

Anekant Education Society's

**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &
COMMERCE, BARAMATI, DIST – PUNE.**

AUTONOMOUS



POST GRADUATE DEPARTMENT OF ZOOLOGY

SYLLABUS

M.Sc. Zoology Part-II, SEMESTER-III

ACADEMIC YEAR 2020-2021

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &
 COMMERCE, BARAMATI.**
 AUTONOMOUS

**Scheme of Course Structure (CBCS) Faculty of Science
 Post Graduate Department of Zoology
 SEMESTER III**

Class: M.Sc. II

Pattern: 40 (IA) + 60 (EA)

Sr. No.	Code	Paper	Paper Title	Credit	Exam.	Marks
1	ZOO: 5301	Theory	Entomology- I/ Animal Physiology I/ Genetics I	4	I / E	40 + 60
2	ZOO: 5302	Theory	Insect Physiology, Biochemistry and Ecology	4	I / E	40 + 60
3	ZOO: 5303	Theory	Mammalian Reproductive Physiology and Histology & Histochemistry	4	I / E	40 + 60
4	ZOO: 5304	Theory	Economic Zoology	4	I / E	40 + 60
5	ZOO: 5305	Zoology Practical-5	Practicals Corresponding to : ZOO:5301, ZOO:5302	4	I / E	40 + 60
6	ZOO: 5306	Zoology Practical-6	Practicals Corresponding to : ZOO:5303, ZOO:5304	4	I / E	40 + 60
7	CC-23	Certificate Course - II		2	-	
8	SD-23	Skill Development- I		2	-	

IA* - Internal Assessment

EA*- External Assessment

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)

Paper Code: ZOO: 5301

Paper: I **Title of Paper:** Entomology- I

Credit: 4 **No. of Lectures:** 60

Learning Objectives:

- To understand the classification of Insecta.
- To be conversant with scientific literature, especially related to insect biology.
- To know and use fundamental concepts in Entomology.
- To articulate positive and negative impacts of insects on human society and economy.

Learning Outcomes:

After successful completion of this course, students are expected to:

- Know the Systematics of class Insecta.
- Have a good understanding of the primary concepts in Entomology
- Get well prepared for research in Entomology under life sciences.
- Understand socio-economical interactions of insects with human

Topic No.	TOPICS / CONTENTS	Lectures
1.	Introduction to Entomology: Definition, Origin, Evolution and Inter-relationship of insects with other arthropods.	03 L
2.	General outline of Classification and Phylogeny of insects: 2.1. Apterygote insects (1-4 orders), 2.2. Exopterygote insects (5-20 orders) and 2.3. Endopterygote insects (21-29 orders).	20L
3.	Integument and its derivatives.	02L
4.	Comparative study of insect appendages: 4.1. Head and its appendages; 4.2. Thorax and its appendages; 4.3. Abdomen and its appendages	08L
5.	Comparative and histological studies of the following systems: 5.1. Digestive system, 5.2. Respiratory system, 5.3. Circulatory system, 5.4. Excretory system, 5.5. Reproductive system and 5.6. Nervous system	20L
6.	Studies of the following systems: 6.1. The Sense organs, 6.2. Endocrine glands and 6.3. Exocrine glands	05L
7.	Light and sound producing organs.	02L

REFERENCES

- Imms' Text book of Entomology- By O. W. Richards and R. G. Davies, (Methuen & Co., London,), Vols. I & II.
- Principles of Insect Morphology- By R. E. Snodgrass, (Tata, McGraw- Hill, Bombay,
- Introduction of Comparative Entomology- By R. M. Fox & J. W. Fox, (Reinhold, New York,).
- The Insect: Structure & Function- By R.F. Chapman (E. L.B.S., & E.U.P. London).
- General & Applied Entomology- By K.K. Nayar, T.N. Anathakrishnan & B.V. David, (Tata, McGraw-Hill, New Delhi,).
- A Text book of Entomology' by H. H. Ross (John Wiley and Sons, Ins. New York,).

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)
Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)
Paper Code: ZOO: 5301
Paper: I **Title of Paper:** Animal Physiology I
Credit: 4 **No. of Lectures:** 60

Learning Objectives:

- To understand the bioluminescence and electricity physiology of animals.
- To understand the roles and functioning excretory organ systems and osmoregulation.
- To learn the biological membrane dynamics and energy metabolism in animals.

Learning Outcomes:

After successful completion of this course, students are expected to:

