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. 2023-2024

(As approved by AC and EC meetings held on 16.08.2023 and 18.04.2023 respectively)

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

Semester	Course Code	Subject Name	Credit			Total Credit	Marks			
							ESE	IA	Total	
			L	P	T				Max	Min
First	MSCZOOLT101	Structure and Function of Invertebrate & Minor phyla	3	-	1	4	80	20	100	36
	MSCZOOLT102	Animal Behaviour	3	-	1	4	80	20	100	36
	MSCZOOLT103	Biosystematics, taxonomy and diversity	3	-	1	4	80	20	100	36
	MSCZOOLT104	Ecology & Environmental Physiology	3	-	1	4	80	20	100	36
	MSCZOOLP101	Lab Course-I	-	2	-	2	100	-	100	36
	MSCZOOLP102	Lab Course-II	-	2	-	2	100	-	100	36
Subtotal			**12**	**4**	**4**	**20**	**-**	**-**	**600**	
Second	MSCZOOLT201	Comparative Anatomy of Vertebrates	3	-	1	4	80	20	100	36
	MSCZOOLT202	Gamete Biology and Reproductive Physiology in Human Being	3	-	1	4	80	20	100	36
	MSCZOOLT203	Molecular Cell Biology	3	-	1	4	80	20	100	36
	MSCZOOLT204	Tools and Techniques for Biology	3	-	1	4	80	20	100	36
	MSCZOOLP201	Lab Course-I	-	2	-	2	100	-	100	36
	MSCZOOLP202	Lab Course-II	-	2	-	2	100	-	100	36
Subtotal			**12**	**4**	**4**	**20**	**-**	**-**	**600**	

M Sc Zoology
Programme Specific Outcome (PSO)

- Providing students with a comprehensive understanding of zoology starting from the fundamental biochemical, molecular, and cellular level, Extending to the study of physiology and reproduction at a organism level, and impact of ecological factors on animals across various levels of organization (individuals, populations, communities, ecosystems, etc.).
- Understand biological diversity, particularly in the animal kingdom. Understand the different forms of animals, both invertebrates and vertebrates, and how they are classified systematically. Learn Comparative structural studies emphasising comparing anatomical features and identifying patterns of evolutionary relationships.
- Learn and appreciate the processes and forces that drive evolutionary changes over the time, understand mechanisms of evolution, such as natural selection, genetic drift, and speciation.
- Understand concepts of physiology, molecular biology, endocrinology, cell biology, and ecology.
- Learn importance of developing practical skills in molecular biology, techniques which involve separation identification and estimation of biological molecules.
- Emphasizes the need to gain proficiency in biostatistics, which is essential for analyzing and interpreting biological data.
- In optional group I Students will understand fish biology and taxonomy. It focuses on introducing students to the fundamental principles and concepts of fisheries science and aquaculture, Students will learn about different aquaculture systems, species selection, and sustainable aquaculture practices.
- In the optional group II student will understand the fundamental principles of cell biology, including the structure, function, and organization of cells. Explore cell signalling and communication, focuses on the metabolic pathways within cells. Students will explore the regulation of cellular energy production and utilization.
- In the optional group III we aims to introduce students to the study of insects, their taxonomy, morphology, physiology, behaviour, and ecology and focuses on the practical applications of entomological knowledge in agriculture, forestry, public health, and other relevant fields. Students will explore how entomological principles can be utilized to address real-world challenges and improve human welfare.
- In the optional group IV students will understand the ecology, behavior, and natural history of wildlife species. Students will learn about the interactions between wildlife and their environment focuses on introducing students to the fundamental principles and concepts of wildlife conservation, learning the techniques and methods used to assess wildlife populations and monitor their status over the time.
- Overall, these PSOs provide a comprehensive roadmap for students in the post graduate programme in Zoology, ensuring that they acquire knowledge and skills in various aspects of zoology.

