Multidisciplinary Course from the department for pool of the Courses in the University

(These courses are to be offered to students of different discipline/Subject)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MDC-01	Population Genetics & Evolution-I	261/ZOO/MD101	02	00	02	02	00	01	03	15	35	05	20	**75**

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MDC-02	Population Genetics & Evolution-II	261/ZOO/MD202	02	00	02	02	00	01	03	15	35	05	20	**75**

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
MDC-03	Aquaculture	261/ZOO/MD303	02	00	02	02	00	01	03	15	35	05	20	**75**



Multidisciplinary Course

ZOOLOGY: SEMESTER-I								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
MDC-01	261/ZOO/MD101	Population Genetics & Evolution-I & Practical	**2**	**2**	**15**	**35**	**50**	**3 hrs**
			1	**2**	**5**	**20**	**25**	**2hrs**

Course Learning Outcomes (CLO)

1. Imparts knowledge regarding the various theories of evolution, evolutionary process such as variation, speciation, natural selection.
2. Students will be able to understand the use of inheritance pattern underlying genetic diseases.
3. Student gets familiar with types of genetic variations used to assess genetic traits/diseases.
4. Students will form concepts about mode of speciation, evolution, system, origination, extinction, and causes of differential rates of diversification.
5. Students will study the origin and diversification of eukaryotes, evolution of eukaryotic cell from prokaryotes, evolution of eukaryotic genomes; gene duplication and divergence.

Instructions for Paper-Setter

1. Seven questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type (14 marks) covering the entire syllabus, will be compulsory.
3. The remaining six questions will be set unit wise selecting two questions from each Unit I to III.
4. The candidate will be required to attempt question No. 1 and three more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Concept of evolution: Darwinism and 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.	10
II	Evolutionary time scale: eras, periods and epoch. Major events in evolutionary time scale: origins of unicellular and multicellular organisms.	10
III	Quantifying genetic variability: Genetic structure of natural populations, phenotypic variations, Models explaining changes in genetic structure of populations. Molecular population genetics: Patterns of change in nucleotide and amino acid sequences Ecological significance of molecular variations.	10
Practical	1. Study of salivary gland chromosomes of larvae of Chironomus/Drosophila from permanent slides. 2. Study of metaphase karyotypes from photographs/permanent slides of Drosophila, grasshopper and man/rat. 3. Study the normal human karyotype 4. Study of sex-chromatin Bars body from human buccal mucosa, drumstick in human blood	30

Learning Resources



1. *Genetics and the origin of species* by **T. Dobzhansky**, Columbia University Press;1951.
2. *Organic Evolution* by **Lull**, MacMillan Co., New York; 1947.
3. *Time, life and Man* by **R.A. Stirton**, John Wiley and Sons, New York; 1959.
4. *Evolution of the Vertebrates* by **E.H. Colbert**, Willy Eastern Ltd., New Delhi;1969.
5. Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M. Valentine. Evolution. Surjeet Publication, Delhi.
6. Futuyama, D.J. Evolutinary Biology, Suinuaer Associates, INC Publishers, Dunderland.
7. Haiti, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.
8. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
9. King, M. Species Evolution-The role of chromosomal change. The Cambridge University Press, Cambridge.



ZOOLOGY: SEMESTER-II								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
MDC-02	261/ZOO/MD202	**Population Genetics & Evolution-II**	**2**	**2**	**15**	**35**	**50**	**3 Hrs**
			1	**2**	**05**	**20**	**25**	**2 Hrs**

Course Learning Outcomes (CLO)

1. Students will be able to understand the use of inheritance pattern underlying genetic diseases.
2. Student gets familiar with types of genetic variations used to assess genetic traits/diseases.
3. Provides description of molecular divergence, molecular clocks, molecular drive and their complication in inferring phylogenetic trees.
4. Students will form concepts about mode of speciation, evolution, system, origination, extinction, and causes of differential rates of diversification.
5. Students will study the origin and diversification of eukaryotes, evolution of eukaryotic cell from prokaryotes, evolution of eukaryotic genomes

Instructions for Paper-Setter

1. Seven questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type (14 marks) covering the entire syllabus, will be compulsory.
3. The remaining six questions will be set unit wise selecting two questions from each Unit I to III.
4. The candidate will be required to attempt question No. 1 and three more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Molecular evolution: molecular divergence and molecular clock. Patterns and mechanism of reproductive isolation, modes of speciation	10
II	Interrelationship among different phyla of Invertebrates and their evolutionary significance. Origin of Vertebrates: Pisces, Amphibia, Reptilia, Aves and Mammalia. Stages of primate evolution. Evolution of human behavior and its consequences.	10
III	Genetics of quantitative traits in populations: Analysis of quantitative traits, Quantitative traits and natural estimation of heritability. Genotype-environment interactions Inbreeding depression and heterosis. phenotypic plasticity	10
Practical	1. Demonstration of monohybrid and dihybrid cross, Co-dominance, Incomplete dominance and Epistasis with the help of beads and photographs. 2. Study of genetic disorders with the help of photographs. 3. Study of structural and numerical alteration of chromosomes: deletion, substitution, duplication etc.	30