- Understand functioning of Excretion via kidneys and other excretory organs of animals.
- Understand the physiology of membrane and physiological aspects of metabolism.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Bioluminescence and Animal electricity: 1.1. Bioluminescence: Phyletic distribution, structure of luminescent organs, biochemical and molecular mechanism 1.2. Animal electricity: electro receptors electro organs and their structure	10 L
2.	Buoyancy: definition, density reduction, gas floats with examples swim bladder with example	07 L
3.	External and Internal environment: 3.1. External environment: the atmosphere, aquatic & terrestrial environment 3.2. Internal environment: Extracellular and intra cellular environment 3.3. Homeostasis and regulation: tolerance and resistance, acclimatisation and acclimation, regulatory mechanism. 3.4. Biological clock and their regulation: Circadian rhythms lunar and tidal rhythm, circa annual rhythm, photo periodism.	07 L
4.	Membrane physiology 4.1. Membrane structure, membrane permeation, diffusion mediated transport, dynamics of semi permeable membrane. 4.2. Resting membrane potential, diffusion, equilibrium potential, Goldman-Hodgkin-Katz potential, conductance, current, capacitance 4.3. Excitable cell membrane: action potential, role of various ion channels, role of Na ⁺ K ⁺ pump, properties of action potentials	10 L
5.	Energy metabolism: 5.1. Metabolic rate 5.2. Energy storage: Fat and glycogen 5.3. Effect of O ₂ concentration: acclimation to low O ₂ level, anaerobic metabolism, lactic acid and glycolysis 5.4. Problem of diving and deep sea hydro thermal vent 5.5. Metabolic rate and body size: mammals, birds, marsupials & monotremes 5.6. Energy cost of locomotion: running, swimming, flying 5.7. Effect of high altitude	15 L
6.	Excretion: 6.1. Nitrogenous waste- ammonia and its excretion, urea, urea cycle, uric acid and its excretion, products of nucleoprotein metabolism, miscellaneous end product of nitrogen metabolism. 6.2. Organ of excretion and urine formation 6.3. Renal regulation and acid–base balance	06 L
7.	Osmoregulation: Maintaining water and electrolyte balance and its regulation in: 7.1. Fresh water: Invertebrates & vertebrates, 7.2. Terrestrial: Moist skinned animals, arthropods & vertebrates and 7.3. Marine: Invertebrates & vertebrates & air breathing vertebrates	05 L

REFERENCES

1. Guyton A.C and Hall J.E, Text book of medical physiology, Hartcortbracc and co. Asia Pvt.Ltd., Singapore.
2. Baldwin, E. An introduction to Comp. Biochemistry. Cambridge.
3. Hill, R.W. & GA Wyse, .Animal Physiology. Harper & Row, NW.
4. Randall, D, W.Burggen & K, French. Eckert Animal Physiology: Mechanism and adaptation, W H Freeman, NY
5. Schmidt-Nielsen, Animal Physiology: Adaptation and Environment. Cambridge.
6. Hoar, W S General and Comparative physiology. Prentice Hall, India, New Delhi.
7. Vernberg, F.J. &Vernberg, W B. Animal and the environment. Holt, Rienhart &Winston, NY.
8. Prosser and Brown. Comparative physiology.

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)
Paper Code: ZOO: 5301
Paper: I Title of Paper: Genetics I
Credit: 4 No. of Lectures: 60

Learning Objectives:-

- To understand the genetics of model organisms.
- To understand the genetics behind evolution.
- To learn the molecular biology techniques and methods of genetic analysis.

Learning Outcomes:-

After successful completion of this course, students are expected to:

- Understand genomics and genetics of model organisms.
- Understand the evolution from genetics point of view.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Model Genetic System: Life cycles and advantages of the following organisms commonly used in genetic studies 1.1. T4 and T1 phages 1.2. <i>Neurospora</i> 1.3. <i>E. coli</i> 1.4. <i>Saccharomyces cerevisiae</i> and <i>Schizosaccharomyces pombe</i> 1.5. <i>Caenorhabditis</i> 1.6. <i>Drosophila</i> 1.7. Zebra fish 1.8. Mouse	08 L
2.	Advanced Population Genetics: 2.1. Recapitulation of basic concepts and H-W law 2.2. Estimation of gene frequencies in population through mutation, migration and selection, selection-mutation equilibrium, derivation and genetic equations for above. 2.3. Assortative matings, inbreeding, genetic drift	13 L
3.	Evolutionary genetics: Part - A: 3.1. Concept of continuous variation, phenotypic variance and its partitioning into subcomponents. 3.2. Co-variance, correlation and regression, degree of genetic determination, measurement of heritability, quantitative inheritance in humans	13 L
4.	Evolutionary Genetics: Part - B: 4.1. Genetic polymorphism 4.2. Selection strategies and effects 4.3. Genetics of speciation- classical and modern concepts 4.4. Use of molecular information in understanding phylogenetic relationship	13 L
5.	Applications of Molecular methodologies in genetic analysis: 5.1. Introduction to gene localization on chromosomes 5.2. Chromosomal Probes and Paints 5.3. Gene Therapy: Ex vivo and In vivo gene therapy and two examples of gene delivery system 5.4. Reverse Genetics	13 L

REFERENCES

1. Strickberger, M.W., genetics, Edn III, Mac Millan.
2. Gardner, E.J., Simmons, M.J. and Snustad, D.P. Principles of genetics, John Wiley and Sons, NY,
3. Griffiths, A.J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. and Gelbert, W.M. An introduction to Genetics analysis. W.H. Freeman and Co. NY,
4. Trends in genetics, Elsevier Publication, Amsterdam.
5. Genetics: Analysis of Genes and Genomes, D.L. Hartl, E. W Jones, Jones and Bartlett Publ. 2009.
6. Genes X: Benjamin Lewin, Jones and Bartlett Publications 2014.

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
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Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)
Paper Code: ZOO: 5302
Paper: II **Title of Paper:** Insect Physiology, Biochemistry and Ecology
Credit: 4 **No. of Lectures:** 60

Learning Objectives:-

- To understand the physiology and biochemistry of insects organs and systems.
- To understand the processes like digestion, excretion and circulation of insects.
- To learn the ecological aspects of insects such as population dynamics, plant insect relationships etc.