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Part A: Introduction				
Program: M.Sc. (Zoology)		Semester: I	Year: 2023-2024	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT101**		
2.	Course Title	**Structure and Function of Invertebrates & Minor Phyla**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Passed B.Sc. Biology		
5.	Course Learning. Outcomes (CLO)	Learning Outcome: Upon completing the course on invertebrates and their structure and function, students will be able to: • Identify and classify major invertebrate groups based on their structural characteristics and evolutionary relationships. • Understand the diverse adaptations and specialized structures exhibited by different invertebrates for locomotion, feeding, reproduction, and defense. • Describe the functional anatomy of various invertebrate systems, including the nervous system, digestive system, circulatory system, respiratory system, and reproductive system. • Explain the physiological processes and mechanisms unique to invertebrates, such as molting, metamorphosis, and regeneration. • Recognize and discuss the impact of human activities on invertebrate populations and ecosystems, and explore strategies for conservation and sustainable management. • Communicate effectively about invertebrate structure and function through oral presentations, written reports, and scientific discussions, using appropriate terminology and evidence-based arguments. • Develop a deeper appreciation for the diversity, complexity, and ecological significance of invertebrates, fostering a broader understanding of biodiversity and the natural world.		
6.	**Credit Value**	**3L+ 1T= 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content oftheCourse		
Unit	**Topics**	**Total Hours**
I.	**Classification of invertebrate phyla up to orders with example** – Protozoa, Porifera, Coelenterate, Platyhelminths, Nemathelminthis, Annelida, Arthropoda, Mollusca, Echinodermata, Relationship – Acoelomate and coelomate, Protostomes and Deuterostomes, Bilateria and Radiate, Metamerism in Annelida	12
II.	**Canal system in sponge (porifera).** **Polymorphism in Coelendrata** **Coral reef and their formation** **Locomotion-** Amoeboid movement, Ultrastructure of cilia, Flagella and their movements, Myonemes and muscle fibres in invertebrates - structures and their movements, Hydrostatic movements in Coelenterate, Annelida and Echinodermata, Torsion in Gastropoda	12
III.	**Nutrition and Digestion-** Patterns of feeding in lower metazoan, Filter feeding in Polychaeta, Mollusca and Echinodermata, Modification of mouth parts in Insects (Cockroach, Mosquito, Housefly, Honey bee) **Respiration-** Respiratory organs – Gills, Trachea, Lung structure and their mechanism, Physiology of Respiratory Pigments.	12
IV.	**Excretion-**Excretion in lower invertebrates – simple diffusion, contractile vacuole, protonephridia, solenocytes, Excretion in higher invertebrates – Coelom, Coelomoduct, Nephridia, Coxal gland, Malpighian tubules, Organ of Bojanus and Green gland and their mechanism. **Nervous System-** Primitive Nervous System (Coelenterate, Echinodermata), Advanced Nervous System (Annelida, Arthropoda, Mollusca),	12
V.	**Invertebrate larval form-** Larval form of Trematoda and Cestoda, Larval form of Crustacea, Larval form of Echinodermata **Minor Phyla-** Organization and general characteristics of - Ctenophora, Rotifera, Branehipoda, Acanthocephala, Onychophora	12

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

Reference Books:

1. E. J. W. Barrington , Invertebrate structure and function, English Language Book Society UK
2. Robert Barnes, Invertebrate Zoology, Robert BarnesIVth edition Holt Saunders International Edition Japan
3. S. F. Harmer, A. E. Shipley, The Cambridge Natural History Vol 1 -9 , Todays and Tomorrows Book Agency, New Delhi INDIA
4. Park Haswell, Marshall and Williams, A textbook on Zoology Invertebrate, AITBSPublishing and Distributers, Delhi
5. Libbic Henrietta Hyman, The Invertebrates Vol 1 -9 , McGraw Hill Book Company
6. Prof R. L. Kotpal, Protozoa to Echinodermata, Rastogi Publication Meerut
7. E.L. Jordan, Dr. P. S. Verma,Invertebrate Zoology , S. Chand Publications, New Delhi
8. N. Arumugam, N. C. Nair S. - Invertebrate Zoology, Saras Publication.
9. Barrington E. J. W., Invertebrate Structure and Function, Nelson London
10. Barnes, R.D., Invertebrate Zoology –Saunders Philadelphia
11. R. L. Kotpal, Invertebrate, Rastogi Publications
12. H. S. Bhampah, KavitaJuneja, Recent trends in vertebrates vol 1 – 9, Anmol Publication
13. S. N. Prasad, Life of invertebrates, Vikash Publication House Pvt Ltd New Delhi
14. G. S. Sandhu, HarshwardhanBhagskar – Advanced invertebrate zoology –Campus books international
15. G. S. Sandhu, HarshwardhanBhagskar – An Introduction to Arthropoda, Campus books international

E – resources

https://www.coursera.org/lecture/emergence-of-life/4-5-invertebrates-successes-of-life-without-a-backbone-WQHqS

https://www.classcentral.com/course/youtube-echinoderms-crinoids-starfish-sand-dollars-more-invertebrate-paleontology-geo-girl-137418

https://www.shiksha.com/online-courses/introduction-to-biology-biodiversity-course-courl5385

https://www.shortcoursesportal.com/studies/297722/invertebrate-zoology.html

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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. AnjuTiwari, Professor Govt. Bilasa Girls PG College, Bilaspur	9424140171
4. Shri Krishan Kumar Chaudhary, Asstt. Professor Govt. GramyaBharti 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: I	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT102**		
2.	Course Title	**ANIMAL BEHAVIOUR**		
3.	Course Type	**Theory**		
4.	Pre-requisite (ifany)	Passed BSc Biology		
5.	Course Learning. Outcomes (CLO)	Learning Outcome: Upon completing the animal behavior course, students will be able to: • Understand the fundamental concepts and principles of animal behavior, • Demonstrate knowledge of different types of animal behavior, such as innate behaviors, learned behaviors, and social behaviors. • Analyze and interpret the factors that influence animal behavior, including genetics, environment, and social interactions. • Evaluate and discuss the role of animal behavior in evolutionary processes, ecological interactions, and conservation efforts. • Identify and explain the key theories and models in animal behavior, including foraging behavior, mating systems, and communication strategies. • Recognize and describe the diversity of animal behaviors across different taxa, highlighting examples of cooperation, aggression, territoriality, and reproductive strategies. • Demonstrate critical thinking and problem-solving skills by analyzing complex animal behavioral patterns • Communicate effectively about animal behavior through oral presentations, written reports, and scientific discussions, using appropriate terminology and evidence-based arguments. • Develop a greater appreciation for the complexity and diversity of animal behavior, fostering empathy and ethical considerations in human-animal interactions and animal welfare.		
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**

