viva (10) 8- Sessional (20) **Total = 100**	
Keywords:		

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. SS lal, Practical zoology Invertebrates, Rastogi publication
2. PS Verma and PC Shrivastava, Practical zoology Invertebrates, S Chand publication
3. Anil Kulshreshth, Practical Zoology Shivlalagrawal and company
4. Dr. H N Baijal, Practical zoology Pioneer publication
5. PrashantKannoje, Practical zoology Navbodhprakashan
6. Dr. P S Verma , Manual of practical zoology Invertebrate S Chand publication

E-Resources:

Applied Entomology- https://onlinecourses.swayam2.ac.in/cec23_bt06/preview
Applied and Economic Zoology- https://swayam.gov.in/explorer?searchText=zoology

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: IV	Year: 2024-25	w.e.f. 2024-25
1.	Course Code	MSCZOOLT409		
2.	Course Title	Wildlife Conservation (Optional Group-IV)		
3.	Course Type	Theory		
4.	Pre-requisite (ifany)	As per University Rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Develop an understanding of how animals interact with each other and their natural environment • Develop the ability to use the fundamental principles of wildlife ecology to solve local, regional and national conservation and management issues • Learn about wild life of Chhattisgarh and India • Gain an appreciation for the modern scope of scientific inquiry in the field of wildlife conservation management • Develop an ability to analyze, present and interpret wildlife conservation management information		
6.	**Credit Value**	**3L+1T**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
I.	. **Wild life** – Values of wild life - positive and negative, Our conservation ethics Importance of conservation , Causes of depletion, World conservation strategies. **Population estimation** - Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation, Faecal analysis of ungulates and carnivores - Faecal samples, slide preparation, Hair identification, Pug marks and census method.	12
II.	**Habitat analysis, Evaluation and management of wild life-** Physical parameters - Topography, Geology, Soil and water, Biological Parameters - food, cover, forage, browse and cover estimation , Standard evaluation procedures - remote sensing and GIS. **Management of habitats** – Setting back succession, Grazing logging Mechanical treatment, Advancing the successional process, Cover construction Preservation of general genetic diversity	12
III.	**National Organization** - Indian board of wild life, Bombay Natural History Society, Voluntary organization involved in wild life conservation **Wild life Legislation - Wild Protection act - 1972, its amendments and implementation.**	12

	Management planning of wild life in protected areas. **Estimation of carrying capacity**	
IV.	**Concept of climax persistence.** **Ecology of protuberance.** **Management of excess population & translocation** **Bio- telemetry.** **Care of injured and diseased animal.** **Quarantine** **Common diseases of wild animal**	12
V.	**Eco tourism /wild life tourism in forests** **Protected areas National parks & sanctuaries, Community reserve** **Important features of protected areas in India.** **Tiger conservation - Tiger reserve in M.P & Chhattisgarh, in India.** **Management challenges in Tiger reserve.**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Gopal Rajesh : Fundamentals of wild life management, Natraj Publishers
2. Agrawal K.C : Wild life India, Nidhi Publishers
3. Dwivedi A.P (2008) : Management wild life in India,
4. Asthana D.K : Envionment problem and solution, S. Chand Publishing
5. Rodgers N.A &Panwar H.S : Planning of wild life / Protected area Network in India vol. the report, wild life Institute of India Dehradun
6. Odum E.P : Fundamentals of Ecology,Cengage Learning India
7. Saharia V.B : Wild life in India, Natraj Publisher
8. E.P Gee : Wild life of India, E.P.Dutton
9. Negi S.S : Wild life conservation, Natraj Publishers