Learning Outcomes:-

After successful completion of this course, students are expected to:

- Understand the insect physiology and biochemistry in depth.
- Have the knowledge of insect population dynamics and behavioral adaptations.

Insect Physiology, Biochemistry

Topic No.	TOPICS / CONTENTS	Lectures
1.	Integument: Structure, Chemistry, sclerotization, functions.	03 L
2.	Digestion and absorption of proteins, Carbohydrates and lipids.	03 L
3.	Fat body: Structure, physiology, biochemistry, functions. Integration of carbohydrate, fat and acid metabolism	04 L
4.	Ventilatory mechanisms and their control	03 L
5.	Haemolymph: Physico-chemical characteristics of plasma : types and structure of haemocytes, functions	03 L
6.	Muscle : structure, physiology and biochemistry of flight muscles	
7.	Excretion and water balance: Structure and function of Malpighian tubules. Water balance and nitrogen excretion.	04 L
8.	Microsomal and extramicrosomal enzymes insecticide degradation and detoxification.	03 L
9.	Endocrines, neurosecretory hormones, chemistry, function and mechanism of hormone action, moulting and juvenile hormones ; chemistry and physiology, other peptide and steroid hormones	04 L
<u>Insect Ecology</u>		
10.	Introduction to Insect ecology: History of ecology & Entomology Ecological associations, Insect and humans	05 L
11.	Insect and Climate: Temperature Photoperiod Rainfall, Wind and Climate change	05 L
12.	Insect Herbivores: Feeding strategies of herbivorous insects Plant defenses	05 L
13.	Natural enemies and insect population dynamics: The variety of Natural enemies Impact of enemies on insect populations The Concept of niche & competition among insects	05 L
14.	Insects in ecosystems: Fundamentals of ecosystem ecology, Leaf shredding insects, Insect defoliators & cycling of nutrients insect, plant Community: structure and successor	05 L
15.	Insect conservation: Threats to insects, Conservation and restoration, Prospects for insect conservation	05L

REFERENCES

1. Fundamentals of insect physiology, Blum N.S., John Wiley and sons, NY
2. An introduction to insect physiology, Bursell, e. academic press, NY
3. Insect biochemistry and function Candy D.J. and Kilby D.A. Chapman and hall, London
4. Comprehensive insect physiology, biochemistry and pharmacology, Kerkut G.A and Gilbert L.I., Vol. 1 to 13 Pergamum Press, Oxford, NY

Insect Ecology References

1. Insect Ecology, M.S. Mani,

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)
Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)
Paper Code: ZOO: 5303
Paper: III **Title of Paper:** Mammalian Reproductive Physiology and Histology & Histochemistry
Credit: 4 **No. of Lectures:** 60

SECTION- I: Mammalian Reproductive Physiology (30 L)

Learning Objectives:

- To understand the concept of mammalian reproduction
- To understand the role of hormones in reproduction
- To understand the concept of pregnancy, parturition and lactation
- To understand the causes of reproductive dysfunction and artificial control of reproduction
- To understand the different methods of microscopy and tissue preservation and the limits of magnification and resolution.
- To understand the structural organization the various types of muscles.
- Explain the scientific basis of tissue preparation and be able to apply that understanding to the practice of the subjects such as making films, spread and counting
- Mention and describe the different types of tissue.

Learning Outcomes:

After successful completion of this course, students are expected to:

- Create awareness about Sexual Transmitted diseases.
- Describe the changes that occur in the reproductive system over the lifetime of an individual.
- Identify the major hormones involved in reproduction and describe their role in regulating reproduction in males and females.
- Describe the processes that can lead to dysfunction of the reproductive system.
- Understand the general principles of Histochemistry.
- To gather hazardous materials information and will recognize and respond properly to potential hazards of handling chemicals and chemical waste.
- Able to design an experimental procedure.
- Explore career opportunities and participate in career and graduate school planning through organization and activities.

SECTION-I: Mammalian Reproductive Physiology (30 L)

Topic No.	TOPICS / CONTENTS	Lectures
1.	Reproductive organ: male and female gonads, duct systems and sex accessories, external sexual dimorphisms	03 L
2.	Reproductive patterns: Environmental factors and breeding, continuous and seasonal breeders	03 L
3.	Sexual cycles: puberty, oestrous and menstrual cycles. Ovarian event: follicular phase, cycling of non-pregnant uterus and vagina.	05 L
4.	Hormonal regulation: hypothalamus –pituitary and gonad axis; other hormones. Hypothalamic GnRH, pituitary gonadotropins, behavioural effects, testicular hormones, testosterone derivatives, inhibin, ovarian hormones: oestrogen, progesterone's feedback relationships	04 L
5.	Pregnancy: conception and blastocyst formation , implantation and delayed implantation, placenta: formation, types and functions, hormones in pregnancy	02 L
6.	Parturition: birth process and its neuroendocrine control, puerperium	03 L
7.	Lactation: mammary glands, milk synthesis, secretion. Hormonal regulation and suckling reflex.	03 L
8.	Reproductive dysfuctions: Aging and reproduction. Climacteric, anatomical, endocrine and genetic disorders.	03 L
9.	Artificial control of reproduction: increasing reproductive potential, Artificial insemination, <i>in vitro</i> fertilization and embryo transfer, induced breeding, synchronization of oestrus and ovulation, chemical and hormonal aspect, limiting reproductive potential, physical, physiological, surgical, chemical methods of contraception in male, female. Infertility: its causes and treatment, hormonal aspects	04 L