As approved by academic council and executive council meetings

I.	**Introduction-**Introduction to Ethology, History of Ethology, Observation and Description, Ethology as a branch and its significance, Methods of studying behaviour **Stereotypes behavior-**Taxes, Reflexes, Instinctive behaviour, Motivation **Learning and memory-**Imprinting, Habituation, Classical conditioning, Insight learning, Reasoning and memory	12
II.	**Ecological aspects of behavior-**Food selection and feeding behaviour, Anti-predator defense, Aggression, Territoriality, Innate Behaviour **Biological Rhythms-** Circadian and circannual rhythms, Homing behaviour, Migration of bird, Migration of fish, Coloranim (Mimicry)	12
III.	**Perception of environment -**Mechanical, Electrical, Olfactory, Auditory, Visual **Communication-** Chemical, Visual, Light, Audio, Species specificity of songs, Evolution of languages	12
IV.	**Social behavior-Aggregation:**Schooling in fishes, Flocking in birds, Herdiry in Animal, **Group selection**: Kin selection, Altuarism, **Social organization:** Social organization in insect, social organization in Primates	12
V.	**Reproductive behavior-**Reproductive strategies, Mating system, Courtship, Sexual selection, The nervous system and behaviour (neuroethology), Neural control of behaviour, Human brain and behaviour, Hormonal control of behaviours	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Alcock. J Animal Behaviour: An evolutionary approach. SinauerAsoc. Sunderland, Mass, USA
2. Bradbury, J.W. and Vehrencamp S.L, Principles of animal communication, Sinauer-Assoc. Sunderland, Mass, USA
3. Clutton-Brock, T.H. The evolution of Parental CarePrincetonUniversity.Press Princeton NJ, USA
4. Eibl-Eibesfeldt, 1. Ethology. The biology of behaviour. Holt, RinehartWinston, New York
5. Goud, J.L The mechanisms and evolution of behaviour
6. Hauser, M. he evolution of communication, MIT press, Cambridge, Mass,USA
7. Hinde, R. A Animal Behaviour. The synthesis of Ethology and Comparative psychologyMcGraw Hill,New York
8. Krebs, J.R. and N.B. Davier: Behavioural Ecology. Blackwell, Oxford, UK
9. Wilson, E.O Sociobiology: The new synthesis Harvard University Press, Cambridge

10. P. R. Yadav, Text Book of Animal Behaviour , Campus Book
11. H. V. Bhaskar, Animal Behaviour, Campus Book
12. Reena Mathur, Animal Behaviour , Rastogi Publications
13. M. P. Arora, Animal Behaviour , Rastogi Publications

E – resources:

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

https://www.classcentral.com/course/animalbehav-485

https://www.coursera.org/learn/animal-welfare

https://www.sciencelearn.org.nz/topics/animal-behaviour

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Part A: Introduction				
Program: M Sc Zoology		Semester: I	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT103**		
2.	Course Title	**Biosystematics, Taxonomy& Biodiversity**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Passed B.Sc. Bio		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know History of Systematics • Understand basic principles of Systemaics and Taxonomy • Practice taxonomic procedures while working in the field • Know Local Biodiversity • Develop an ability to analyze, present and interpret Biodiversity at Local, Regional, National & Global levels • Communicate effectively about Biosystematics & Biodiversity 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 Taxonomy • Evaluate biodiversity of a region using indices and create inventories		
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.	**Definition and basic concepts of biosystematics and taxonomy,** Historical resume of systematic, Importance and applications of biosystematics in biology **Trends in biosystematics concepts of different conventional and newer aspects** Chemotaxonomy, Cytotaxonomy, Molecular taxonomy	11
II.	**Dimensions of speciation and taxonomic characters,** Mechanisms of speciation in panmictic and apomictic species, Species concepts and species category, Theories of biological classification, Taxonomic characters and different kinds	11
III.	**Procedure keys in taxonomy,** Taxonomic procedures-taxonomic collections, preservation, curetting, Taxonomic keys-different kinds of taxonomic keys, their merits and demerits, Process of typification and different Zoological types, International code of Zoological Nomenclature (ICZN)	12

IV.	**Biodiversity,** Types of Biodiversity, Hot spots of Biodiversity in general and Hot spots of Biodiversity in India, Threats to Biodiversity, Conservation of Biodiversity	12
V.	**Current status of Biodiversity in India,** National Park and Sanctuaries of Chhattisgarh, **Evaluation of biodiversity indices,** Evaluation of Shannon Weiner Index. , Evaluation of Dominance Index. , Similarity and Dissimilarity Index.	14

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

- Principle of Animal Taxonomy G.G. Simpson, Oxford & IBH Publishing Co
- Elements of Taxonomy Earnst Mayer
- Biodiversity E.O. Vilson, Acadmic Press Washington
- The Biology of Biodiversity M. Kato, Springer
- Molecular Markers - Natural History & Evolution J.C. Avise
- Biosystematics & Taxonomy Dr.R.C.Tripathi, University Book House JAIPUR
- Theory & Practice of Animal Taxonomy V.C. Kapoor, 5th Edition Oxford & IBH Publishing Co.
- Prabodh K. Maiti and PaulamiMaiti, Biodiversity: Principles, Peril, Preservation, PHI Publishing
- Kapoor V.C., Taxonomy
- Krishnmurthi KV, An Advance Text book on Biodiversity, Oxford IBH Publishing Co Pvt Ltd

E-Resources:

