

**Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon**

॥अंतरी पेट्यू ज्ञानज्योत॥



'A' Grade
NAAC Re-Accredited
(3rd Cycle)

SYLLABUS

for

**Master of Science (M. Sc.) II
Zoology**

**Choice Based Credit System
(Outcome Based Curriculum)**

2022 - 2023

Program at a Glance

Name of the program (Degree)	: M. Sc. (Zoology)
Faculty	: Science and Technology
Duration of the Program	: Two years (four semesters)
Medium of Instruction and Examination	: English
Exam Pattern	: 60 : 40 (60 marks University exam and 40 marks continuous internal assessment)
Passing standards	: 40% in each exam separately (Separate head of passing)
Evaluation mode	: CGPA
Total Credits of the program	: 88 (64 core credits including 4 credits of project/dissertation, 08 skill enhancement credits, 08 subject elective credits and 08 audit credits)

**Summary of Distribution of Credits under CBCS Scheme
for
M.Sc. (Zoology)**

Sr. No	Type of course	Sem I	Sem II	Sem III	Sem IV
01	Core	16	16	16	12
02	Skill based	04	04	-	-
03	Elective	-	-	04	04
04	Project	-	-	-	04
05	Audit	02	02	02	02
06	Total Credits	22	22	22	22

Subject Type	Core	Skill based	School Elective	Project	Audit	Total
Credits	60	08	08	04	08	88

Total Credits = 88

KBC North Maharashtra University Jalgaon

M. Sc. Zoology

Choice Based Credit System (Outcome Based Curriculum) with effect from 2021 -2022

Course credit scheme

Semester	(A) Core Courses			(B) Skill Based / Elective Course			(C) Audit Course (No weightage in CGPA)			Total Credits (A+B+C)
	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (T+P)	Total Credits	No. of Courses	Credits (Practical)	Total Credits	
I	4	8 + 8	16	1	4 + 0	4	1	2	2	22
II	4	12 + 4	16	1	4 + 0	4	1	2	2	22
III	4	8 + 8	16	1	4 + 0	4	1	2	2	22
IV	4	8 + 8	16	1	4 + 0	4	1	2	2	22
Total Credits	64			16			8			88

(T= Theory; P=Practical)

Structure of Curriculum

		First Year				Second Year				Total Credit Value
		Semester I		Semester II		Semester III		Semester IV		
		Credit	Course	Credit	Course	Credit	Course	Credit	Course	
	Prerequisite and Core Courses									
(A)	Theory	4	2	4	3	4	2	4	2	36
	Practical	4	2	4	1	4	2	4	2	28
(B)	Skill Based / Subject Elective Courses									
1	Theory /Practical	4	1	4	1	4	1	4	1	16
(C)	Audit Course (No weightage in CGPA calculations)									
1	Practicing Cleanliness	2	1	--	--	--	--	--	--	2
2	Personality and Cultural Development Related Course	--	--	2	1	--	--	--	--	2
3	Technology Related + Value Added Course	--	--	--	--	2	1	--	--	--
4	Professional and Social + Value Added Course	--	--	--	--	--	--	2	1	2
	Total Credit Value	14	6	14	6	14	6	14	6	88

List of Audit Courses (Select any ONE course of Choice from Semester II; Semester III and Semester IV)

Semester I (Compulsory)		Semester II (Choose One)		Semester III (Choose One)		Semester IV(Choose One)	
		Personality and Cultural Development		Technology + Value Added Course		Professional and Social + Value Added Course	
Course Code	Course Title	Course Code	Course Title	Course Code	Course Title	Course Code	Course Title
AC-101	Practicing Cleanliness	AC-201A	Soft Skills	AC-301A	Computer Skills	AC-401A	Human Rights
		AC-201B	Sport Activities	AC-301B	Cyber Security	AC-401B	Current Affairs
		AC-201C	Yoga	AC-301C	Seminar + Review Writing	AC-401C	Seminar + Review Writing
		AC-201D	Music	AC-301D	Biostatistics	AC-401D	Intellectual Property Rights (IPR)

Semester-wise Course Structure of M.Sc. II Zoology

Semester III

Course	Course Type	Course Title	Teaching Hours/ Week			Marks (Total 100)				Credits
			T	P	Total	Internal		External		
						T	P	T	P	
Zoo-301	Core (Any one from A,B,C&D)	A)Animal Physiology I B)Reproductive Physiology I C)Entomology I D)Heminthology I	4	--	4	40	--	60	--	4
Zoo-302	Core	Enzymology and Immunology	4	--	4	40	--	60	--	4
Zoo-303	Core	Practical I	--	4+4	8	--	40	--	60	4
Zoo-304	Core	Practical II	--	4+4	8	--	40	--	60	4
Zoo-305	Elective (Select any one)	(A)Animal behaviour	4	--	4	40	--	60	--	4
		(B) Forensic Zoology								
		(C) Endocrinology								
Zoo AC-301 A/B/C/D	Audit Course	Choose one out of Four (AC-301A/ AC-301B/AC-301C/AC-301D) from Technology + Value Added Courses	--	2	2		100	--	--	2
Total Credit for Semester III: 22 (T = Theory: 8; P = Practical: 8; Skill Based: 4; Audit Course: 2)										

Semester IV

Course	Course Type	Course Title	Teaching Hours/ Week			Marks (Total 100)				Credits
			T	P	Total	Internal		External		
						T	P	T	P	
Zoo-401	Core (Any one from A,B,C&D)	A) Animal Physiology II B) Reproductive Physiology II C) Entomology II D) Heminthology II	4	--	4	40	--	60	--	4
Zoo-402	Core	Molecular Biology	4	--	4	40	--	60	--	4
Zoo-403	Core	Practical I (corresponds to 401 and 402)	--	4+4	8	--	40	--	60	4
Zoo-404	Core	Project	--	4+4	8	--	40	--	60	4
Zoo-405	Elective (Select any one)	(A)Zoogeography	4	--	4	40	--	60	--	4
		(B)Writing & presenting scientific research paper								
		(C)Computational Biology								
Zoo AC-401 A/B/C/D	Audit Course	Choose one out of Four (AC-401A/ AC-401B/ AC-401C/ AC-401D) from Professional and Social + Value Added Courses	--	2	2		100	--	--	2
Total Credit for Semester IV: 22 (T = Theory: 8; P = Practical: 8; Skill Based: 4; Audit Course: 2)										

MSc II Sem III Core Courses		
Zoo- 301: (A) Animal Physiology – II		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To learn about the various aspects of Animal physiology. • To acquire a broad understanding of physiological processes. 	Credits: 4
	Program specific outcomes <ul style="list-style-type: none"> • To understand the structure and functioning of Animal physiology • To gain the detail knowledge on Animal physiology 	Lectures 60
Unit	Topics	
Unit I	A)Defination, significance and scopes of physiology B)Water Relation and Ionic Regulation i) Role of membranes in osmotic and ionic regulation; Role of body fluid; ii) Adaptation to marine habitat; Adaptation to brackish water habitat; Adaptation to Fresh water habitat; Adaptation to terrestrial habitat C) Thermoregulation: i)Homeostasis; ii)Classification of Animals Based on Thermoregulation; iii)Vants Hoff law; Lethal temperature; iv)Effect of cold Acclimation; v)Thermoregulatory Mechanisms; Vi)Thermoregulation in Camel.	15
Unit II	Metabolism a) Carbohydrate Metabolism: Intermediary Metabolism; Glycogenesis; Glycogenolysis; Glycolysis, Krebs cycle, Electron transport system; Respiratory chain; Oxidative phosphorylation; Energetics of Glucose; Metabolism; Pasteur effect; Gluconeogenesis; Cori cycle or lactic acid cycle; Uronic acid pathway; Crabtree effect, b) Lipid metabolism: Metabolism of lipids; Oxidation of Glycerols; Fatty Acid, Oxidation; β -Oxidation; Ketogenesis; Ketosis; Ketolysis; Biosynthesis of Fatty Acids; Biosynthesis of Triglycerides, c) Protein Metabolism: Deamination; Transamination; Decarboxylation; Ornithine cycle; Krebs Cycle, Citric Acid Cycle; Catabolism of the Carbon; Skeleton of amino acids; Pyruvic acid; Amino acids entering by α -Ketoglutaric Acid; Amino Acids entering by Succinyl Co-enzyme A; Catabolism of Amino Acids that are both Ketogenic and Glucogenic; Anabolism of Proteins; Energetics of amino Acids Oxidation.	15
Unit III	Nutrition and Digestive system a) Types of nutrition; Ingestion; Feeding mechanism; Digestion; Enzymes; b) Physiology of digestion; Absorption; Assimilation; Egestion or defecation, c) The evolution of digestive mechanism: Phagocytosis; A digestive cavity (Intracellular digestion), d) Organization of Vertebrate Digestive System, e) Functional Adaptations of the Alimentary Canal,	10

	f) Types of Digestion.	
Unit IV	Respiration a) Introduction; b) Mechanism of respiration in man; c) Tidal volume and Vital capacity; d) Control of respiration; e) Respiratory pigments: a) Hemoglobin, b) Haemocyanin, c) Haemoerythrin, d) Chlorocruorin, e) Molpadin, f) Pinnaglobin, g) Vanadium, h) Echinochrome f) Haemoglobin as an Oxygen Carrier; Transport of Gases- Oxygen transport: Oxygen, Dissociation Curve; Bohr's effect; Chloride shift; Respiratory Quotient; g) Anaerobiosis	10
Unit V	Circulatory system a) Introduction; Functions of Circulatory system in Vertebrates; Closed and open Circulatory system; b) Types of Circulation: a) Systemic circulation b) Pulmonary circulation, c) Advantages of Double Circulation; c) Types of Heart: Pulsating Heart, Tubular Heart, Chambered Heart, Accessory heart d) Physiological types of Hearts: Neurogenic heart and Myogenic heart, e) ECG; Heart Sound; Cardiac cycle; Cardiac output; f) General plans of Circulation: Annelid plan, Amphioxus plan, Gill plan of fishes, Lung plan of Mammals; g) Blood vessels: i) Arteries and arterioles ii) Veins and Venules, iii) Microcirculation	15
	Total	60
Suggested Readings	G. J. Tortora: Principle of Anatomy and Physiology • Hoar: General and Comparative physiology • Dr. P.V. Jabade: General Physiology • B. K. Berry: Animal Physiology • C. C. Chatterjee: Human Physiology • Goel and Shastri: Textbook of Animal Physiology • K.S. Nelson: Animal Physiology • Holurn: Principles of Physiology and Biochemistry • Bell and Davidson: Textbook of Physiology and Biochemistry • Withers: Comparative Animal Physiology • Mohan P. Arora: Animal Physiology R. C. Solti; Animal Physiology	