REFERENCES

1. Austin C.R. and short R V., reproduction in mammals Books 1-5, Univ. of Cambridge
2. Hogarth PH Biology of Reproduction, Blackie and Son, Glasgow, London.
3. Nalbandov, AV, Reproductive Physiology, Lea and Febiger, Philadelphia

Paper Code: ZOO: 5303
Paper: III **Title of Paper: Mammalian Reproductive Physiology and Histology & Histochemistry**
Credit: 4 **No. of Lectures:** 60

SECTION-II: Histology and Histochemistry (30 L)

Learning Objectives:

- To understand the different methods of microscopy and tissue preservation and the limits of magnification and resolution.
- To understand the structural organization the various types of muscles.
- Explain the scientific basis of tissue preparation and be able to apply that understanding to the practice of the subjects such as making films, spread and counting
- Mention and describe the different types of tissue

Learning Outcomes:

After successful completion of this course, students are expected to:

- Understand the general principles of Histochemistry.
- Gather hazardous materials information and will recognize and respond properly to potential hazards of handling Chemicals and chemical waste.
- Design an experimental procedure.
- Explore career opportunities and participate in career and graduate school planning through organization and activities.

SECTION-II: Histology & Histochemistry (30 L)

Topic No.	TOPICS / CONTENTS	Lectures
1.	Fundamentals of histology: Epithelial, connective, muscular, nervous and other specialized tissues.	05 L
2.	Tools in histology: Principles, design and functioning of microtomes, automated microtomes, ultra microtome, cryostat, problems and troubleshooting	03 L
3.	Techniques in histology: Sample preparation, obtaining tissue samples, handling reagents, fixatives (types of fixatives and effect on tissue), processing of fixed samples, dehydration(procedure and significance), embedding, block making, staining(staining methods histochemical and immunohistological methods), dyes and dye binding reactive groups, mordants and mordanting, temporary and permanent preparations, whole mount preparation	07 L
4.	Fundamentals of histochemical techniques: principle and practice, detection of glycogen, neutral and acid mucopolysaccharides, detection of basic proteins, detection of specific and nonspecific lipids, detection of nonspecific esterases, detection of acid /alkaline phosphatase.	15 L

REFERENCES

1. Text book of Histology Roland lesson DL. WB Saunders Company, Tokyo.
2. Histology: Roland lesson and Thomas Leesan WB Saunders company Co., Canada
3. Histochemistry Vol. I II III A G E Pearse Churchill Livingstone NY

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)

Paper Code: ZOO: 5304

Paper: IV Title of Paper: Economic Zoology

Credit: 4 No. of Lectures: 60

Learning Objectives:

- To know the role of protozoans in human welfare.
- To understand various cultivation methods.
- To understand different industries with their roles.
- To study and understand animals used in pharmaceuticals.
- To know the importance of wildlife and its conservation.

Learning Outcomes:

After successful completion of this course, students are expected to:

- Understand the role of different cultures in day to day life.
- Understand the different industries with economic profit.
- Develop ability to start their own farms.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Parasitic protozoans and their role in human welfare, soil protozoans and their role in agriculture.	04L
2.	Sponge culture and its importance in industry	02L
3.	Concept of Coral reef and its significance	04L
4.	Helminthes as human and animal parasites	02L
5.	Nematodes- parasitic roundworms of animals and plants	02L
6.	Vermiculture industry in India	04L
7.	Household insects, Apiculture, Lac culture, Sericulture, Prawn culture, Pearl Culture, Fish Culture, Insects of commercial value and stored grain pests	18 L
8.	Economic importance of amphibian, reptiles, birds and mammals	04L
9.	Poultry, Piggery, Dairy industry, wool industry and fur industry, fish industry and byproducts of fishing industry.	14L
10.	Model animals in pharmaceutical industry	04L
11.	Wild Life in India and its conservation	02L

REFERENCES

- 1) *Economic Zoology-Shukla and Upadhyay*
- 2) *Economic Zoology-P.D.Srivastava*
- 3) *Economic Zoology-Manju Yadav*
- 4) *Economic Zoology-K.R.Ravindranathan*
- 5) *Textbook of Economic Zoology- P.R.Venkitaraman*

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class:	M.Sc. II (Semester– III)
Paper Code:	ZOO: 5305
Paper: V	Title of Paper: ZOOLOGY PRACTICAL - 5 (Based on Courses: ZOO: 5301, ZOO: 5302)
Credit: 4	No. of Lectures: 60

Section I: Practical based on: ZOO: 5301– Entomology- I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Methods of collection, preservation & presentation of insect.	01P
2.	Study of generalized insect including Systematic position, Habit and Habitat, Important morphological features and Dissection of so as to study: Digestive. Nervous and Reproductive system and Retro-cerebral complex.	03P
3.	Study of head capsule, mouthparts and antenna and their modification.	02P
4.	Study of generalized wing and their modification with significance.	01P
5.	Study of insect orders; (i) Apterygote insects, (ii) Exopterygote insects and (iii) Endopterygote insects inclusive of Taxonomy and diagnostic features upto family (at least one insect from each order).	06P
6.	Dissection of an insect pest (Plant bug or any insect pest as per local availability and legal permissibility) so as to study Taxonomy, Diagnostic features and Anatomy pertaining to Digestive, Nervous and Reproductive systems	03P
7.	Temporary mounting of Mouth parts, Antenna, Wings and Appendage of the insect pest used in practical number 4.	01P