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=0Xvq9yUM2ILDrJ07FvlArQ==

https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=0Xvq9yUM2ILDrJ07FvlArQ==

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: I	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT104**		
2.	Course Title	**Ecology and Environmental Physiology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Passed BSc Biology		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Know the physical factors affecting ecology • Understand the functional basis of animal ecology. • Understand the physiological adaptation in different environment. • Know the basic principles of population ecology, • Analyse a biological &Physiological problems in diverse ecological conditions. • Communicate effectively about Ecology & Environmental 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 Ecology. • Understand & solve the environmental problems involving interaction of humans and natural systems at local or global level.		
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.	**Ecology**-Abiotic, Climatic, Edaphic and Biotic Factors, Limiting Factors, Biogeochemical cycle-Nitrogen, Phosphorous, Sulphur, Carbon and Water Cycle, Community Ecology-Biotic community, community structure and its characteristics, Ecotone and Edge effects, Ecological Succession **Adaptation**- Levels of adaptation, Types of adaptation, Significance of body size,	12
II.	**Physiological adaptation to different Environment-** a)Marine b)Freshwater c)Terrestrial d)Extreme aquatic e) extreme terrestrial f) Parasitic	12
III.	**Population Ecology: Population Growth-** Exponential growth, Logistic growth model, Stochastic and time lag model of population growth; **Demography-** Life table, Net reproductive rate, Reproductive value **Population regulation,** Extrinsic mechanism, Intrinsic mechanism, **Models of pray-predator dynamics**	12
IV.	**Pollution Ecology-** Definition and types of pollution, Bioindicator of pollution Environment and impact assessment, **Environmental toxicology**-Toxic chemicals, Toxicity, toxicants and mechanisms of action; **Environmental Issues-** Green House gases, Ozone Depletion , Environmental awareness programmes	12

V.	**Stress Physiology-** Basic concept of stress and strain , stress resistance, stress tolerance and stress avoidance, Adaptation-acclimatization and acclimation, Concept of homeostasis, Endothermy and Physiological mechanisms of regulation of body temperature, Osmoregulation in aqueous and terrestrial environment, Physiological response to Oxygen deficient stress, Physiological response to body exercise, Meditation, yoga and their effects	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Eckert, r Animal Physiology : Mechanism and adaptation, W.H. freeman & co, NY
2. Willmer, Grahum Stone Blackwell: Environmental Physiology, Sci Oxford
3. Hochanchka, P.W. and Somero, G.N:Biochemical Adaptation, Princeton NJ
4. Hoar, W.S General and comparative animal physiology, Prentice hall of India
5. Schiemdt Nielsen, animal Physiology : adaptation and environment, Cambridge
6. Strand, F.L Physiology: Regulatory systems approach, Macmillan Pub Co,NY
7. Pummer,L. Practical Biochemistry, Tata McGraw Hill
8. Prosser, C.L. Environmental and metabolic animal physiology, Willey-Liss Inc. NY
9. Townsend, C.R. and P. Calow : Physiology Ecology : an evolutionary approach to resource use, Blackwell Sci. Publ.Oxford, UK
10. Alexander, R.M.N., Optima for animals Princeton Univ press, Princeton NJ
11. Chapman,J.L. & Reiss M.J., Ecology: Principles and application, Cambridge University Press
12. Edward J. Kormondy,Concepts of Ecology, Pearson Education
13. Aulay Mackenzie, Andy S. Ball and Sonia R. Virdee, Ecology , Viva Publication
14. P.D. Sharma ,Ecology and Environment, Rastogi Publication
15. R.L.Kotpal& Bali, Concept of Ecology Vishal Publishing
16. S.C. Rastogi, Essentials of Animal Physiology, New Age International Publisher

E-Resources:

1. **Ecology-**

   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=0Xvq9yUM2ILDrJ07FvlArQ==
2. **Population Ecology -**

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

   https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=0Xvq9yUM2ILDrJ07FvlArQ==
4. Ecology and Environmental ethics: Problems and Perspectives-

   https://onlinecourses.swayam2.ac.in/cec23_hs04/preview
5. Complex Ecosystem Dynamics-

   https://onlinecourses.swayam2.ac.in/cec22_hs31/preview

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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. GramyaBharti 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: I	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLP101**		
2.	Course Title	**LAB-COURSE** I-Invertebrates and Animal Behaviour		
3.	Course Type	**Practical**		
4.	Pre-requisite (if any)	As Per University rules		
5.	Course Learning. Outcomes (CLO)	Course Learning Outcomes for "Invertebrates and Animal Behaviour": 1. Identify and classify various groups of invertebrates, understanding their key characteristics and anatomical features. 2. Apply proper methods of mounting and preserving invertebrate specimens for scientific study and display. 3. Analyze and interpret the behavior patterns, communication mechanisms, and social interactions of invertebrates. 4. Investigate the impact of environmental factors on invertebrate behavior through experimental design and data collection. 5. Communicate scientific findings effectively, using appropriate terminology and visual aids to convey information clearly and concisely.		
6.	**Credit Value**	**P-2**		
7.	**Total Marks**	**External Marks: 100**	**Min Passing Marks:36**	