MSc II Sem III Core Courses		
Zoo -303: Practical I Corresponding to Zoo 301 (A) Animal Physiology I		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To know process of preparation of buffers and saline • To estimate SGOT and SGPT and analyse vital functions • To understand process of estimating biochemicals 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • acquire the knowledge related to process of preparation of buffers and saline • gain the knowledge related to estimation of SGOT and SGTP • learn the process of estimations of various biochemicals 	
Practical	<ol style="list-style-type: none"> 1. Preparation of Phosphate and Bicarbonate Buffers, given Normality solutions, Physiological Mammalian Saline Solution. 2. To demonstrate the principle of Osmosis. 3. Estimation of SGOT/SGPT from given biological sample. 4. Study of adaption in brackish, Fresh, marine water and terrestrial habitat. 5. Determination of oxygen consumption of any suitable animal. 6. Determination of Salivary Enzyme digestion and Effect of Temperature on Enzyme Activity. 7. Recording of lung volumes and capacities by spirometry. 8. Determination of Fatty acids and Amino Acid from Lipid and Protein Digestion respectively. 9. Antioxidant activity of any suitable material. 10. Estimation of plasma proteins by copper sulphate specific gravity method. 11. Estimation of Blood Glucose level. 	

MSc II Sem III Core Courses		
Zoo – 301 (B): Reproductive Physiology-I		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To learn about the various aspects of reproductive physiology. • To acquire a broad understanding of the hormonal regulation of physiological processes. • To build reproductively healthy society by providing proper knowledge related to reproductive aspects. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • Understand the structure of male and female reproductive systems particularly in humans. • Understand the functioning of male and female reproductive systems particularly in humans. • Comprehension of the interplay of various hormones in the functioning and regulation of the male and female reproductive systems. 	Lectures 60
Unit	Topics	
Unit I	Male Reproductive System : <ul style="list-style-type: none"> • Internal and External Genitalia • Histological structure and functions of testis • Male accessory ducts and accessory reproductive organs:- Epididymis, Seminal vesicle, Prostate gland, Bulbourethral gland • Cryptorchidism • Semen 	14
Unit II	Female reproductive System: <ul style="list-style-type: none"> • Internal and External Genitalia • Histological structure and functions of:- ovary ,Graafian follicle corpus luteum and corpus albicans • Structure and functions of:- Fallopian tube ,Uterus • Structure and functions of:- Bartholin’s gland, Mammary glands 	14
Unit III	Gametogenesis- <ul style="list-style-type: none"> • Structure of sperm • Spermatogenesis , Spermiogenesis,, Maturation and storage of sperm, Motility, capacitation and fate of spermatozoa. • Structure of ovum • Oogenesis , Ovulation, Gametogenesis at the chromosomal level: mitosis and meiosis 	14
Unit IV	Reproductive cycles- <ul style="list-style-type: none"> • Estrous and menstrual cycles • Hormonal control of normal menstrual cycle • Puberty and delayed puberty , menarche and menopause 	10
Unit V	Chemistry, biosynthesis, mode of action and functions of Sex hormones and Gonadotropins <ul style="list-style-type: none"> • Male Sex hormones :- androgen • Female sex hormones:- oestrogens and progesterone • Hormones of pituitary gland:- FSH, LH 	08

<p>Suggested Readings</p>	<ul style="list-style-type: none"> • Prakash S Lohar, 2012 – Endocrinology Hormones and Human Health, MJP Publishers, Chennai • P. J. Hogarth, 1978- Biology of Reproduction Wiley, New York. • J. S. Perry, 1971- The Ovarian cycle of animals, Oliver and Boyed. • C.R. Austin and R. V. Short, 1972 Reproduction in Mammals, Vol. 1-8, Cam. Uni. Press. • P. Gibian and E.J. Platz, eds, 1970- Mammalian Reproduction, Springer Verlag. • Robert H. Williams, 1981 – Text book of Endocrinology, W. B. Saunders Company • Chandi Charan Chatterjee, 1985 – Human Physiology Vol.II Tenth Edition, Medical Allied Agency, Calcutta, India. • Arthur J. Vander, James H. Sherman and Dorothy S. Luciano – Human Physiology, • Mcgraw-Hill International Editions, Biological Sciences Series. • Nalbandov, A. V.- Reproduction Physiology. 	
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MSc II Sem III Core Courses

Zoo - 303: Practical corresponding to ZOO 301 (B) Reproductive Physiology - I

<p>Total Hours: 60</p>	<p>Program specific objective</p> <ul style="list-style-type: none"> • To demonstrate endocrine glands and their physiological role • To study different stages of reproductive cycle • To understand histology of organs of reproduction 	<p>Credits: 4</p>
	<p>Program specific outcomes After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • acquire the knowledge related to endocrine glands • gain the knowledge related to reproductive cycle • understand the histology of organs related to reproductive system 	
<p>Practical</p>	<ul style="list-style-type: none"> • Demonstration of rat/mice endocrine glands with the help of figure/chart/model. • Histological structure of male and female reproductive organs in rat/mice/human. • Study of different stages of estrous cycle. • Microscopic observations of spermatozoa / ova from suitable mammal • Histological structure of male accessory reproductive organs. • Histological structure of female accessory reproductive organs. • Cellular structure of anterior pituitary gland. 	

MSc II Sem III Core Courses		
Zoo - 301: (C) Entomology I		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To understand habit, habitat and taxonomic status of vertebrate animals. • To know the basic aspects of structural and functional anatomy of vertebrate animals. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • Acquire the knowledge of entomology and insects and understand origin and evolution of insects and their relation to other arthropods. • Understand the classification of insects up to family with distinguishing characters and examples of each order and family. • Understand the structure, chemical composition and functions of Integument and its derivatives, modifications of insect body regions and their appendages. • Acquire the knowledge of comparative anatomical and histological structure of various body systems. • Understand the location, structure and functions of various Endocrine and Exocrine glands, Light and Sound producing organs in various insects. 	Lectures 60
Unit	Topics	
Unit I	General outline of Classification and Phylogeny of insects.	12
	Classification of following insect orders up to families A) Apterygota: Thysanura, Collembolla	
Unit II	B) Pterygota: <ol style="list-style-type: none"> a) Odonata b) Orthoptera – Tettigonidae, Gryllotalpidae, Acrididae c) Dytioptera- Blattidae, Mantidae d) Isoptera e) Mallophaga f) Siphanunculata g) Hemiptera: <ul style="list-style-type: none"> • Suborder- Homoptera - Flugoridae, Cicadidae, Aphididae • Suborder- Heteroptera – Cimiadae, Pyrrhoridae, Pentatomidae, Belostomidae 	12
Unit III	h) Coleoptera: <ul style="list-style-type: none"> • Suborder- Adephaga- Carabidae, Dysticidae • Suborder- Polyphaga- Hydrophilidae, Scarabidae, Bupristidae, Tenebrionidae, Curcurlionidae i) Diptera: <ul style="list-style-type: none"> • Suborder- Nematocera- Culicidae, Chironomidae • Suborder- Brachaeocera- Tabanidae 	12

	<ul style="list-style-type: none"> • Suborder- Cyclorrhapha- Syrphidae, Muscidae, Hippoboscidae, Glossinidae j) Lepidoptera: Nymphalidae, Papilionidae, Sphingidae, Noctuidae k) Hymenoptera: <ul style="list-style-type: none"> • Symphyta- Tenthredinidae • Apocrita- Apidae, Ichneumonidae 	
Unit IV	<p>A) Integument and its derivatives</p> <p>B) Comparative study of –</p> <ul style="list-style-type: none"> • Head and its appendages • Thorax and its appendages and • Abdomen and its appendages 	12
Unit V	<p>A) Comparative anatomical and histological study of the following:</p> <ul style="list-style-type: none"> • Alimentary canal and associated glands • Circulatory system • Ventilatory system • Excretory system and fat bodies • Nervous system and sense organs • Reproductive system <p>B) Light and sound producing organs</p>	12
Suggested Readings	<ul style="list-style-type: none"> • Chapman R. F.: The Insect: Structure and Function, E.L.B.S., and E.U.P. London. • Comstock J. H.: An Introduction to Entomology, Ithaca, New York. • Fox R. M and J. W. Fox: Introduction to comparative Entomology, Reinhold, New York. • Mani M. S.: General Entomology, 2nd edition, Oxford and IBH Publishing Company, New Delhi. • Nayar K. K., T. N. Anathakrishnan and B.V. David: General and Applied Entomology, Tata McGraw-Hill, New Delhi. • Richards O. W. and R. G. Davies: Imm's text book of entomology, Methuen and com, London, Vol. I and II • Ross H. H.: A Text book of Entomology, John Wiley and Sons, Ins. New York. • Snodgrass R. E.: Principles of insect morphology, Tata McGraw Hill Bombay. • Tembhare D. B.: Modern Entomology, 2nd edition, Himalaya Publication House, Bombay. 	