Section I: Practical based on: ZOO: 5301–Animal Physiology I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Estimation serum uric acid	01P
2.	Study the correlation between body size and oxygen consumption in aquatic animals	01P
3.	Effect of salinity on oxygen consumption in aquatic animals	01P
4.	Absorption spectra of blood pigment	01P
5.	Study of Osmotic stress and volume change in earthworm	01P
6.	Effect of temperature on water loss in cockroach	01P
7.	Estimation of Carbohydrates in mammalian gut	01P
8.	Detection of allantoin in mammalian urine	01P
9.	Determination of Glomerular filtration rate by creatinine clearance	01P
10.	Effect of starvation on liver and muscle glycogen in mouse	02P
11.	Induction of heat shock puff in salivary gland chromosomes of Drosophila	01P
12.	Estimation of blood Sodium, potassium, Calcium	01P
13.	Estimation of blood alkaline & acid phosphatases	01P
14.	Normal & abnormal constituents of human urine	01P

Section I: Practical based on: ZOO: 5301 – Genetics I (Any 10)

Practical No.	Title of Practical	No. of Practicals
1.	Analysis of metric trait and estimation of phenotypic variance.	01P
2.	Partitioning of phenotypic variance in genetic and nongenetic components in a simulated population. Estimation of DGD.	01P
3.	Detection of polymorphism in a population – Biochemical (Enzyme, protein etc.)	01P
4.	To study population cage experiments using <i>Drosophila</i> : a) Genetic Drift b) Artificial selection- Experimental simulation and modeling.	01P
5.	Extraction of Genomic DNA from <i>Drosophila</i> .	02P
6.	Microbial genetics: Basic methodology, colony count, growth curve	02P
7.	Microbial genetics: Isolation of Auxotroph (Estimation of frequency), Replica plate technique.	02P
8.	Bacterial transformation and blue white selection. Calculation of transformation efficiency.	01P
9.	Study of conventions of nomenclature of genes and gene products in different model systems.	02P

Section II: Practical based on: ZOO: 5302 – Insect Physiology and Biochemistry & Ecology

Practical No.	Title of Practical	No. of Practicals
1.	Kymographic study of ventilatory movement in beetle.	01 P
2.	Estimation of Oxygen consumption in dragon fly nymph	01 P
3.	Study of heart and haemocytes of cockroach	01 P
4.	Estimation of the trehalase activity in haemolymph of any insect.	01 P
5.	Determination of Amino acid in haemolymph of any insect by chromatographic technique.	02 P
6.	Study of fat body glycogen of cockroach and effect of starvation	01 P
7.	Assay of amylase in midgut of cockroach	01 P
8.	Effect of temperature on water loss in cockroach	01 P
9.	Von Wisselinghs test for presence of chitin in insect cuticle	01 P

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class:	M.Sc. II (Semester– III)
Paper Code:	ZOO: 5306
Paper:	VI
	Title of Paper: ZOOLOGY PRACTICAL – 6
	(Based on Courses: ZOO: 5303, ZOO: 5304)
Credit:	4
	No. of Lectures: 60

Section I: Practical based on: ZOO: 5303– Mammalian reproductive physiology

Practical No.	Title of Practical	No. of Practicals
1.	Anatomy of male and female reproductive system in rat/mouse	01P
2.	Histology of male reproductive organs	01P
3.	Histology of female reproductive organs	01P
4.	Vaginal smear technique in mice.	01P
5.	Ovarectomy in white rats	01P
6.	Study of placental type	01P
7.	Archeotomy in white rat	01P
8.	Study of uterine smooth muscles	01P
9.	Study of contraceptive devices	01P
10.	Visit to artificial insemination centre and family planning clinic	01P

Section I: Practical based on: ZOO: 5303 – Histology and Histochemistry

Practical No.	Title of Practical	No. of Practicals
1.	Enzyme detection: acid phosphatase, alkaline phosphatase, esterases	01P
2.	Nucleic acid staining: methyl green, pyronine, feulgen stain	01P
3.	Study of different types of tissue with help of permanent slides	02P
4.	Effect of fixatives, fixation of tissues	01P
5.	Block preparation and sectioning	02P
6.	Mucopolysaccharide staining, AB pH 1.5, 2.5	01P
7.	Proteins (basic mellrg) and lipid staining by Sudan black	01P
8.	Comparative study of effect of fixative on a given tissue	01P
9.	Effect of fixatives on tissue sections- liver	01P

Section II: Practical based on: ZOO: 5304 – Economic Zoology

Practical No.	Title of Practical	No. of Practicals
1.	Prawn culture in laboratory aquarium	01P
2.	Apiculture equipments: Bee Box and Tools.	01P
3.	Poultry breeds, feeding utensils in poultry	02P
4.	A visit to piggery/poultry/pearl culture centre/ apiculture centre/sericulture centre.	01P
5.	Fishing tools, crafts and gear.	01P
6.	Morphology of Edible marine and freshwater fishes-	02P
7.	Collection and identification of locally available/cultured fishes.	02P

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AUTONOMOUS



POST GRADUATE DEPARTMENT OF ZOOLOGY

SYLLABUS

M.Sc. Zoology Part-II, SEMESTER-IV

ACADEMIC YEAR 2020-2021

Anekant Education Society's
**TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE &
 COMMERCE, BARAMATI.**
 AUTONOMOUS