Part B: Content ofthe Course		
Exercises	**Topics**	**Total Hours**
	Invertebrates Study of non-chordates through museum specimen Study of permanent slides of non-chordates Dissection of representative types (invertebrates) (any available animal)/ study through alternative methods of dissection or model any other method virtual/demonstration Squilla, Mytilus, Sepia, Aplysia, Echinus Mounting Permanent and suitable stained micro- preparation Earthworm-nerve ring, ovary, spermatheca, nephridia Cockroach-mouthparts , salivary glands, trachea Prawn appendages, statocyst Protozoan- Rhizopods, Flagellates and Ciliates (fresh water forms) Porifera- spiculesand gemrnules of fresh water sponges Crustaceans and Rotifers Larval forms of the free living invertebrates **Animal Behaviour.** Experimentsrelated to Animal Behaviour Feeding behaviour in house fly	30

Life cycle of Lac insect and honey bee (chart model/material)
Study of structural organization of the bee hive
Learning behavior
Conditioned and unconditioned reflex
Projects

a) Visit to study the management of following
Fish farm, dairy farm, poultry farm, sericulture and apiculture

b) Study of invertebrate local fauna
c) Any other relevant topic

Student should prepare a report and submit

Note-

1- Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act

External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or culturable species without paining them

Distribution of marks in practical exam

Time-08 Hours Max. Mark100

1.	**Spotting (1-10)-invertebrates**	**(20)**
2.	**Mounting**	**(10)**
3.	**Dissection(Virtual)**	**(10)**
4.	**Exercise based on behaviour (Two Exercises)**	**(30)**
5.	**Viva**	**(10)**
6.	**Sessional**	**(20)**
	Total =	**100**

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: I	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLP 102**		
2.	Course Title	**LAB-COURSE-II** - Biosystematics, Taxonomy & Biodiversity and, Ecology and Environmental Physiology		
3.	Course Type	**Practical**		
4.	Pre-requisite (if any)	Passed BSc (Bio)		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn and apply knowledge of Systematics and taxonomy to identify and arrange animals in definite strata. • To understand the real meaning of biodiversity and create the new ideas for its conservation. • Analyze and interpret ecological data: Students will learn to collect and analyze ecological data, including field observations, experimental data. • Students will study how organisms respond physiologically to environmental challenges, such as temperature changes, pollutants, and habitat alterations. • They will learn experimental techniques to measure physiological parameters, analyze physiological data, and assess the adaptive strategies employed by organisms to cope with environmental stressors. • Students will enhance their communication skills by develop collaborative skills by working in teams to conduct research or solve problems related to Biosystematics, Taxonomy, and Biodiversity & ecology.		
6.	**Credit Value**	**P-2**		
7.	**Total Marks**	**Maximum Marks: 100**	**Min Passing Marks:36**	

Part B: Content ofthe Course		
Exercises	**Topics**	**Total Hours**
	Biosystematics, taxonomy & Biodiversity 1. Study of animal diversity by field trip and excursion, extension activity to spread health awareness. Students have to submit project report. 2. Study of biodiversity among various invertebrates and vertebrates (Listing of all the animals found in and around your house and also try to find out their Zoological names). 3. Collection of various insect species. 4. Visits to a local animal park or zoo to identify and study the captive fauna and preparation of report. 5. Study of adaptive characteristics of various invertebrates and vertebrates in different climate. 6. Taxonomic key formation and conversion.	30

	7. Study of biodiversity in grassland and pond water by using Shannon-Wiener index. **Ecology and Environmental Physiology** 1- Study of animals showing -adaptation, to, different environments 2- Soil analysis physical and chemical, composition of soil 3- Effect of physical exercise on blood Pressure 4- Exercise based on blood glucose level 5- Carbonates and nitrates from soil sample 6- Determination of free CO2 and salinity in pond	
	Distribution of marks in practical exam **Time-06 Hours Max.** **Marks-100** **1. Exercise related to Taxonomy (Three) (30)** **2. Exercise based on Soil & Water analysis (Two) (20)** **3. Exercise based on Physiology (Two) (20)** **4. Viva (10)** 5. **Sessional (20)** **Total = 100**	

Part C - **Learning Resource**
Reference Books, E-Resources
Reference Books: 1. VC Kapoor, "Theory and Practice of Animal Taxonomy and Biodiversity", Oxford & IBH Publishing company Pvt. Limited. 2. Ernst Mayr, Principles of Systematic Zoology, McGraw-Hill INC.,US. 3. P.D. Sharma, Ecology , S. Chand publication.

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: II	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT201**		
2.	Course Title	**COMPARATIVE ANATOMY OF VERTEBRATES**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	As Per University Rules		
5.	Course Learning. Outcomes (CLO)	Course Learning Outcome for "Vertebrates and Their Structure and Function": • Knowledge of Vertebrate Classification: Students will demonstrate a comprehensive understanding of the classification of vertebrates • Understanding of Vertebrate Anatomy: Students will acquire a detailed knowledge of vertebrate anatomy. They will be able to compare and contrast the anatomical features across different vertebrate groups. • They will be able to analyze the evolutionary trends and adaptations in vertebrate structures and functions. • Students will be able to integrate their knowledge of vertebrate structure, function, evolution, • Students will develop scientific inquiry skills and critical thinking abilities necessary for studying vertebrates. • Students will enhance their communication skills by effectively conveying their understanding of vertebrate structure and function 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 vertebrate biology. • Lifelong Learning and Professional Development: Students will appreciate the importance of lifelong learning in the field of vertebrate biology and understand the relevance of ongoing research and discoveries.		
6.	**Credit Value**	**3L+ 1T= 04**		
7.	**Total Marks**	**Internal Marks: 20** **External Marks: 80**	**Min Passing Marks:36**	