Learning Resources

1. *Genetics and the origin of species* by **T. Dobzhansky**, Columbia University Press;1951.
2. *Organic Evolution* by **Lull**, MacMillan Co., New York; 1947.
3. *Time, life and Man* by **R.A. Stirton**, John Wiley and Sons, New York; 1959.
4. *Evolution of the Vertebrates* by **E.H. Colbert**, Willy Eastern Ltd., New Delhi;1969.
5. Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M. Valentine. Evolution. Surjeet Publication, Delhi.
6. Futuyama, D.J. Evolutinary Biology, Suinuaer Associates, INC Publishers, Dunderland.
7. Haiti, D.L. A Primer of Population Genetics. Sinauer Associates, Inc, Massachusetts.
8. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
9. King, M. Species Evolution-The role of chromosomal change. The Cambridge University Press, Cambridge.



ZOOLOGY: SEMESTER-III								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
MDC-03	261/ZOO/MD303	**Aquaculture**	**2**	**2**	**15**	**35**	**50**	**3 Hrs**
		Practical	**1**	**2**	**05**	**20**	**25**	**2 Hrs**

Course Learning Outcomes (CLO)

1. Students will be able to understand the aquaculture system
2. Student gets familiar with impact of aquaculture on Environment
3. Gain knowledge about conditioning factors and how they can be manipulated
4. Students will form concepts about Integrated farming

Instructions for Paper-Setter

1. Seven questions will be set in all. All questions will carry equal marks.
2. Question No. 1, which will be short answer type (14 marks) covering the entire syllabus, will be compulsory.
3. The remaining six questions will be set unit wise selecting two questions from each Unit I to III.
4. The candidate will be required to attempt question No. 1 and three more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Theory Culture technology– freshwater (carps, catfishes, murrels, prawns), brackish water (asian sea-bass, milk fish, mullets, crabs, shrimps), mariculture (mussels, oysters, sea weeds), fish food organisms (algae; Artemia; zooplankton).	10
II	Water Quality Requirements for Aquaculture- Role of temperature, pH, salinity, dissolved oxygen, ammonia, nitrite, nitrate, phosphate, biological oxygen demand, Chemical oxygen demand.	10
III	Integrated farming and its economic importance - fish-cum-livestock farming, paddy-cum-fish farming. Fish seed technology - natural collection, bundh breeding, induced breeding, cryopreservation of gametes. Fish farming	10
Practical	1. Estimation of hydrobiological parameters- temperature, pH, conductivity, salinity, dissolved oxygen, primary productivity, ammonia, nitrite, nitrate, phosphate, biological oxygen demand, chemical oxygen demand of nursery, rearing, stocking and breeding ponds. 2. Estimation of ovarian egg counts. 3. Culture of live food organisms and assay of nutritional quality of live food; estimation of population density of live food organisms. 4. Decapsulation and hatching of Artemia cysts for use in hatcheries. 5. Demonstration of breeding pools and hatcheries. 6. Induced breeding of Indian major carps and catfishes. 7. Identification of eggs, spawn, fry and fingerlings of cultivable fishes of India.	30

Learning Resources

1. Fishponds in Farming Systems, Zijpp, V. D., Verreth, J. A. J., Tri, L. Q., van Mensvoort, M. E. F., Bosma, R. H., and Beveridge, M. C. M., Wageningen Academic Publishers,Netherlands
2. Aquaculture Principles and Practices, Pillay, T. V. R., Blackwell Publishing, USA
3. Aquaculture and Fisheries Biotechnology Genetic Approaches, Dunham, R. A., CABI Publishing, USA



Value Added Courses from the department for pool of the Courses in the University

(These courses are offered by each department for students of other departments/same department and is designed to provide value- based and/or skill-based knowledge and should contain both theory and lab/hands-on/training/field work.)