**Scheme of Course Structure (CBCS) Faculty of Science
 Post Graduate Department of Zoology
 SEMESTER IV**

Class: M.Sc. II

Pattern: 40 (IA) + 60 (EA)

Sr. No.	Code	Paper	Paper Title	Credit	Exam.	Marks
1	ZOO: 5401	Theory	Entomology- II/ Animal Physiology-II/ Genetics-II	4	I / E	40 + 60
2	ZOO: 5402	Theory	Immunology and Parasitology	4	I / E	40 + 60
3	ZOO: 5403	Theory	Pest Control and toxicology	4	I / E	40 + 60
4	ZOO: 5404	Theory	Environmental Biology and Animal Systematics & Diversity	4	I / E	40 + 60
5	ZOO: 5405	Zoology Practical-7	Practicals Corresponding to : ZOO:5401, ZOO:5402, ZOO:5403, ZOO:5404	4	I / E	40 + 60
6	ZOO: 5406	RESEARCH PROJECT	DISSERTATION (Review of Literature and Summer /Industrial Training)	4	I / E	40 + 60
7	SD-24	Skill Development- II		2	-	
8						

IA* - Internal Assessment

EA*- External Assessment

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)
Academic Year 2020 - 2021

Class: M.Sc. II (Semester– IV)
Paper Code: ZOO: 5401
Paper: I **Title of Paper: Entomology- II**
Credit: 4 **No. of Lectures: 60**

Learning objectives:

- To understand the detailed growth and developmental process in insects.
- To understand various adaptive mechanisms in insects.
- To understand the concepts of regeneration and aging in insects.

Learning outcomes:

After successful completion of this course, students are expected to:

- Understand growth and development in insects.
- Understand the adaptive mechanisms in insects.
- Prepare for research projects in life sciences.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Gametogenesis: Spermatogenesis, Oogenesis, Seminal transfer, Fertilization and Oviposition.	08 L
2.	Insect early embryonic development: Cleavage and Blastoderm formation, Germ band, Gastrulation, Blastokinesis, differentiation of germ layers, Segmentation, Appendages formation and organogenesis in brief.	21 L
3.	The post embryonic development: Eclosion from the egg. The developmental stages: larva, Pupa, Nymph, Emergence from the pupa/cocoon. Metamorphosis and Growth.	20 L
4.	Hadorn's experiments: Experiments with imaginal disc, Regeneration and Aging.	06 L
5.	Diapause: Occurrence, Initiation and Preparations for diapauses, Diapause development and Controls.	05 L

REFERENCES

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2. 'A Text book of Entomology' by H. H. Ross (John Wiley and Sons, Ins. New York,
3. 'Imms' Text Book of Entomology- By O. W. Richards and R. G. Davies, (Methuen & Cc., London,), Vols. I & II.
4. 'Embryology of Insects and Mariapods' by O. A. Johanson and F.H. Butt, (McGraw Hill, New York,).
5. 'The ecology of insect populations in theory and practice' by L.R. Clarks P. W. Geier, R.D. Hughes, R.F. Morris (Methen, London).
6. 'Developmental system: Insects' Vol. I, by S. J. Counce and C.H. Waddington (Academic Press, London,).
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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)
Academic Year 2020 - 2021

Class: M.Sc. II (Semester– IV)
Paper Code: ZOO: 5401
Paper: I **Title of Paper:** Animal Physiology II
Credit: 4 **No. of Lectures:** 60

Learning objectives:

- To understand the process of digestion and importance of nutrients.
- To understand the physiology of blood circulation and related diseases.
- To understand the anatomy and contraction of muscles.
- To study the sense organ and mechanism of sensation.

Learning outcomes: After successful completion of this course, students are expected to:

- Understand the physiology of animals in detail.
- Design research problems based on human physiology .

Topic No.	TOPICS / CONTENTS	Lectures
1.	Nutrition and digestion a) Nutrition b) Nutrients and Nutritive types c) Calorimetry and BMR d) Digestion e) Components of digestive system f) General mechanism of digestion; Autonomous smooth muscle function, intrinsic nerve flexes, extrinsic nerve and gastrointestinal hormones	10 L
2.	Respiration a) Internal and external respiration ; Anatomy of respiratory system b) Pulmonary respiration: Partial pressure, inspiration and expiration, Lung volume and capacities c) Gas exchange across the pulmonary and systemic capillaries d) Gas transport; O ₂ transport, CO ₂ transport and abnormalities in the blood gas content e) Neuronal control of respiration, role of central and peripheral receptors f) Other functions of respiratory system	11 L
3.	Blood and blood vessels a) Blood composition and function, Haematopoiesis b) Blood clotting and it's molecular mechanism c) Blood vessels and blood pressure: Blood vessel types, Arteries, role as pressure reservoir and arterial pressure: Aeteriole: role in distribution in cardiac output and maintenance of arterial blood pressure, Capillaries and its functions, veins: its role as blood reservoir and venous return d) Blood pressure-Hypertension and Hypotension	09 L
4.	Cardiac Physiology a) Anatomy of heart b) Electrical activity of the heart pace makers, spread of cardial coupling, action potential of cardiac cells c) Electrocardiography d) Mechanism events of cardiac cycle, Heart sound e) Neuronal and Hormonal control of heart f) Cardiovascular response of exercise	10 L
5.	Neuronal Physiology a) Nerve cells : Structure & Function b) Excitation and conduction of nerve fiber: Resting membrane potential, Action potential, all or none law, electronic potential, saltatory conduction c) Ionic basis of excitation and conduction d) Neurotransmitter types and receptors: Metabolism of neurotransmitters, Neuropeptides e) Synapse and Neuronal integration f) impact of drugs and disease on synaptic transmission	08 L
6.	Muscle Physiology a) Structure of skeletal muscle and molecular basis of skeletal muscle contraction, types of contraction, twitch summation and tetanus, relation between muscle length and tension, velocity of contraction b) Pathways of ATP formation during contraction	05 L