Part B: Content ofthe Course		
Unit	**Topics**	**Total Hours**
I.	**Origin of chordates** – Fish, Amphibians, Reptiles, Aves and Mammals. **Classification of Vertebrates** upto orders with examples: Class – Fish, Amphibia, Reptilia, Aves and Mammalia	12
II.	**Extinct Reptiles. Birds are glorified reptiles. Aquatic mammals** **Skeleton system** – Comparative accounts of Jaw suspensorium, Development of vertebra and vertebral column, types of vertebra , limbs and Girdles	12

III.	**Vertebrate integument and its derivative**: Soft epidermal derivatives, Hard epidermal derivatives, Dermal Derivatives Development and General Structure and function of skin and its derivatives-Glands Scales horn, claw, nails, Hoof, Feather and Hair **Evolution of Heart, Evolution of Aortic arches** in vertebrates	12
IV.	**Digestive system** – Comparative account of digestive system. **Dentition in Mammals** **Respiratory system** – Comparative account of Respiratory systems.	12
V.	**Comparative account of Brain and Spinal cord in vertebrate series,** **Sensory Receptors,** **Urinogenital systems in vertebrate series.**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Alexander, R.M. The Chordata. Cambridge University Press, London
2. Bourne, G.H. The structure and functions of nervous tissue. Academic Press, NY
3. Carter, G.S. Structure and habit in vertebrate evolution - Sedgwick & Jackson, London
4. Kingsley, J.S. Outlines of Comparative Autonomy of Vertebrates,Central Book Depot, Allahabad.
5. MalcomJollie, Chordata morphology, East-West Press Pvt., New Delhi.
6. Milton Hilderbrand. Analysis of vertebrate structure. IV Ed. John Wiley
7. Tansley, K. Vision in Vertebrate. Chapman and Hall Ltd., London.
8. Walters, H.E. and Sayles, L.D. Biology of Vertebrates. Macmillan & Co., NY
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia.
10. Young, J.Z. Life of Vertebrates. Oxford University Press, London.
11. Montagna, W. Comparative anatomy. John Wiley & Sons Inc
12. ShobhanMitra – Biological Process –Campus Books
13. S. N. Prasad, SantikaKashyap – A text book of vertebrate zoology 0 –New Age International Publication Limited
14. H. H. Newman The phylum chordata –Satish book enterprise
15. R. L. Kotpal Modern Textbook of Zoology Vertebrates –- Rastogi Publications
16. KavitaJuneja, H. S. Bhumpah – Introduction to amphibia –Anmol publications

E- Resources :

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/

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: II	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT202**		
2.	Course Title	**Gamete biology and reproductive physiology in Human being**		
3.	Course Type	**Theory**		
4.	Pre-requisite (if any)	Passed BSc Biology		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Understanding the reproductive organ of male and female and its physiology & Hormonal control. • Understand the origin and characteristics of common congenital malformations. • Learn to distinguish between main stages of embryonic, foetal and neonatal development and causes of foetal disorders. • Awareness on social myth about menstrual cycle. • Awareness on population control. • Learn to give equal place to both men and women in the society to Promote gender equality through scientific attitude. • Students will enhance their communication skills by effectively conveying their understanding of Gamete Biology & Reproductive Physiology 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 Gamete Biology & Reproductive Physiology. • Create awareness on reproductive problems and sex transmits diseases.		
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.	**Endocrinology of sex differentiation & judgment-**Chromosomal (genetic) basis of sex determination, Gonadal sex, Phenotypic sex, Brain sex differentiation, Role of hypothalamus and pituitary on Biosynthesis of Gonadal steroid hormones.	12
II.	**Male reproductive system-** Anatomy, physiology and morphology of male reproductive system, Spermatogenesisand development of spermatozoa, Biochemistry of semen. **Endocrine function in male-**Endocrine control of testicular function,Chemistry and biosynthesis of androgens, Secretion, transport and metabolism of testis hormone, Physiological role of androgens in : Spermatogenesis, Secondary sex characteristics & Anabolic function	12

III.	**Female reproductive system-** Anatomy of female reproductive system : Ovary, Fallopian tube, Uterus , **Oogenesis : Formation of Ova, Ovarian hormones :** Chemistry, biosynthesis, secretion, transport, function, action and metabolism of Estrogen, Progesterone and Relaxin,Control of ovarian function, Abnormalities of ovarian function.	12
IV.	**Reproductive cycle- Estrous cycle** Adrenarche, Pubarche and Puberty, Menstruation cycle: Ovarian cycle (Follicular cycle & Luteal cycle), Uterine cycle (Bleeding phase ,Proliferative phase, Secretory phase). Pregnancy, Lactation	12
V.	**Fertilization -** Pre-fertilization events, Biochemistry of fertilization, Post fertilization **Collection and cryopreservation of gamete and embryo.** **Formation and development of placenta and its endocrine function.** **Role of hormone in parturition and lactation.** **Hormonal and immune contraception.**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. Leon, Developmental Biology, 2nd editionW.B. Sounders College publishing
2. R. A. Pedersen, G.P. Schatten, Current topics in Developmental Biology.
3. S.C. Goel, Principles of animal development biology , Himalaya publishing house
4. M.J. Barresi & S.F. Gilbert 12th edition, Developmental Biology
5. D.A. Ede, An introduction to developmental biology
6. Paul Weiss, Principles of developmental biology, edited by Hafner Publishing Co., NY
7. John Phillip &Trinkaus, Cells into organs, 2nd edition the forces that shape the embryo,
8. Lewis Wolpert et al 6th edition, Principles of development,
9. Patten's "Foundation of embryology": 6th edition B.M. Carlson
10. B.I. Balinsky& B.C. Fabian, an introduction to embryology: 5th edition
11. Austin & Short, Embryonic and fetal development
12. Marshall's Physiology of Reproduction : G.E. Lamming
13. Goodrick, Developmental biology
14. Mac E. Hardley, Endocrinology
15. Chandra S. Negi, Endocrinology
16. G. J. Tortora, B.H. Derrickson, Principles of Anatomy & Physiology