MSc II Sem III Core Courses		
Zoo - 304: Practical I (corresponding to Zoo 301(C) Entomology I)		
Total Hours: 60	<p>Program specific objective</p> <ul style="list-style-type: none"> • To know the knowledge of entomology and insects and understand origin and evolution of insects and their relation to other arthropods. • Understand the outline of classification of insects up to family with distinguishing characters and examples of each order and family. • To know the location, structure and functions of various endocrine and exocrine glands, light and sound producing organs in various insects. 	Credits: 4
	<p>Program specific outcomes</p> <p>After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • Acquire the knowledge of entomology and insects and understand origin and evolution of insects and their relation to other arthropods. • Give outline of classification of insects up to family with distinguishing characters and examples of each order and family. • Understand the structure, chemical composition and functions of Integument and its derivatives, modifications of insect body regions and their appendages. • Understand the location, structure and functions of various endocrine and exocrine glands, light and sound producing organs in various insects. 	
Unit	Zoo 301(C) Entomology I	
	<ul style="list-style-type: none"> • Collection and preservation techniques of insects • Classification of insects upto orders and families as per syllabus • Pictorial Collection and Identification of 25 insect species related to different orders and families • Culturing/rearing of any suitable insect/s (Housefly/ Drosophila) • Histology of Integument and its derivatives with the help of Slides (D) • Comparative study of Head capsule – any four (adults or larvae) from local area • Temporary preparation of Insects, <ul style="list-style-type: none"> • Mouthparts, Antennae, Legs, Wings and Genitalia. • Halter of Housefly • Study of Bugs, Beetles, House Fly with reference to following systems (Any 2 insects) <ul style="list-style-type: none"> • Digestive system 	

	<ul style="list-style-type: none"> • Reproductive system • Nervous system <hr/> <ul style="list-style-type: none"> • Histology of different organs of – <ul style="list-style-type: none"> • Alimentary canal, • Trachea, • Heart, • Muscle, • Blood of suitable insects <hr/> <ul style="list-style-type: none"> • Compulsory visit to Agriculture College or University or Research institute. 	
<p>Suggested Readings</p>	<ul style="list-style-type: none"> • Chapman R. F.: The Insect: Structure and Function, E.L.B.S., and E.U.P. London. • Comstock J. H.: An Introduction to Entomology, Ithaca, New York. • Fox R. M and J. W. Fox: Introduction to comparative Entomology, Reinhold, New York. • Mani M. S.: General Entomology, 2nd edition, Oxford and IBH Publishing Company, New Delhi. • Nayar K. K., T.N. Anathakrishnan and B.V. David: General and Applied Entomology, Tata McGraw-Hill, New Delhi. • Richards O. W. and R. G. Davies: Imm's text book of entomology, Methuen and com, London, Vol. I and II • Ross H. H.: A Text book of Entomology, John Wiley and Sons, Ins. New York. • Snodgrass R. E.: Principles of insect morphology, Tata McGraw Hill Bombay. • Tembhare D. B.: Modern Entomology, 2nd edition, Himalaya Publication House, Bombay. 	

M. Sc. II Sem III Core Courses		
Zoo 301 (D) Helminthology-1		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • The programme has been designed in such a way so that the students get the flavour of both classical and modern aspects of Zoology/Animal Sciences. • It aims to enable the students to study Heminthology-1 as a core course. • The lab courses have been designed in such a way that students will be trained to join public or private labs. 	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Understand the Parasitology and Heminthology. • Know about the classification of Helminthes. • To be familiar with the life cycle of various parasites • Students learn about the Nature, pathogenicity and prevention of endoparasites. • Their identification, nature of damage control of these endoparasites. 	Lectures 60
Unit	Topics	
Unit 1	1. Introduction to Parasitology and scope of Helminthology 2. Origin and evolution of parasites. 3. Inter-specific biological relationships , symbiosis, Commensalisms and parasitism. 4. Adaptation in parasites. 5. Types of Parasites. 6. Types of hosts- Definitive and intermediate, primary, secondary specific host, Paratenic, Carrier, Susceptible, Resistant, Accidental, Vectors etc.	12
Unit 2	1. General organization and Classification of Platyhelminthes up to order level. Cestodes (Cestodarians and Eucestodes), Trematodes (Monogenea, Aspidobothria and Digenea) 2. Functional anatomy of Reproductive system a. Trematodes (Digeneans) b. Cestodes (Pseudophyllideans & Cyclophyllideans). 3. Types of Cercaria. 4. Different types of larvae in cestodes and their pathogenicity. 5. Holdfast organs with its adaptations in cestodes	14
Unit 3	1. Life cycle patterns of Digenetic Trematodes a) Single intermediate host life cycle. b) Two intermediate host life cycles 2. Life cycle patterns in Cestodes a) No intermediate host life cycle b) Single intermediate host life cycle c) Two intermediate host life cycles.	12
Unit 4	Geographical distribution, habitat, morphology (Structure), life cycle, pathogenicity, diagnosis, treatment & prevention of the following Trematodes 1. <i>Pragonimus westermani</i> 2. <i>Fasciolopsis buski</i> 3. <i>Gastrodiccoides hominis</i> .	10
Unit 5	Geographical distribution, habitat, morphology (Structure), life cycle, pathogenicity, diagnosis, treatment and prevention	12

	<p>of the following Cestodes: 1) <i>Diphylidium canium</i> 2) <i>Diphyllobothrium latum</i> 3) <i>Echinococcus granulosus</i> 4) <i>Taenia saginata</i> 5) <i>Hymenolepis nana</i></p>	
Suggested Readings	<ol style="list-style-type: none"> 1. Medical Parasitology by Markell, Voge and John, 8thed. W.B. Saunders Co. 2. The Biology of animal parasites, Cheng T.C. (1964)- Saunders International Student Edition. 3. The advances in the Zoology of tapeworm from 1970- Wardle and Mcleod 4. Text book Medical Parasitology Jaypee Brothers, - Medical Publishers, New York. - Panikar C.K.J (1988) 5. The Parasitology of Trematodes Oliver and Boyd Ltd. Edinburgh - Smyth J.D (1977) 6. Parasitology (Protozoology and Helminthology) –Sood Pannik (1993) CBS Publication and Distrubution, Delhi. 7. Human helminthology Manual for Clinical, Sanitarians Medical Zoologists – Faust, Emerest Caroll. 8. Systema Helminthum Vol. II Cestoda - Yamaguti S. (1963) Inter-Science Publishers, London. 9. Synopsis of Digenetic Trematodes of Vertebrates – Yamaguti S. (1971) Vol. I & II Keigaku Publishing Co., Tokyo, Japan. 10. Keys to the Cestode Parasites of Vertebrates, CBA International - Khalil, Jones and Bray (1994) 11. Cestodes Parasites of Indian Mammals - Nama (1990) 	

MSc II Sem III Core Courses

Zoo - 303: Practical I Practical corresponding to ZOO 301 (D) Helminthology I		
Total Hours: 60	<p>Program specific objective</p> <ul style="list-style-type: none"> • To know process of Collection, fixation and staining methods of worms • To understand use of identification keys for cestodes and trematodes. • To learn Histopathology of host and worms 	Credits: 4
	<p>Program specific outcomes After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • Study the Collection, fixation and staining methods of worms • Understand key of Identification for cestodes and trematodes. • Practice the study of Histopathology of host and worms • Study the various types of parasites 	
Practical	<ul style="list-style-type: none"> • Study of different types of animal associations with suitable examples. • Collection, fixation and preservation of Cestodes from locally available hosts • Collection, fixation and preservation of trematodes from locally available hosts. • Staining and identification of cestodes and preparation of permanent slides • Staining and identification of trematodes and preparation of permanent slides • Histopathology of host tissue, to study host parasites relation • Study of different cestodes (10) and trematodes (10) from permanent slides. • Examination of ova in fecal samples of any suitable animal. • Submission of five permanent slides at the time of practical examination. 	