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Part A: Introduction				
Program: M.Sc.Zoology		Semester: IV	Year: 2024-25	w.e.f.: 2024-25
1.	Course Code	MSCZOOLT410		
2.	Course Title	Environment and Biodiversity Conservation (Optional Group-IV)		
3.	Course Type	Theory		
4.	Pre-requisite (ifany)	As per University Rules		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Develop understanding for the environment which is largely degraded in the current scenario. • Understand the importance of bio diversity and the consequences of bio diversity loss • Learn about the judicious utilisation of natural resources • Follow the concept of green technology and the eco-friendly practises and other prospects of environment protection • understand and practice appropriate legal/regulatory and ethical issues in the context of the work environment. • design research projects to collect information to assess the effectiveness of current practices, and interpret the results of a statistical analysis of data, and use this to make informed decisions		
6.	Credit Value	3L+1T		
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Basic concept of Environmental Biology Scope and Environmental Science Biosphere and Biogeochemical cycles Environmental monitoring and impact assessment Environmental and sustainable development Water conservation, rain water harvesting, water shed management	12
II.	Cause, effects and remedial measure of Air pollution, Water pollution Noise. radioactive and thermal pollution Agriculture pollution Basic concepts of Bioaccumulation Solid waste management	12
III.	Global warming and disaster management Cause of global warming Impact of global warming – acid rains and ozone depletion, green house effect Control measures of global warming- Afforestation (b) reduction in the use of CFCS Disaster management -floods, earthquake, Cyclones landslidesEnvironmental legislation	12

IV.	**Natural Resources:-** **Forest** -Use and over exploitation of forests, Timber extraction **Land-** Land degradation, Landslides, Soil-erosion and desertification **Water-** Use and over utilization of surface and ground water, Floods, Drought dams- benefits and problems	12
V.	**Mineral** - Use and exploitation, Environmental effect of extracting and using mineral resources **Food** - World food problem, Effects of modern agriculture and overgrazing **Energy-**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Arora : Fundamentals of environmental biology, KalyaniPublibation
2. Anathakrishnan : Bio-resources ecology, CRC Press
3. Bottain : Environmental studies
4. Bouhey : Ecology of populations, Collier MacMillan Ltd
5. Clark : Elements of ecology, Sagwan Press
6. Dowdoswell : An introduction to animal ecology, Littlehampton Book Services Ltd
7. Goldman : Limnology
8. Kormondy : Concepts of ecology, Pearson Education
9. Odum : Ecology, Cangage Learning India
10. Pawlosuske : Physico-chemical methods for water
11. SouthWood's Ecological methods, OUP Oxford
12. Robert Wetzal : Limnology Lake and river Ecosystem, Elsevier

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Part A: Introduction				
Program:M.Sc.		Semester: IV	Year: 2024	w.e.f.2024-25
1.	Course Code	MSCZOOLP405		
2.	Course Title	Lab Course II-Optional Paper (Wildlife Conservation and Environment & Biodiversity conservation)		
3.	Course Type	Practical		
4.	Pre-requisite (ifany)	As Per University rules		
5.	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to: • Learn to identify local fauna especially Insects fishes, Birds, Reptiles Birds • Learn to use basic equipments used in Wildlife studies • Learn field techniques used in Biodiversity studies • Practice analysis of physico-chemical factors of Soil & water • Learn to recognize animal evidences in field study and collection of biodiversity data • Analyze biodiversity data of the particular area		
6.	Credit Value	P-2		
7.	Total Marks	Marks: 100	Min Passing Marks:36	

Part B: Content of the Course		
Exercises	**Topics**	**Total Hours**
	1. Identification of flora, mammalian fauna, avian fauna, herpeto-fauna. 2. Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses). 3. Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc. 4. Demonstration of different field techniques for flora and fauna. 5. Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences). 6. Visit to an area to document environmental assets including natural resources/flora/fauna, etc. 7. Identification and study of common insects, fish, birds, mammals of a particular area. 8. To determine the physical conditions of water: Depth, Viscosity, Density, Buoyancy. 9. To determine the chemical conditions of water: pH, dissolved oxygen and carbon-dioxide, hardness etc. 10. To determine Cl, SO4, NO3 in soil and water samples from different locations. 11. To study acidity and alkalinity of sample water by methyl orange and phenolphthalein 12. Visit to a local pollution site (Urban /Rural /Industrial	30

	/Agricultural).	
	Distribution of marks in practical exam **Time: 06 hours** **Max. Marks : 100** 1. Exercise based on wild life conservation. (35) 2. Exercise based on environment and biodiversity conservation (35) 3. Viva (10) 4. Sessional (20) Total = 100	

Part C - **Learning Resource**

Text Books, Reference Books, E-Resources

Text Books:

Reference Books:

1. Gopal Rajesh : Fundamentals of wild life management, Natraj Publishers
2. Agrawal K.C : Wild life India, Nidhi Publishers
3. Pawlosuske : Physico-chemical methods for water
4. SouthWood's Ecological methods, OUP Oxford

E-Resources:

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