17. Gyton& Hall, Textbook of Medical Physiology
18. K.V. Sastry , Endocrinology & Reproductive Biology, Rastogi Publication

E-Resources:

1. Reproductive Hormones

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

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Part A: Introduction				
Program: M.Sc. Zoology		Semester: II	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT203**		
2.	Course Title	**MOLECULAR CELL 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:** • 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, • 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 Molecular 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 Molecular Cell Biology. • Get new avenues of joining research in related areas such as therapeutic strategies or related opportunities in industry.		
6.	**Credit Value**	**L-3+ T-1= 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.	**Biomolecules-**Structure, molecular composition and function of plasma membrane, Specialization of plasma membrane, Transport across cell membrane, diffusion, facilitated diffusion, ion channel, active transport and pumps, uniports and symports and antiports.	12
II.	**Cytoskeleton-**Microfilaments and microtubules: structure and dynamics, Role of microtubule in mitosis, Cell movements: intracellular transport, role of kinesin and dynein, Signal transduction mechanism **Celia and flagella**	12

III.	**Cell cycle and its controlling mechanism; check points in cell cycle, regulation of cell cycle by CDK's and cyclases.** **Cell-cell signaling general ideas** **Cell-cell adhesion and communication-**Ca++ dependent cell-cell adhesion**,** Ca++ independent cell-cell adhesion **Cell matrix and adhesion-**Integrins**,** Collagens **Cell organelles-**Structure and function of Mitochondria, Ribosomes, Golgi bodies, Endoplasmic reticulum.	12
IV.	**Genomic organization-**Morphological and functional elements of Eukaryotic chromosome, Morphology of Giant chromosome, DNA structure, replication, RNA structure, Genetic code, Transcription. **Intracellular protein traffic-**Protein synthesis on free and bound polysomes, Uptake into E.R.**,** Uptake into mitochondria**.** **DNA Damage and Repair**	12
V.	**Transposon** **Operon system** **Repetitive DNA** **Biology of cancer** **Biology of Ageing** **Apoptosis-**definition, mechanism and significance**.**	12

Part C - **Learning Resource**

Reference Books, E-Resources

Reference Books:

1. J.H. Damell, H. Lodish and D. Baltimore, Molecular cell biology, Scientific American book inc USA.
2. B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J. D. Watson, Molecular Biology of the cell, Garland Publishing Inc NY.
3. P. K. Gupta, Molecular Cell Biology.
4. D. Robertis, Molecular cell Biology.

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: II	Year: 2023-24	w.e.f.:**2023-2024**
1.	Course Code	**MSCZOOLT204**		
2.	Course Title	**Tools and techniques for biology**		
3.	Course Type	**Theory**		
4.	Pre-requisite (ifany)	As per Atal Bihari Vajpayee University rule.		
5.	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Discuss the relevant tools and techniques needed for quality planning • Understand the difference between tools and technique • Students learn how to implement and monitoring tools and technique • Learn the theoretical basis of technique, its principle of working and its correct applications • Students will able to learn how to separate organelle by centrifugation as well as cell preparation by density gradient		
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.	**Principal and use of analytic instruments** Ph meter, Colorimeter, Spectrometer, Ultra centrifuge	12 Hours
II.	**Microscopy** Principal of light microscope, Phase contrast, Fluorescence Scanning electron microscope, Transmission microscope	12 Hours
III.	**Histochemical technique** Design and function of tissue culture laboratory, Culture media preparation, Cell harvesting method, Cell proliferation measurement	12 Hours
IV.	**Cryotechniques** Cryopreservation For cell tissue and organisms, Polymerase chain reaction, Bio Sensor, Antigen antibody interaction	12 Hours
V.	**Separation technique in biology** Molecular separation by chromatography, Electrophoresis, Organelle separation by Centrifugation, Cell preparation by density gradient, centrifugation	12 Hours

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

Reference Books:

1. Introduction to instrumental analysis-Robert Braun, McGraw Hill Publication
2. A biologist guide to principles and techniques of practical biochemistry-K. Wilson and K;HGoulding EBS Edn.
3. Clark and Swizer, Experimental Biochemistry, Freeman, 2000
4. Locquin and Langeron, Handbook of Microscopy, Butterwaths, 1983
5. Boyer, Modern Experimental Biochemistry, Benjamin, 1993

E-Resources:

- Principal of Bio technique https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==
- Histological and Histochemical Technique https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==
- Separation Technique https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==