M. Sc. II Sem III Core Courses		
Zoo 302 Enzymology and Immunology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To acquire the flavour of modern aspects of Zoology/Animal Sciences. • To enable the students to study Enzymology and Immunology as a core course. • To learn practicing skill so that to join public or private labs. 	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Know about the Enzymology and Immunology. • To be familiar with the Enzyme structure, properties and its activity • Understand the basic principles of Enzymology and Immunology • To understand the principle and mechanism of immunoglobulins 	Lectures 60
Unit	Topics	
Unit I	Enzyme structure and properties : a) Enzyme Classification and nomenclature (International Union of Biochemistry (I.U.B.); Enzyme Commission number (EC) b) Primary and secondary structure, tertiary structure, the active site, quaternary structure, examples of enzyme- ribonuclease and chymotrypsin and their mechanism of action.	12
Unit II	Enzyme activity: a) Methods of investigating the mechanisms of enzyme catalyzed reactions- Isotopes labeling, b) Kinetics methods (enzyme velocity, units) steady-state methods, continuous methods. c) Steady-state enzyme kinetics- Effect of substrate concentration on initial velocity, d) Michaelis-Menten Hypothesis, Briggs- Haldane Hypothesis, Determination of Km and Vmax.	12
Unit III	Enzyme immobilization and inhibition: a) Enzyme purification techniques, b) Immobilization techniques, experimental procedures, enzyme stabilization, properties of immobilized enzyme c) Enzyme inhibition Competitive, non-competitive and uncompetitive inhibition, d) Allosteric activation and inhibition- sequential and concerned symmetry models.	12
Unit IV	Central cell types of the immune system: T and B lymphocytes, the NK cells, the neutrophilic, basophilic and eosinophilic granulocytes and the macrophages Types, structure, and function of molecules: immunoglobulins, T-cell receptors, MHC molecules, complement proteins, a few key cytokines and chemokines and their receptors.	12

Unit V	<ul style="list-style-type: none"> • Defense against as bacteria, fungi, virus and parasites • Mechanisms behind several immunological diseases, as hypersensitivity reactions, allergies, autoimmunity and immuno deficiencies. • Mechanisms of action of certain immunosuppressive drugs as glucocorticoids and cyklosporin. • Immunological methods: ELISA, Western blot, production of monoclonal and polyclonal antibodies 	12
Suggested readings	<ol style="list-style-type: none"> 1. Immunology (6 th Edition) by Roit IM, Brostoff J and Male D. Mosby, An imprint of Elsevier Sci Ltd., 2002. 2. Kuby Immunology (4 th Edition) by Golds RA, Kindt TJ, Osborne A. W.H. Freeman and Co. Ltd., New York, USA, 1994. 3. Textbook on Principles of Bacteriology, Virology and Immunology, 5 Volumes (9 th Edition) by Topley and Wilson. Edward Arnold, London, 1995. 4. Basic and Clinical Immunology, by Stites DP. Appleton & Lang Press. 5. Immunology, by Weissman and Wood. Benjamin Cummings. 6. Fundamentals of Immunology, by Coleman RM, Lombard MF, Sicard RE and Rencricca NJ. Wm. C. Brown Publishers, 1989. 	

MSc II Sem III Core Courses		
Zoo -304: Practical I Corresponding to Zoo 302 Enzymology and Immunology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To know process of cell fractionation technique • To analyse the enzyme activity and Km value • To understand immunological techniques 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • acquire the knowledge related to process of cell fractionation • gain practical skill related enzyme analysis and Km • learn various immunological techniques. 	
Practical	Practical corresponding to Enzymology <ul style="list-style-type: none"> • Preparation of tissue homogenate and fractionation of liver cell components • Effect of activators and inhibitors on enzyme activity • Determination of α-amylase by starch digestion • Determination of tryptic activity by casein digestion method • Determination of pancreatic lipase activity • Determination of Km Value of enzyme 	
	Practical corresponding to Immunology <ul style="list-style-type: none"> • Chemistry of immunoglobulin molecules, classes and physiological importance. • Use of ELISA technique (HIV) or any suitable method • Isolation and purification Bovine serum immunoglobulin G (IgG) fraction by suitable method • Study of agglutination reaction and its significance performing WIDAL test. • Determination of Antigen and Antibody reaction by using any suitable method 	

M. Sc. II: Semester III Elective Courses		
ZOO 305 (A) Animal behavior		
Total Hours: 60	Program specific objective 1. The programme has been designed in such a way so that the students get the flavour of both classical and modern aspects of Zoology/Animal Sciences. 2. It aims to enable the students to study Heminthology-1 as a core course. 3. The lab courses have been designed in such a way that students will be trained to join public or private labs.	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: ➤ Understand the Feeding and Antipredator behavior of animals. ➤ Know about the Aggression, Territoriality and Conflict behavior. ➤ To be familiar with the Biological Communication ➤ Students learn about the Orientation and Navigation	Lectures 60
Unit 1	Introduction: 1.1 What is Behavior? Behavioral Ecology.	04
Unit 2	Feeding and Antipredator Behavior: 2.1 Food preferences, Feeding Techniques, Using Tools, Feeding in Group-living Herbivores, Social Carnivores, 2.2 Anti Predator Behavior, Concealment, Camouflage, Warning Coloration and Mimicry, Freezing, Escape, Social Antipredator Behavior, Confusion Effect, Detection, The Development of Anti Predator Behavior.	14
Unit 3	Aggression, Territoriality and Conflict behavior: 3.1 Forms of Aggressive Behavior, Aggression and Competition, Types of Aggressive Behavior. 3.2 Social Use of Space (Territoriality), Size and Boundaries of Territory, Territorial Model, Dominance Hierarchies, Dominance in Females, Dominance in males, Advantage of Dominance, Factors Affecting aggression, Limbic System, Hormones, Genetic Control, 3.3 External factors in Aggression, Learning and Experience, Pain and Frustration, Xenophobia, Crowding, Breeding, Feeding, Restrain of Aggression, Displays, Territorial Conflicts	14
Unit 4	Biological Communication: 4.1 How signal convey information, Discrete and Graded Signals, Distance and Duration, Composite Signals, Syntax and Context, Metacommunication, Information and Manipulation, Messages and their Meaning, Signals, 4.2 Measurement of Communication, Observation, Quantification, Channels of Communication, Odor, Sound, Touch, Surface Vibration, Electric Field, Vision.	14
Unit 5	Orientation and Navigation: 5.1 Navigation, Invertebrates, Topographic Features, Sun, Stellar Cues, Meteorological Cues, Olfactory Cues, Geomagnetic Cues, Mammals, 5.2 Other Navigation Mechanisms.	14
Suggested Readings	1. Reena Mathur: Animal Behaviour, Rastogi Publication, Meerut 2. M.P.Arora: Animal Behaviour Himalaya Publishing House, Mumbai 3. Harjindra singh: A text book of Animal Behaviour, Anmol Publiccations Pvt. Ltd, New Delhi)	

M. Sc. II Sem III Elective Courses		
ZOO 305 (B) Forensic Zoology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • The programme has been designed in such a way so that the students get the flavour of modern aspects of Zoology/Animal Sciences. • It aims to enable the students to study Forensic Science as a elective course. 	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Understand the History and development of forensic science. • Know about the forensic science laboratories. • To be familiar with the Biological evidences, collection and packaging. • Students learn about the analysis of biological fluids 	Lectures 60
Unit	Topics	
Unit 1	Forensic Science : Definitions, History and Development Scope and importance of forensic science	06
Unit 2	Forensic Science Laboratories And Facilities: Growth of Forensic Science Laboratories in India – Central and State level laboratories; Educational setup in Forensic Science in India; Services and functionalities provided by various FSLs	12
Unit 3	Biological Evidences Collection and Packaging: Protection of Biological Evidences; Documentation; Recognition of Biological evidences encountered in various cases; Search & Collection of Biological Evidences; Packaging & transportation of Biological Evidences	15
Unit 4	Analysis of Biological Fluid- Saliva; Semen; Vaginal Fluid; Urine; Sweat; Serological Concepts; Antigen / Antibodies; Polyclonal antibodies; Monoclonal antibodies; Antiglobulins; Human & Animal Hair morphology; Blood Grouping – Human & Non-human; Analysis of Skeletal Remains	15
Unit 5	Forensic Entomology Basic Principle of Insect Biology; Life Cycle; Estimation of Time of Death; Preservation of Sample.	12
Suggested Readings	<ul style="list-style-type: none"> • Nanda, B.B. and Tewari, R.K. (2001) : Forensic Science in India : A vision for the twenty first century Select Publisher, New Delhi. • James, S.H and Nordby, J.J. (2003) Forensic Science: An introduction to scientific and investigative techniques CRC Press, USA. • Barnett (2001): Ethics in Forensic Science. • Saferstien : Forensic Science, Handbook, Vol. I, II & III, Prentice Hall Inc. USA. • Saferstein : Criminalistics, 1976, Prentice Hall Inc., USA. • Nickolas : Scientific Criminal Investigation • Deforest, Gansellen & Lee : Introduction to Criminalistics. • Sharma, B.R. : Forensic Science in Criminal Investigaion and Trials, Central Law Agency, Allahabad, 1974. • Kirk : Criminal Investigation, 1953, Interscience Publisher Inc. New York 	

M. Sc. II Sem III Elective Courses		
ZOO 305 (C) Endocrinology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • The programme has been designed in such a way so that the students get the flavour of modern aspects of Zoology/Animal Sciences. • It aims to enable the students to study Endocrinology as a elective course. 	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: <ul style="list-style-type: none"> • Understand the Histology of endocrine glands. • Know about the synthesis, transport and metabolism of hormones. • To be familiar with the hormone replacement theory • Students learn about the classification of hormones 	Lectures 60
Unit	Topics	
Unit I	1.1 Histology of vertebrate endocrine glands: Pituitary gland, Thyroid gland, Parathyroid gland, Adrenal gland, Pineal and Thymus gland 1.2 Melatonin function: Jet-lag and sleep disturbances. Melatonin as an anti-oxidant. Melatonin and cancer. Melatonin and depressive disorders. Melatonin and endocrine disorders. Adverse effects of Melatonin. 1.3 Histophysiology of endocrine placenta, testis and ovary in vertebrates 1.4 Structure and functions of Islets of Langerhans 1.5 Histophysiology of Uropharynx and Corpuscles of Stannius in fishes	12
Unit II	2.1 Classification of Hormones (Peptides, Steroids and amino acid derived) a. Hormone action at cellular level 2.3 Hormone action at genetic level 2.4 Hormones in biological clock 2.5 Role of hormones in digestion 2.6 Hormonal regulation of carbohydrate, Lipid and Protein metabolism 2.7 Hormonal regulation of Growth and Reproduction	12
Unit III	3.1 Synthesis, transport (release) and metabolism of steroid hormones 3.2 Synthesis, transport and metabolism of T ₃ , T ₄ and epinephrine 3.3 Synthesis transport and metabolism of insulin 3.4 Prostaglandins 3.5 Ectohormones in insects and mammals	12
Unit IV	4.1 Thyroid hormones and disorders 4.2 Parathyroid hormones and disorders 4.3 Pituitary hormones and major Disorders 4.4 Adrenal Gland hormones and Disorders 4.5 Diabetes: Diabetes Type I, Diabetes Type II, Diabetic Kidney Problems, Diabetes And Pregnancy, Diabetic Nerve Problems, Autoimmune diabetes	12