c) Skeletal muscle fiber types, contractile machinery of smooth muscle

7. Sensory Physiology

07 L

- a) Receptor types, receptor potential and receptor adaptation
- b) Eye-structure and physiology of vision
- c) Ear-Hearing and equilibrium, sound waves and it's characters, structure of ear and physiology of hearing and equilibrium
- d) Chemical senses : Taste and smell

REFERENCES

1. Guyton A.C and Hall J.E, Text book of medical physiology, Hartcortbracc and co. Asia Pvt.Ltd.,Singapore.
2. Baldwin, E. An introduction to Comp biochemistry. Cambridge.
3. Hill, R.W. & GA Wyse, Animal physiology. Harper & Row, NW.
4. Randall, D, W.Burggen& K, French. Eckert Animal Physiology: Mechanism and adaptation, W H Freeman, NY
5. Schmidt-Nielsen,. Animal Physiology: Adaptation and Environment. Cambridge.
6. Hoar, W S General and Comparative physiology. Prentice Hall, India, New Delhi.
7. Vernberg, F.J. &Vernberg, WB .Animal and the environment.Holt, Rienhart& Winston, NY.
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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)
Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)
Paper Code: ZOO: 5401
Paper: I **Title of Paper:** Genetics II
Credit: 4 **No. of Lectures:** 60

Learning Objectives:-

- To understand the genetics of model organisms.
- To understand the genetics behind evolution.
- To learn the molecular biology techniques and methods of genetic analysis.

Learning Outcomes:-

After successful completion of this course, students are expected to:

- Understand genomics and genetics of model organisms.
- Understand the evolution from genetics point of view.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Solving problems (Numerical Probability estimation) of Mendelian and non Mendelian genetics.	03 L
2.	Basic Human Genetics: 2.1. History of Human Genetics 2.2. Pedigree- Gathering Family history, pedigree symbols, construction of pedigrees, Autosomal inheritance- Dominant & Recessive, Monogenic traits (Sex Linked inheritance, Sex Limited & Sex-influenced traits, mitochondrial traits), MIM number. 2.3. Presentation of molecular genetic data in pedigrees 2.4. Complications to the basic pedigree patterns- non penetrance, variable expressivity, pleiotropy, late onset, dominance problems, genetic heterogeneity, genomic imprinting & uniparental disomy, spontaneous mutations, mosaicism & chimerism, male lethality, X- inactivation. 2.5. Parametric and non- parametric analysis, identifying recombinants & non recombinants in pedigree, two- point mapping- LOD score analysis, genetic & physical map distances, genetic markers.	18 L
3.	Clinical Genetics: 3.1.0. Monogenic diseases 3.1.1 Cystic Fibrosis 3.1.2 Tay-Sachs syndrome 3.1.3 Marphan syndrome 3.2.0. Triplet repeat based disorders 3.3.0. Inborn metabolic errors- 3.3.1. Disorders of carbohydrate metabolism 3.3.2. Disorders of nucleic acid metabolism 3.3.3. Disorders of lipid metabolism 3.3.4. Lysosomal storage disorders 3.3.5. Peroxisomal disorders 3.4.0. Disorders of Hematopoietic systems- 3.4.1. Over view of blood cell types & haemoglobin 3.4.2. Sick cell anemia 3.4.3. Thalassemias 3.4.4. Hemophilia's 3.5.0. Prenatal and pre-implantation diagnosis 3.5.1. Indications for prenatal diagnosis 3.5.2. Indications for chromosomal testing 3.5.3. Non- invasive methods 3.5.4. Invasive methods	16 L
4.	Physical mapping methods: 4.1. Low resolution mapping- cell hybrids, radiation hybrid mapping, syteny homology. 4.2. Restriction maps, clone contig maps, STS map, EST map, DNA sequence map.	03 L
5.	Immunogenetics: 5.1. Genetic basis of antibody diversity. 5.2. Regeneration of TCR diversity.	03 L