Semester 1

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
VAC-01	**Animal Diversity & Conservation**	261/ZOO/VA101	02	00	00	02	00	00	02	15	35	00	00	50

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
VAC-02	**Human Genetic Syndrome**	261/ZOO/VA302	02	00	00	02	00	00	02	15	35	00	00	50



ZOOLOGY: SEMESTER-I								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam duration**
VAC-01	**261/ZOO/VA101**	**Animal Diversity & Conservation**	**2**	**2**	**15**	**35**	**50**	**2hrs**

Course Learning Outcomes (CLO)

1. Biological diversity provides immediate benefits to society such as recreation and tourism
2. It will generate initiative among students for conservation of our rich natural resources and diversified life forms.
3. It gives jobs opportunities for people by establish training research programs that have been launched for conservation and sustainable use of bio diversity.
4. Expand the knowledge of researchers to explore diversity of animal, its protection from extinction and their habitat from destruction

Instructions for Paper-Setter

1. Five questions will be set in all.
2. Question No. 1, which will be short answer type (15 marks) covering the entire syllabus, will be compulsory.
3. The remaining four questions will be set unit-wise selecting two questions from each Unit.
4. The candidate will be required to attempt question No. 1 and two more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Wildlife: Definition, significance. Techniques of animal counts (Examples of Tiger count), Wildlife zones of the India, Wildlife Tourism. Biodiversity: Concept, threats to biodiversity, its Conservation (objectives and strategies), biodiversity indices	**12**
II	Concept of Protected areas: Red Data Book, IUCN Categories of wildlife species. Important Protected Areas of India (Biosphere reserve, National Park & Wildlife sanctuaries	**11**
Learning Resources		



1. Techniques for wildlife Census in India by W.A. Rogers (A field manual); Wildlife Institute of India, Dehradun.
2. Wildlife Wealth of India by T.C. Majupuria; Tecpress Services, L.P., 487/42-SOL-Wattenslip, Pratunam Bangkok, 10400, Thailand
3. The Book of Indian Animals by S.H. Prater, BNHS-Publication, Bombay.
4. Wildlife in India by V.B. Saharia. Natraj Publishers, Dehradun. 5. E.P. Gee, The Wildlife of India.



ZOOLOGY: SEMESTER-III								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam duration**
VAC-02	**261/ZOO/VA302**	**Human Genetic Syndrome**	**2**	**2**	**15**	**35**	**50**	**2hrs**

Course Learning Outcomes (CLO)

1. Students will gain knowledge about genetic syndromes.
2. It will generate initiative among students for their clinical management.
3. Students will know about genetic counseling.
4. Expand the knowledge of researchers to explore ethical consideration in genetic testing.

Instructions for Paper-Setter

1. Five questions will be set in all.
2. Question No. 1, which will be short answer type (15 marks) covering the entire syllabus, will be compulsory.
3. The remaining four questions will be set unit wise selecting two questions from each Unit.
4. The candidate will be required to attempt question No. 1 and two more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Overview of Genetic Syndrome: Definition and classification of genetic disorder, Multifactorial and mitochondrial disorder: Impact of genetic and environmental factors. Chromosomal and Single gene Disorder: Down syndrome, Turner syndrome, Klinefelter syndrome, Patau Syndrome, cystic fibrosis, and their Inheritance pattern.	12
II	Diagnostic Technique: Methods, Karyotyping and genetic testing, Management and ethical issues: Clinical management, genetic counseling and ethical considerations in genetic testing and family planning	**11**
	Learning Resources: 1. Genetics in medicine by James S. Thompson and Margaret W. Thompson 2. Medical Genetics by William S. McDermott and Nancy A.N. Jones 3. The genetics of human disease by Edward W.C.B. Robert D.L. R.G. McGown	



Skill Enhancement Course from the department for pool of the Courses in the University

(These courses are offered by each department for students of other departments/same department and is designed to provide value-based and/or skill-based knowledge and should contain both theory and lab/hands-on/training/field work.)

Semester 2

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
SEC-1	Economic Zoology	261/ZOO/SE201	02	00	00	02	00	00	02	15	35	00	00	50

Semester 3

Course Code	Course Title	Course ID	L	T	P	L	T	P	Credits	MARKS				
			(Hrs)			Credits				TI	TE	PI	PE	Total
SEC-2	Medical Physiology	261/ZOO/SE302	02	00	00	02	00	00	02	15	35	00	00	50



Skill Enhancement Course

ZOOLOGY: SEMESTER-II								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam duration**
SEC-1	**261/ZOO/SE201**	**Economic Zoology**	**2**	**2**	**15**	**35**	**50**	**2 hrs**

Course Learning Outcomes (CLO)

1. Students will understand the economic importance of various animals and their roles in agriculture, medicine, and industry.
2. Students will gain knowledge about the management and sustainable utilization of economically significant animal resources.
3. Students will be able to identify and address the challenges related to pest control, animal husbandry, and aquaculture practices.
4. Students will develop skills in the conservation of economically valuable species and the assessment of their ecological impacts.