	4.6. Comparative study of steroid and non-steroid hormones in reproduction	
Unit V	5.1 Hormone replacement therapy 5.2 Risks and benefits of Hormone replacement therapy 5.3 Other hormones: Rennin, angiotensin, cytokines, ANF, Erythropoietin 5.4 Evolution of hormones 5.5 Neuroendocrine mechanism in insects and crustacean metamorphosis 5.6 Neuroendocrine mechanism in Amphibian metamorphosis	12
Suggested Readings	<ul style="list-style-type: none"> • .Lohar Prakash S.2014 Endocrinology:Hormone and Human Health.MJP Publishers, Chennai • Human Physiology- C. C. Chatterji Vol. I and II • Comparative Vertebrate Endocrinology, Bentley: Cambridge University Press, 1998 • Fundamentals of Comparative Endocrinology, Chester-Jones et al.: Plenum Press, New York, London, 1987. • Comparative Endocrinology, Gorbman et al.: John Wiley & Sons, New York, 1983 • Vertebrate Endocrinology, Norris: (2nd ed.), Lea & Febiger, 1997. • Vertebrate Endocrinology Schreibman & Pang: Vol. I-IV, Fundamentals & Biomedical Implications, Academic Press, 1985 & onwards • Endocrinology, Hadley: Prentice hall. International Edition. 2000 • Text Book of Endocrinology, 10th edition Larson: Williams. W. B. Saunders Company, Philadelphia. 2002. • William's text book of Endocrinology. (XI edition) H. M. Kronenberg, S. Melmed, K.S. Polonsky and P. R. Larsen. Publisher - Saunders, Elsevier Inc. (2009). 	

MSc II Sem IV Core Courses		
Zoo- 401: (A) Animal Physiology – I		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To learn about the anatomy and physiology. • To understanding the various systems of animal body. 	Credits: 4
	Program specific outcomes <ul style="list-style-type: none"> • To understand the functioning of Animal physiology • To obtain the detail knowledge on structure of animal systems. 	Lectures 60
Unit	Topics	
Unit I	A)Excretion and Osmoregulation i)Definition of Excretion; Types of excretory Products, ii)Comparative aspect of Excretory organs in Invertebrates and Vertebrates, iii)Osmoregulation in Invertebrates and Vertebrates B) Nervous System i)Nervous cordination: Brain; Spinal cord, Neurons ii)Nerve Fibres; Neuroglea; Nerve impulse; Neuromuscular junction; iii) Neurotransmitters; Reflex arc; Types of Reflexes; iv) Evolution of nervous system; v)EEG	12
Unit II	Physiology of Muscles a) Types: Phasic muscles, Tonic Muscles, Striated Muscles,Smooth muscles, Cardiac muscles b) Chemical Composition of Muscle: Water; Proteins; Actin; Myosin; Tropomyosin; Troponin; Actinin; c) Neuromuscular junction; Motor unit; Membrane excitation; d) Mechanism of muscle contraction; Sliding filament theory; e) General properties of Muscles; Properties of Voluntary muscles; Physical and Chemical aspects of muscle contraction; Molecular basis of Muscle contraction; Control of Muscle contraction; f) Role of Regulator proteins and calcium in muscle contraction;Changes during muscle contraction; Single muscle twitch; Latent phase or period; Contraction phase; Relaxation phase; g) Invertebrate muscle, h) Tetanus	14
Unit IV	Endocrine System a) Properties and types of Hormones, Mechanism of Hormone action b) The Pituitary Gland: Pituitary Gland in Different Chordates, It Hormones, c) Gigantism, Acromegaly, Dwarfism; d) Thyroid Gland: Cretinism, myxoedema, exophthalmic Goitre; e) Parathyroid Gland: Functions of PTH, Disorders of parathyroid; f) Pancreas: Islets of Langerhans: Diabetes g) Adrenal Gland: Addison’s disease, Cushing’s syndrome;	14

	<p>h) Thymus Gland: Thymosin; i) The pineal Gland: Melatonin, j) Reproductive glands; Testes; Prostate gland, Ovary; Placenta; k) Gastrointestinal hormones; Renal Hormones; Prostaglandins; l) Endocrine Glands in Invertebrates: Neurosecretory cells and Neurosecretion; Neurosecretion in Insects; Pheromones</p>	
Unit V	<p>Reproductive System a) Patterns of Animal Reproduction: Asexual and Sexual i) Sexual Reproduction; Male Reproductive System- Spermatogenesis, Transportation of sperm, Composition of Semen; Female Reproductive System- Puberty; Oogenesis; Graafian Follicles; Menstrual cycle; Ovulation; Fertilization; Implantation; Oestrus Cycle: b) Hormonal Control of Reproductive Cycle; Menopause; c) Hormonal Control of Pregnancy; Parturition; d) Hormonal Control of Lactation</p>	12
Unit VI	<p>Sensory Physiology a) Sensory coding - Transduction, Relationship between Stimulus Intensity and Response, Central control of Sensory Reception; b) Chemoreception - Gustation and Olfaction; c) Thermoreceptors and Infrared reception; d) Mechanoreception, Mechanotransduction - Invertebrate and vertebrate Mechanoreceptors - Muscles spindle, e) Acoustico lateralis System, f) Echolocation; g) Electroreception; h) Magnatoreception</p>	08
	Total	60
Suggested Readings	<p>Prakash S Lohar: Endocrinology-Hormones and Human Health, MJP Pulishers, Chennai</p> <ul style="list-style-type: none"> • G. J. Tortora: Principle of Anatomy and Physiology • Hoar: General and Comparative physiology • Dr. P.V. Jabade: General Physiology • B.K. Berry: Animal Physiology • C.C. Chatterjee: Human Physiology • Goel and Shastri: Textbook of Animal Physiology • K.S. Nelson: Animal Physiology • Holurn: Principles of Physiology and Biochemistry • Bell and Davidson: Textbook of Physiology and Biochemistry • Harper, Physiological chemistry • Mariakuttikan N. Arumugam: Animal Physiology • Itta Sambasiviah, A. P. Kamalakara Rao, S. Augustiane Chellappa: A Textbook of Animal Physiology and Ecology 	

MSc II Sem IV Core Courses		
Zoo 403 Practical correspond to Zoo - 401 (A) Animal Physiology II		
	Program specific objective <ul style="list-style-type: none"> • To understand the process of determining GFR • To analyse reflexes in man an sensivity • To understand process of ovulation, semen analysis 	Credits: 2
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • acquire the knowledge related to determination of GFR • gain the knowledge related to reflexes in man • understand the process of ovulation and semen analysis. 	
Practical	<ol style="list-style-type: none"> 1) To demonstrate the principle of dialysis. 2) Determination of GFR. 3) Determination of Nitrogenous Excretory Product – Uric acid 4) Reflexes in man. 5) Study of different types of muscles. 6) Super-ovulation in Rat. 7) To study the estrous cycle by vaginal smear method. 8) Assessing skin sensitivity - locating different receptors. 9) Study of Endocrine glands with the help of Slides/ Photographs 10) Qualitative estimation of hCG. 11) Perform Semen analysis (Motility, Sperm count, Morphology of sperm) 12) Isolation of Haemoglobin. 	

MSc II Sem IV Core Courses		
Zoo – 401 B: Reproductive Physiology-II		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To learn about the various aspects of reproductive physiology and events. • To acquire a broad understanding of the hormonal regulation of physiological processes. • To create awareness of new technologies in assisted reproduction as well as contraceptive methods. • To build healthy society by providing proper knowledge related to reproductive aspects. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • Understand the functioning of male and female reproductive systems particularly in humans. • Comprehension of the interplay of various hormones in the functioning and regulation of the male and female reproductive systems. • Know about infertility • Know about modern contraceptive devices 	Lectures 60
Unit	Topics	
Unit I	Fertilization- <ul style="list-style-type: none"> • Ejaculation, Insemination, • Gamete transport (ovum and sperm) • Sperm capacitation and activation • Entry of sperm into ovum, Acrosomal reaction, Activation of ovum • Significance of fertilization • Early development:- Early cleavages, blastomeres 	12
Unit II	Implantation and Pregnancy <ul style="list-style-type: none"> • Morphological and physiological relationship between blastocyst and uterus during implantation. • Abnormal implantation • Hormonal changes during pregnancy. • Ectopic pregnancy and pseudo pregnancy • Role of Hormones during Pregnancy:- Progesterone hCG, HPL, relaxin 	12
Unit III	Placenta, Parturition and Lactation <ul style="list-style-type: none"> • Formation and development of placenta • Histological structure of placenta • Endocrine functions of placenta Parturition <ul style="list-style-type: none"> • Initiation of labour • Properties of uterine muscles • Process and factors involved in parturition Lactation <ul style="list-style-type: none"> • Development of mammary gland • Hormonal control on the Functions of mammary gland 	12