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4. Shri Krishan Kumar Chaudhary, Asstt. Professor Govt. GramyaBharti 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: II	Year: 2023-24	w.e.f.:**2023-2024**
•	Course Code	**MSCZOOLP201**		
•	Course Title	**Lab Course I-Comparative Anatomy of Vertebrates &Gamete Biology and Reproductive Physiology in Human Beings**		
•	Course Type	Practical		
•	Pre-requisite (ifany)	As per University rule.		
•	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Learn the internal anatomy of different animal through dissection / alternative methods of dissection. • Learn to identify and classify various group of chordates and understanding their key characteristics and anatomical features. • Analyze the importance of different animal in ecosystem for greater understanding of diversity of animal structure. • To evaluate how economically important all these animals are in our lives. • Understand reproductive biology and role of hormones in it • Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field.		
•	**Credit Value**	P-2		
•	**Total Marks**	**Marks: 100**	**Min Passing Marks:36**	

Part B: Content of the Course		
Unit	**Topics**	**Total Hours**
	Comparative Anatomy 1. Dissection of animals: Amphioxus, Scoliodon, Electric ray, Sting ray, Calotes, Bird head, Rat (Subject to availability of material)/study through alternative methods of dissection. 2. Micro preparation of suitable and available material. 3. Study of the representative examples of different classes of chordates. 4. Study of permanent slides showing whole mount or section as per theory syllabus, including embryological slides of frog and chick. 5. Osteology of Amphibia, Reptile, Bird & Mammal. **Gamete biology and reproductive physiology in human beings** 1. Study of Estrous cycle in mouse or rat 2. Preparation on Blastodisc of hen's egg	30

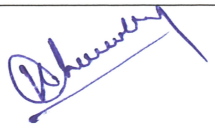
	3. Formation of egg window in chicken egg. 4. Collection of developmental stages of eggs of Lymnea or any gastropod. 5. Collection of developmental stages of insects/ fishes. 6. Study of development stages of frog through slides and whole mounts. 7. Study of development stages of chick through slides and whole mounts. 8. Slide preparation (earthworm ovary, amphibian, reptiles, birds and mammals testes & ovary) **Note-** 1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act 2. External features and anatomy should be studied by digital techniques and the alternatives.. Wherever live animals is studied it should be either pest or culturable species without paining them	
	Distribution of marks in practical exam **Time : 06 Hours** **Max. Marks : 100** 1. Dissection of Vertebrates (Virtual/Other methods) (10) 2. Micropreparation (10) 3. Spotting (1-10) (20) 4. Cytological preparation/preparation of estrogen cycle. (10) 5. Exercise based on Developmental stages of Insect /Fish/Frog. (10) 6. Preparation of egg window and Blastodisc. (10) 7. Viva. (10) 8. Sessional. (20) Total = 100	

Part C - **Learning Resource**
Text Books, 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.

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. GramyaBharti 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
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Part A: Introduction				
Program:M.Sc Zoology		Semester: II	Year: 2023-24	w.e.f.:**2023-2024**
•	Course Code	**MSCZOOLP202**		
•	Course Title	Lab Course II- Molecular Biology &Tools and techniques for biology		
•	Course Type	Practical		
•	Pre-requisite (ifany)	As per University rule.		
•	Course Learning. Outcomes (CLO)	**At the end of this course, the students will be able to:** • Discuss the relevant tools and techniques needed for quality planning in the field of molecular biology • Understand the difference between tools and technique • Students learn how to implement and monitoring tools and technique • Students will enhance their communication skills by effectively conveying their understanding of Tools and techniques for biologythrough 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 • Students will able to learn how to separate organelle by centrifugation as well as cell preparation by density gradient		
•	**Credit Value**	P-2		
•	**Total Marks**	**100**	**Min Passing Marks:36**	

Part B: **Content of the Course**		
Unit	**Topics**	**Total Hours**
	Molecular Cell biology 1. Study of Prokaryotic and Eukaryotic cells 2. Study of permanent slides -Mitosis, Meiosis and cell organelles 3. Temporary squash preparation to show mitosis and meiosis 4. Preparation of giant chromosomes, barr bodies 5. Histological study of cancer cells **Tools and techniques for biology** 1. Use of balance Ph meter, colorimeter, centrifuge spectrophotometer, camera Lucida etc. 2. Molecular separation by Chromatography, Electrophoresis 3. Media preparation 4. Cell culture 5. Colorimetric estimation of glucose, protein, RNA, DNA 6. Absorption spectrum of any coloured solution 7. Histochemical techniques **Note-** 1. Use of animal for dissection and practical work is subject to the conditions that they are not banned under the wildlife protection act	30

Rahalkar

	2. External features and anatomy should be studied by digital techniques and the alternatives. Wherever live animals is studies it should be either pest or culturable species without paining them	
	Distribution of marks in practical exam **Time : 06 hour** **Max. Marks: 100** 1. Spotting (mitosis and meiosis, Tools & Techniques). (20) 2. Exercise based on cell Biology. (10) 3. Chromatography. (20) 4. Colorimetric estimation. (10) 5. Application of different instruments (10) 6. Viva. (10) 7. Sessional (20) Total = 100	

Part C - **Learning Resource**
Reference Books, E-Resources
Reference Books: **E-Resources:** • https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2rAs1Puvga4LW93zMe83aA==

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