Instructions for Paper-Setter

1. Five questions will be set in all.
2. Question No. 1, which will be short answer type (15 marks) covering the entire syllabus, will be compulsory.
3. The remaining four questions will be set unit wise selecting two questions from each Unit.
4. The candidate will be required to attempt question No. 1 and two more questions

UNIT	TOPICS	CONTACT HOURS
I	Definition and scope of economic zoology, importance of animals in agriculture, medicine, and industry, Historical developments and contributions of eminent zoologists, Impact of zoological research on economic development. Economic status and products of poultry keeping and	12
II	Role of insects in pollination and pest control, impact of parasitic invertebrates on human and animal health, utilization of mollusks, crustaceans, and other invertebrates in industries, apiculture, sericulture, and lac culture	11

Learning Resources

1. A Textbook of Applied Zoology — R. L. Kotpal
2. Very useful for economic zoology, apiculture, sericulture, lac culture, poultry and dairy topics.
3. Economic Zoology — G. S. Shukla & V. B. Upadhyay
4. Covers economic importance of animals, insects, parasites, apiculture, sericulture and lac culture.
5. Economic Zoology — S. S. Lal
6. Useful for animal products, livestock, poultry, dairy, insects and industrial applications.



ZOOLOGY: SEMESTER-III								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Mark**	**Exam Duration**
SEC-01	**261/ZOO/SEC302**	**Medical Physiology**	**2**	**2**	**15**	**35**	**50**	**2 hrs**

Course Learning Outcomes (CLO)

1. Students will understand the concept of medical physiology
2. Students will gain knowledge about the composition and function of blood.
3. Students will be able to learn nervous system and special sense
4. Students will develop knowledge about homeostasis and feedback mechanisms

Instructions for Paper-Setter

1. Five questions will be set in all.
2. Question No. 1, which will be short answer type (15marks) covering the entire syllabus, will be compulsory.
3. The remaining four questions will be set unit wise selecting two questions from each Unit.
4. The candidate will be required to attempt question No. 1 and two more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Introduction to physiology, Nerve muscle physiology, Composition and function of blood, physiology of gastrointestinal tract, Respiratory system	11
II	Physiology of cardiovascular system, Endocrine system, Reproductive system, Excretory system, Nervous system and special sense	12

Learning Resources

1. Medical physiology ➔ A. C. Guyton
2. Review of medical physiology ➔ W. F. Ganong
3. Human physiology ➔ Vander, Sherman & Luciano



ZOOLOGY: SEMESTER-IV								
Course Code	**Course ID**	**Course Title**	**Credit**	**Contact Hours/Week**	**Internal Assessment marks**	**End Term Marks**	**Max. Marks**	**Exam Duration**
AEC-03	261/ZOO/AE403	**Manuscript Writing**	**2**	**2**	**15**	**35**	**50**	**2 hrs**

COURSE OUTCOMES: At the completion of this course, the learner will be able to:
CO1: Understand the fundamental principles and components of manuscript writing.
CO2: Develop knowledge of the stages and processes involved in effective writing.
CO3: Apply appropriate techniques and strategies for manuscript preparation.
CO4: Demonstrate proper use of citation and referencing methods in academic writing.

Instructions for Paper-Setter

1. Five questions will be set in all.
2. Question No. 1, which will be short answer type (15 marks) covering the entire syllabus, will be compulsory.
3. The remaining four questions will be set unit wise selecting two questions from each Unit I to II.
4. The candidate will be required to attempt question No. 1 and two more questions selecting one question from each unit.

UNIT	TOPICS	CONTACT HOURS
I	Fundamentals of Manuscript Writing Manuscript Writing: Definition, purpose, and significance in academic and research contexts. Types of Manuscripts: Original research articles, case studies, review articles, reflective essays, and brief reports. Writing Process: Pre-writing, drafting, revising, editing, and proofreading. Ethical Considerations: Academic integrity, plagiarism, proper citation practices, and avoiding misconduct in writing.	12
II	Writing Techniques and Final Presentation Principles of Effective Writing: Clarity, coherence, conciseness, and precision. Writing Techniques: Developing thesis statements, structuring arguments, and use of evidence. Revision and Editing: Techniques for improving organization, clarity, and logical flow. Proofreading: Common proofreading symbols and error correction. Drafting and Revising: Outlining, drafting, and refining manuscripts. Final Manuscript Preparation: Formatting, preparing final drafts, and effective presentation of key arguments.	11