	<ul style="list-style-type: none"> • Lactogenesis 	
Unit IV	<p>Reproductive Health</p> <ul style="list-style-type: none"> • Definition, Reproductive Health Care programme • Goals of RCH programme • Birth Control Methods • A) Natural Temporary methods :- Safe period, Coitus inerruptus, Lactational amenorrhea • B) Male and female contraceptives with their Advantages and disadvantages :- Chemical means, Mechanical means (Barrier), Physiological devices(Oral pills), Birth control Implants • C) Permanent method: - Tubectomy, Vasectomy 	12
Unit V	<p>Problems and Remedies related to Reproduction</p> <ul style="list-style-type: none"> • MTP (Medical Termination of Pregnancy) • Amniocentesis , PNDT Definition and Legal acts • Sexually Transmitted Diseases:- Syphilis, Gonorrhoea • Male and female infertility(sterility) • Artificial/assisted reproductive techniques :- IVF, GIFT, ZIFT, ICSI, AI, IUI, Surrogacy, Sperm bank. 	12
Suggested Readings	<ul style="list-style-type: none"> • Prakash S Lohar, 2012 – Endocrinology Hormones and Human Health, MJP Publishers, Chennai • P. J. Hogarth, 1978- Biology of Reproduction Wiley, New York. • J. S. Perry, 1971- The Ovarian cycle of animals, Oliver and Boyed. • C.R. Austin and R. V. Short, 1972 Reproduction in Mammals, Vol. 1-8, Cam. Uni. Press. • P. Gibian and E.J. Platz, eds, 1970- Mammalian Reproduction, Springer Verlag. • Robert H. Williams, 1981 – Text book of Endocrinology, W. B. Saunders Company • Chandi Charan Chatterjee, 1985 – Human Physiology Vol.II Tenth Edition, Medical Allied Agency, Calcutta, India. • Arthur J. Vander, James H. Sherman and Dorothy S. Luciano – Human Physiology, • Mcgraw-Hill International Editions, Biological Sciences Series. • Nalbandov, A. V.- Reproduction Physiology. 	

MSc II Sem IV Core Courses		
Zoo 403 Practical correspond to Zoo - 401 (B) Reproductive Physiology II		
	<p>Program specific objective</p> <ul style="list-style-type: none"> • To know different stages of embryonic development • To study placenta and types of contraceptives • To estimate biochemicals associated with reproduction 	Credits: 2
	<p>Program specific outcomes</p> <p>After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • acquire the knowledge related to embryonic development • gain the knowledge related to histology of placenta and types of contraceptives • Estimate biochemicals associated with reproduction. 	
Practical	<ol style="list-style-type: none"> 1. Study of various stages of development of mammalian egg, cleavage, blastula, gastrula. 2. Study of histological slides of placenta. 3. Study of types of contraceptives. 4. Demonstration of surgical operation in rat/mice- tubectomy. 5. Demonstration of surgical operation in rat/mice- vasectomy. 6. Collection of Mammalian sperms. 7. Pregnancy test (immunological) 8. Estimation of total gonadal (testis) cholesterol from rat/mice. 9. Estimation of total adrenal cholesterol from rat/mice. 10. Estimation of Ascorbic acid from Ovary / Testis. 11. Estimation of Protein from Ovary / Testis by Lowry's method 12. Estimation of Glycogen from Ovary / Testis by Anthrone Method 	

MSc II Sem IV Core Courses		
Zoo - 401: (C) Entomology II		
Insect Physiology and Applied Entomology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To develop a strong foundation in entomology, including understanding of the importance of insects to human society. • To know the process of digestion and metabolism, circulation, excretion, respiration, role of hormone in insect reproduction. • To familiarize the students with identification of insect pests, vectors and their control methods. • To develop a sufficient background for those students who wish to study more advanced entomological topics. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • Acquire the knowledge of process the process of digestion and metabolism, circulation, excretion, respiration, role of hormone in insect reproduction. • Understand the systematic position, habit and habitat of Insects pests. • Acquire the knowledge about morphology, physiology, ecology, behavior and physiology of insect pests. • Acquire the knowledge of identification of insect pests, vectors and their control methods. 	Lectures 60
Unit	Topics	
	Insect Physiology	
Unit I	A) Penetration of substances through cuticle B) Nutritional requirement and Mechanism of Digestion C) Circulation : a) Circulatory Mechanisms in Terrestrial and Aquatic insects b) Control of Heart beat D) Excretion in Terrestrial and Aquatic insects E) Respiration : a) Diffusion theory of respiration b) Respiratory Mechanisms in Terrestrial and Aquatic insects	12
Unit II	A) Physiological Properties of Insect Muscle B) Locomotion - Terrestrial, Aerial and Aquatic C) Neural Integration and Sense Organs D) Role of Hormones in Reproduction, E) Metamorphosis and Regeneration	12
	Applied Entomology	

MSc II Sem IV Core Courses		
Zoo - 403: Practical I (corresponding to Zoo 401 (C) Entomology II)		
Insect Physiology and Applied Entomology		
Total Hours: 60	<p>Program specific objective</p> <ul style="list-style-type: none"> • To develop a strong foundation in entomology, including understanding of the importance of insects to human society. • To know the process of digestion and metabolism, circulation, excretion, respiration, role of hormone in insect reproduction. • To familiarize the students with identification of insect pests, vectors and their control methods. • To develop a sufficient background for those students who wish to study more advanced entomological topics. 	Credits: 2
	<p>Program specific outcomes After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • Acquire the knowledge of process the process of digestion and metabolism, circulation, excretion, respiration, role of hormone in insect reproduction. • Understand the systematic position, habit and habitat of Insects pests. • Acquire the knowledge about morphology, physiology, ecology, behavior and physiology of insect pests. • Acquire the knowledge of identification of insect pests, vectors and their control methods. 	
	Insect Physiology	
	<ul style="list-style-type: none"> • Detection of chitin in insects • Detection of CaCO₃ in Malpighian tubules of cockroach • Study of haemocytes in insect haemolymph • Detection of Uric acid in Malpighian tubules of cockroach • Estimation of Amylase activity in alimentary canal of Cockroach • Counting of Heart beats of cockroach by using normal insect saline and effect of drugs, temperature on Heart beats 	
	Applied Entomology	
	<ul style="list-style-type: none"> • Study of insect pests of agricultural importance <ul style="list-style-type: none"> • Agricultural crop pests: Maize, Sugarcane • Pests of Vegetables: Bhendi, Brinjal, Cabbage • Pests of Fiber Crops: Cotton and Jute • Pests of Fruit Plants: Lemons, Mango, guava. • Pests Oil Seeds: Ground nut, Soyabean 	

	<ul style="list-style-type: none"> • Study of Insect Vectors of Man: Mosquitoes, House fly, Bedbug, Head louse • Study of Insect Pest of Cattle and Domestic Animals: Mite, Horn fly, Horse fly 	
	<ul style="list-style-type: none"> • Study of Stored Grain and Household Pests: Flour beetle, Rice weevil, Pulse beetle • Study of Forest Pests: Termites, Borers, Defoliators etc. • Study of Forensic Insects: Flesh fly, Blow fly • Compulsory Field Trip: To visit Agriculture University, Institute etc. 	
<p>Suggested Readings</p>	<ul style="list-style-type: none"> • Bursell E.: An Introduction to Insect Physiology, Academic Press Inc. New York, 1978 • Crop pests and how to fight them: Govt. of Maharashtra Pub. Bombay. • Pfadt R.E.: Fundamental of Applied Entomology, Mac Millan, New York, 2nd Ed.1971. • Pradhan S.: Insect pests of crop, NBY, New Delhi 1969. • Rock Stein M.: The Physiology of Insects by Vol. I- VI, Academic press London 1973-76. • Roy D. N. and A WA Brawn: Entomology, The Bangalore Printing and Publ. Co. Ltd. 1970. • Short JRI: Introduction to Applied Entomology, Longmans Green London 1963. • Simi KGV Trustees of Britmus London: Insects and other Arthropods of Medical importance, 1973. • Wigglesworth V. B.: The principles of Insect Physiology, Chapman and Hall Ltd. London. 7th Ed. 1972. 	

M. Sc. II: Semester IV Core Courses		
Zoo 401 (D) Helminthology-II		
Total Hours: 60	Program specific objective 4. The programme has been designed in such a way so that the students get the flavour of classical and modern aspects of Zoology/Animal Sciences. 5. It aims to enable the students to study Heminthology-II as a core course. 6. The lab courses have been designed in such a way that students will be trained to join public or private labs.	Credits: 4
	Program specific outcomes The student at the completion of the course will be able to: ➤ Understand the Heminthology-II. ➤ Know about the classification of Nematodes. ➤ To be familiar with the life cycle of various nematodes ➤ Students learn about the Nature, pathogenicity and prevention of ecto and endoparasites. ➤ Their identification, nature of damage control of these nematodes.	Lectures 60
Unit	Topics	
Unit 1	1. General control measure of endo-parasites. Chemical, Biological, Physical/ Mechanical, Culture and Legislative. 2. Economic importance of parasites, direct or indirect effect on human, animal, farm animals and agriculture, poultry and fisheries pathogenicity. 3. General pattern of parasitic transmission. 4. Parasitic zoonosis.	14
Unit 2	Study of medically and veterinary important Parasitic Nematodes. a. Intestinal nematodes infective in egg stage. b. Intestinal nematodes infective in larval stage. c. Blood & tissue dwelling nematodes	08
Unit 3	1. Feeding and nutrition's in Nematodes. 2. Reproductive system in male, female, fertilization, development and hatching of eggs. 3. Molting and Development in nematodes. 4. Different life cycle patterns in Nematodes. 5. Morphology, life cycle, pathogenicity, control and Prevention of following types. a. <i>Strongyloides stercoralis</i> b. <i>Wuchereria bancrofti</i> c. <i>Trichenella spiralis</i> d. <i>Trichuris trichura</i> e) <i>Dracunculuc medinensis</i>	16
Unit 4	1. General organization and Outline classification of plant Nematodes. 2. Feeding habits and modifications in anterior region. 3. Symptoms of Nematode injuries to plants (above ground. below ground)	10

Unit 5	<ol style="list-style-type: none"> 1. Controlling nematode diseases of plants (Cultural, biological, chemical, physical, legislative) 2. Life cycle studies of followings <ol style="list-style-type: none"> a. Root knot Nematodes (<i>Meloidogyne</i>) b. Citrus Nematodes (<i>Tylenchulus</i>) c. Bud and leaf Nematodes (<i>Aphelenchoides</i>) d. Seed gall Nematodes (<i>Anguina</i>) 	12
Suggested Readings	<ol style="list-style-type: none"> 1. Text book of medical Parasitology - Dey 2. Structure of Nematode - Allen bird 3. An introduction to Nematodology - Chitwood 4. Organization and Biology of nematodes -Crool 5. Physiology of nematodes - Lee 6. Principal of Nematodology - Throne 7. Applied Parasitology - Hiware, Jadhav and Mohekar 8. Physiology of nematode parasite - Smith 9. Animal Nematodes from Indian Mammals - Nama, Shinde and Jadhav 10 Vertebrate Nematodes - York and Mapelston 11. Physiology of nematode parasites - Bee 12. Nematodes Parasites of domestic animal - Levine 13. Structure of Nematodes -Allen Bird 14. Biology of nematode - Crool 	

MSc II Sem IV Core Courses		
Zoo 403 Practical correspond to Zoo - 401 (D) Helminthology II		
Total Hours: 60	<p>Program specific objective</p> <ul style="list-style-type: none"> • To understand the process of Study the Collection, fixation and staining methods of nematodes • To understand key of Identification for nematodes. • To practice camera lucida for sketching of nematodes • To study the various types of nematodes in vertebrates 	Credits: 2
	<p>Program specific outcomes</p> <p>After successful completion of this course, students are expected to:</p> <ul style="list-style-type: none"> • Study the Collection, fixation and staining methods of nematodes • Understand key of Identification for nematodes. • Practice camera lucida for sketching of nematodes • Study the various types of nematodes in vertebrates 	
Practical	<ul style="list-style-type: none"> • Techniques for collection and Fixation of nematodes from various hosts. • Basic techniques of preservation and mounting of Nematodes. • Identification of collected nematodes. • Sketching of the nematodes with the help of Camera Lucida • Examination of fecal sample of sheep, goat and chicken for different helminthes ova and their identification. • Study of permanent whole mount slides: (At least 8). • Submission of permanent slides at the time of examination. • Visit to veterinary and medical parasitology laboratory 	

MSc II Sem IV Core Courses		
Zoo – 402: Molecular Biology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To understand the basic structure of cells, tissues and their working system. • Know the handling skill in laboratory methods of estimation, determination, working of cells and their molecules. • Use of binocular research microscope and bioinstrumentation in laboratory. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • Acquire skills related to molecular analysis of biological species, cells and tissues. • Predict the outcome of various cellular reactions carried out in cell and cellular system under various conditions. • Predict the role of genes and its relevance to human genetics and diseases. 	Lectures 60
Unit	Topics	
Unit I	DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms	12
Unit II	RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport	12
Unit III	Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proofreading, translational inhibitors, post- translational modification of proteins.	12
Unit IV	Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing	12
Unit V	Tools and Techniques in Molecular Biology. i. Polymerase chain reaction (PCR); ii. Electrophoresis- PAGE, SDS - PAGE and Agarose gel electrophoresis. iii. Blotting techniques: Southern, Northern and Western blotting iv. ELISA technique and v. DNA finger printing	12
Suggested Readings	<ul style="list-style-type: none"> • Prakash S. Lohar : Cell and Molecular Biology, MJP Publishers, Chennai 	

	<ul style="list-style-type: none"> • Gerald Karp: Cell and Molecular Biology, John Wiley and Sons International, London • H.S. Bhamrah: Molecular Cell Biology • J.D. Watson: Molecular Biology of the gene • P.K. Gupta: Cell and Molecular Biology 	
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MSc II Sem IV Core Courses		
Zoo 403 Practical correspond to Zoo - 402 Molecular Biology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To know process of making paper model of DNA • To estimate DNA and demonstrate vital staining • To understand the process of AGE and PAGE 	Credits: 2
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • acquire the knowledge related to preparation of DNA model • learn the process of estimation of DNA and vital staining • understand the process of AGE and PAGE. 	
Practical	<ol style="list-style-type: none"> 1. Study of cell fractionation (D) 2. Preparation of Paper Model of DNA (D) 3. Extraction of DNA from rat liver/ Spleen (E) 4. Estimation of DNA from suitable material by Diphenylamine reagent. (E) 5. Estimation of RNA from suitable material by Orcinol reagent. (E) 6. Vital staining of mitochondria by using Janus Green B stain. (E) 7. Preparation of salivary gland chromosome from Chironomus / Drosophila larva. (E) 8. Isolation of Genomic DNA from suitable material. 9. Determination of Thermal melting point (T_m) of nucleic acid. 10. Isolation of plasmid DNA and detection by Agarose gel electrophoresis. 11. Detection of protein by PAGE and molecular determination. 12. Gene mapping in Prokaryotes problem. 	

MSc II Sem IV Zoo 404: Project

(Credit 4)

Project on suitable topic should be given to each student in the beginning of 3rd Semester and through the year work should supervised and finally Project Report with following points should be typed, bind (at least 30 pages) and submitted to department before final examination (4th Semester).

Title of the Project: Define a short, significant title which reflects clearly the contents of the report.

Abstract: Succinct abstract of less than one page.

Table of content: The table of content lists all chapters (headings/subheadings) including page number.

Introduction: Explain why this work is important giving a general introduction to the subject, list the basic knowledge needed and outline the purpose of the report.

Background and results to date: List relevant work by others, or preliminary results you have achieved with a detailed and accurate explanation and interpretation. Include relevant photographs, figures or tables to illustrate the text. This section should frame the research questions that your subsequent research will address.

Aims and Objectives : List the main research question(s) you want to answer. Explain whether your research will provide a definitive answer or simply contribute towards an answer.

Methodology: Explain the methods and techniques which will be used for your project depending on the subject: field work, laboratory work, modeling technique, interdisciplinary collaboration, data type, data acquisition, infrastructure, software, etc.

Discussion / Conclusion: Explain what is striking/noteworthy about the results. Summarize the state of knowledge and understanding after the completion of your work. Discuss the results and interpretation in light of the validity and accuracy of the data, methods and theories as well as any connections to other people's work. Explain where your research methodology could fail and what a negative result implies for your research question.

Acknowledgement: Thank the people who have helped to successfully complete your project, like project partners, tutors, etc.

Reference & Literature (Bibliography): List papers and publication you have already cited in your proposal or which you have collected for further reading. The style of each reference follows that of international scientific journals.

Appendix: Add pictures, tables or other elements which are relevant, but that might distract from the main flow of the proposal

MSc II Sem IV Elective Course (Any one from A,B and C)		
Zoo – 405 (A): Zoogeography		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • The course is designed to provide students with an understanding of zoogeography, the study of the spatial patterns, or geography, of animals. • Examine environmental and zoogeographic patterns • Develop an understanding of the influence of earth history and basic zoogeographic processes on animals • Explore the application of zoogeography to conservation of animals • The course will finish by applying this knowledge to an understanding of current issues in biodiversity. 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • show mastery in the broad areas of environmental factors and their variation on various spatial and temporal scales • learn ecological and evolutionary biogeography, and application of such knowledge to conservation biology. 	Lectures 60
Unit	Topics	
Unit I	Introduction to Zoogeography <ul style="list-style-type: none"> • History. Concepts- Zoogeography. • Definitions, Nature, Scope, Principles, Disciplines – Geography, Plant ecology and evolution, Geology, Ethnology • Environmental and geographical settings Physical Setting: the Geographic Template • The Changing Earth, continental drift. 	12
Unit II	The Geography of Communities <ul style="list-style-type: none"> • Distributions of communities • Glaciation and its biotic effects • Glaciation and Biogeographic Dynamics of the Pleistocene • Speciation and its geographical context Endemism, cosmopolitanism, and disjunction • Classification and Mapping of Animals Classification of animals according phylum Protozoa, Coelenterata, Platyhelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, Chordate. • Factors of animal mapping: Shape of area, Structure of area, Ecology of area, History of area, Relict area, Geography of area, Dynamic of area, Community area, areas of Aquatic animals. 	12

Unit III	<p>Dispersal and Immigration</p> <ul style="list-style-type: none"> • Animal Dispersal :- Factors of Animals dispersal: – Climate, Vegetation, Physical barriers, other animals. • Types of Animals dispersal- Active, Passive, Gradual, Rapid, Seasonal, Forced, Anthropogenic. • Barriers of Animals dispersal – Physical, climatic, biological Water, Ecological, Living environment, Time and distance. • Modes of dispersal • Dispersal routes of faunas. 	12
Unit IV	<p>The Geography of Diversification</p> <ul style="list-style-type: none"> • Types of distribution of animals- Areography, Ecogeographic Rules, and Diversity Gradients • The Distribution of Species: Ecological Foundations • Distributions of single species, • Types of Distribution continuous discontinuous Bipolar. • Bathymetric distribution- Geobiotic Limnobiotic Holobiotic. • Theories of distribution of animals climatic and evolution theory of Matthew, age and area theory of Willis • Zoogeographical regions of the world with characteristic fauna (Distributional Regions and sub regions of animals)- Ethiopian, Australian, New world, Neartic, oriental, Palaeartic, Neotropical. Wallece’s line 	12
Unit V	<ul style="list-style-type: none"> • Eco- Geographic System Concept, Allen’s Eco-geographic system, evolution of new species and their causes, faunal main and sub-regions-land, aquatic. • Factors affecting on ecology of animals - light , weather , food , temperature, space, mobility, shelter, soil , plant formation and size of population. • Marine realm and characteristics . Biogeography and the Geography of Extinction Conservation Biogeography 	12
Suggested Readings	<ul style="list-style-type: none"> • Frank Evers Beddard (2008): A Text-Book of Zoogeography, Published by BiblioBazaar, • John R. Merrick (2006): Evolution and Biogeography of Australasian Vertebrates. Publisher • Savindra Singh (1997): Environmental science, Prayang Pustak Bhawan, Allahabad • Tiwari S.K. (1985): Zoo-Geography of India and South East Asia. International Book Dist. Dehra Dun. • Tiwari, S. K Wallace.(2006): Fundamentals of World Zoogeography. Vedams eBooks (P) Ltd (India) • Wallace A.R., (1962): The geographical distribution of animals. Hafner Publ. Co. • Illies, J .1974 .Introduction to zoogeography .Macmillan . • International commission for zoological Nomenclature(ICZN). 1999 . International code of zoological Nomenclature. Nature History Museum Cromwell Road, London S W 7 5BDUK • .Kapoor, v.c Theory and practice of Animal Taxonomy Oxford –IBH publishing co., N Delhi ,Mumbai & Kolkata . • Mayer , E. Principles of systematic zoology . Mc-Graw Hill publication, New Delhi Simpson , G.C. Principles of Animal Taxonomy. Oxford –IBH publishing co, New Delhi 	

MSc II Sem IV Elective Course		
Zoo – 405 (B): Writing and Presenting Scientific Research Paper		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To understand the process of writing, presentation and publication of research paper • To learn the skills related to presentation of paper • To avoid the mistakes in writing research paper 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • acquire the knowledge of writing, presentation and publication of research paper • gain the skills related to presentation of paper • learn to avoid the mistakes in writing research paper 	Lectures 60
Unit	Topics	
Unit I	Introduction to writing research project purpose of writing research report of dissertation and thesis, style and structure of research report, preliminary section. Review of Literature Purpose, method and Types: Argumentative, Integrative, Historical, Methodological, systematic and theoretical.	12
Unit II	Writing a research report: Main body of the report, - introduction, review of literature, methods of study, results and analysis of data, summary, suggestion, conclusion of data and reference section. General precautions , editing and correction, final evaluation of research report, IMMRAD pattern of research report.	12
Unit III	Use of visual aid for effective presentation: Power point presentation: Synopsis, summary, abstract, tables, graphs, Summary, References, Acknowledgement	12

	Poster presentation: Appropriate size of the poster with Title, author, affiliation, introduction material and methods, results, summary selection of appropriate font size, table, figure, etc	
Unit IV	Common mistakes in writing scientific paper <ul style="list-style-type: none"> • Unclear aim • Structure of the manuscript is confusing • Methods without enough details • Wrong statistic used • Sections are mixed up • Conclusions do not match with present results • Writing inaccurate • Citations/references are incomplete 	12
Unit V	Guidelines for paper publication: <ul style="list-style-type: none"> • Formatting of the paper as per rules of journal • Guidelines for Author. • Submission of Article. • Assigned Reviewers. • Decision by Reviewers. • Reviews to the Author. • Updated Paper Received. • Feedback. 	12
Suggested Readings	<ul style="list-style-type: none"> • Dr. Nageshwar Rao and Dr. Rajendra P. Das: Communication Skills, Himalaya Publishing House 2005 • Margerson, J.E.: The Art of effective communication, Excel Books New Delhi • Richard, W. Clark and Barbara, L. Clinton: Effective Speech Communication, MacMillan, Mac Graw Hill, New York, 1999 • N. Gurumani, Research Methodology for biological sciences, MJP publishers, Chennai • Gopen, G.D. and Swan J.A. The Science of Writing, American Scientist, 1990 • Hall, G.M. How to write a paper, By Word publication, 1996 	

MSc II Sem IV Elective Course		
Zoo – 405 (C):Computational Biology		
Total Hours: 60	Program specific objective <ul style="list-style-type: none"> • To get introduced to the basic concepts of Computational biology • To overview about types of Biological data and database search tools. • To acquire knowledge about computational tools for Proteomics and Genomics 	Credits: 4
	Program specific outcomes After successful completion of this course, students are expected to: <ul style="list-style-type: none"> • learn the basic concepts of Computational biology • gain knowledge about types of Biological data and database search tools. • acquire skill to use computational tools for Proteomics and Genomics 	Lectures 60
Unit	Topics	
Unit I	<ul style="list-style-type: none"> • Definition, Objectives and scope of Computational Biology • Application of Bioinformatics in various Fields. • Concept of Biological database • Types and significance of biological database 	12
Unit II	<ul style="list-style-type: none"> • Concept of Sequence alignment • Types of sequence alignment • BLAST, types and applications • FASTA, format and applications 	12
Unit III	<ul style="list-style-type: none"> • Proteomics : Definition and significance • Protein structure visualization tools • Protein sequence databases- • Protein folding and disorders • PDB and Protein microarray 	12
Unit IV	<ul style="list-style-type: none"> • Genomics: Definition and significance • Comparative, structural and functional genomics • DNA microarray • Human Genome Project 	12
Unit V	A)Computational analysis of the genomics of <ul style="list-style-type: none"> • <i>Escherchia coli</i> • <i>Drosophila melanogaster</i> • <i>Rattus rattus</i> B) GenBank, DDBJ, EMBL	12
Suggested Readings	<ul style="list-style-type: none"> • Attwood, T.K., Michie, A.D. and Jones, M.L. (1996): DbBrowser: integrated access to database worldwide. <i>TiBS</i>. Vol. 21(5), 191. • Barnes, M.R. and Gray, I.C.(2003) eds., <i>Bioinformatics for Geneticists</i>, first edition. Wiley,ISBN 0-470-84394-2 • Prakash S.Lohar (2011) <i>Bioinformatics</i> ISBN 978-81-8094-066-8 MJP Publishers, Triplicane, Chennai. • Lesk, A.M. (2001): <i>Introduction to Protein Architecture: The Structural Biology of Proteins</i> (Oxford: Oxford University Press). • Pocock,M.R. et al. (2000) BioJava: open source components for bioinformatics. ACM SIGBIO 	

Paper Code	Old Courses 2018-19	Paper Code	New Courses 2022-23
Semester III			
ZOO 301 (Any one from A,B,C,and D) Specialized paper	(A) Entomology I or (B) Animal Physiology I (C) Reproductive Physiology I (D) Helminthology I	ZOO 301 (Any one from A,B,C,and D) Specialized paper	(A) Animal Physiology I (B) Reproductive Physiology I (C) Entomology I (D) Helminthology I
ZOO 302	Immunology and Molecular Biology	ZOO 302	Enzymology and Immunology
ZOO 303	Genetics	Elective course ZOO 303 (Any one) Audit Course	Animal Behaviour Forensic Zoology Endocrinology Any one
		AC-301A	Computer Skills
		AC-301B	Cyber Security
		AC-301C	Seminar + Review Writing
		AC-301D	Biostatistics
ZOO 304	ZOO 304: Practical 301 + 302	ZOO 304	Practical I: Zoo 301
ZOO 305	ZOO 305: Practical 302 + 303	ZOO 305	Practical II: Zoo 302
		AC-301 Audit Course	Any one
		AC-301A	Computer Skills
		AC-301B	Cyber Security
		AC-301C	Seminar + Review Writing
		AC-301D	Biostatistics
Semester IV			
ZOO 401 (Any one from A,B,C,and D) Specialized paper	(A) Entomology II or (B) Animal Physiology II or (C) Reproductive Physiology II or (D) Helminthology II	ZOO 401 (Any one from A,B,C,and D) Specialized paper	(A) Animal Physiology II (B) Reproductive Physiology II (C) Entomology II (D) Helminthology II
ZOO 402	Systematic and Evolutionary Biology	ZOO 402	Molecular Biology
ZOO 403	Skill in Communication and Writing Research Paper	ZOO 403 Elective (Select any one)	A) Zoogeography B) Writing scientific research paper C) Computational Biology
ZOO 404	ZOO 404: Practical 401 + 402	ZOO 404	Practical I: Zoo 401 + Zoo 402
ZOO 405	ZOO 405: Practical 402 + 403	ZOO 405	Project
		Audit Course	Any one
		AC-401A	Human Rights
		AC-401B	Current Affairs
		AC-401C	Seminar + Review Writing
		AC-401D	Intellectual Property Rights (IPR)