5.3. HLA polymorphism and disease association.

6. Oncogenetics:	03 L
6.1. Concepts of oncogenes and tumor suppressor genes.	
6.2. Role of oncogenes.	
6.3. Cytogenetic studies.	
7. Behavioural Genetics:	05 L
7.1.0. Rothen Buhler's experiment on genetics of Bee behavior (hygienic and unhygienic Trait).	
7.2.0. Nature- nurture and behavior-	
7.2.1.0. Genetics experiments to investigate animal behavior	
7.2.1.1. Selection studies.	
7.2.1.2. Inbred strain studies.	
7.3.0. Identifying genes for controlling behavior	
7.3.1. Induced mutations	
7.3.2. Quantitative trait loci.	
7.3.3. Synteny orthology	
7.4.0. Twin and adoption study designs.	
7.5.0. Environmental influence- shared and non- shared environment.	
7.6.0. Genetics of human behavioural defects- Schizophrenia.	
8. Neurogenetics:	03 L
8.1 Circadian rhythms, learning and memory mutants in <i>Drosophila</i> .	
8.2 Psychopathology- Alzheimer's disease	
9. Drosophila genetics:	06 L
9.1. History of <i>Drosophila</i> genetics.	
9.2. Genetic basis of Sex determination and dosage compensation in <i>Drosophila</i> .	
9.3. Genetic Regulation of <i>Drosophila</i> early embryonic development and pattern formation: Maternal genes and formation of body axis, Segmentation genes, Homeotic gene functions, Regulation of Hox- gene expression;	

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3. Griffiths, A.J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. and Gelbert, W.M. An introduction to Genetics analysis. W.H. Freeman and Co. NY,
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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)
(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– IV)

Paper Code: ZOO: 5402

Paper: II **Title of Paper: Immunology and Parasitology**

Credit: 4 **No. of Lectures:** 60

Learning objectives:

- To understand the concept of antigen and antibodies.
- To understand the innate and cognate immune system.
- To learn the host parasite interactions, types and life cycle of parasites.
- To understand the control measures to avoid parasitic infections.

Learning outcomes:

After successful completion of this course, students are expected to:

- Understand the details of immune response.
- Design the experiments related to immunity and parasites.
- Understand pathogenicity of various parasites.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Immune System: a) Introduction to Immunology b) Concept of immunity (self – non self, antigen, antibody, immune response, immunological tolerance, autoimmune disease) and active and passive immunization, c) Primary and Secondary lymphoid organ. Tissue, cells and molecules of the human immune system.	03 L
2.	Humoral immunity, and cell mediated immunity , T cell receptors.	02 L
3.	Immediate response to infection: Inflammation, cell migration, acute phase response interferons and NK cell.	03 L
4.	Antibody structure , antibody classes, subclasses, structure- function relationship, iso, idio and allo types	04 L
5.	Theories of antibody synthesis , generation of antibody diversity (molecular basis), Antibody class switching	03 L
6.	Antigen antibody reaction and complement fixation pathways.	02 L
7.	Immunogenetics: HLA and Disease association, immune deficiencies and disorders. Antigen processing and MHC	05 L
8.	Hybridoma principle and application , ELISA, Immunofluorescence, Immunoelectrophoresis, RIA and Monoclonal & Polyclonal Antibody and its application.	05 L
9.	Immunological Memory and Vaccination	03 L
10.	Host-Parasite systems: 10.1. Preadaptation to infectiousness, Myiasis: Classification according to tissue, vectors specific, sub specific, accidental; clinical presentation humans, syndrome, symptoms, diagnostic, control method prevention, treatment.; Transmission: Types, categories: A. Conspecific: Contact, Transplacental, Transovarian, B. Heterospecific: Mechanical (Indirect & Direct), Biological, Paratenic, Hyper parasitic, Parasitoidal. 10.2. Manipulation of Host behavior, Parasitism & Altruism, parasites & social behavior of hosts, parasitism & life history, parasitic effects benefiting the host.	07 L
11.	Type study: Classification geographical distribution, morphology, life-cycle, transmission, pathogenicity, treatment and prophylaxis of: 11.1 Protozoa: <i>Trypanosoma</i> sps. , <i>Leishmania</i> sps. 11.2 Platyhelminthes: <i>Schistosoma</i> sps., <i>Echinococcus</i> sps. 11.3 Nematoda: <i>Ancylostoma</i> sps., <i>Dracunculus</i> sps.	08 L

12. Genetics & Molecular Biology:	07 L
12.1 Trypanosoma: Diploid & Sexual stage, Molecular characteristics of surface coat, Variable surface glycoprotein (VSG) and VSG gene expression.	
12.2 Plasmodium: Diploid & haploid stages, Chromosome polymorphism, gene encoding circumsporozoite protein & merozoites S- antigens, surface antigen diversity. Resistance of Malaria to drugs, its mechanism & assessment.	
12.3 Platyhelminthes: Inseminative behaviour, parthenogenesis and polyspermy, sex determination, sex linked inheritance in Schistosomes.	
12.4 Nematoda: chromosome germ line limited DNA & chromatin diminution in Ascaris.	
13. Serology & immunodiagnostic methods:	06 L
13.1 Serology & antibody synthesis, preparation & demonstration of specific antigens of <i>Entamoeba</i> , <i>Plasmodium</i> , <i>Trypanosoma</i> & <i>Leishmania</i>	
13.2 Immunodiagnostic assays, Immunodiffusion, Indirect Haemagglutination test, indirect fluorescent antibody test, Radio immuno assay, ELISA, complement fixation test, Latex agglutination test	
14. Prophylaxis & control:	02 L
Biologic, Genetic, Chemical, Physical & Other methods chemical, Physical & Other methods	

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- Comparative protozoology, Ecology, Physiology, Life history, Anderson, O.R. , Springer verlag, Berlin.
- General Parasitology, Cheng T. C., Academic Press.
- Modern Parasitology, Cox F.E.G., Eds. Parasitology in focus, facts & trends, Melhorn h., Eds., Springer Verlag, Berlin.
- Medical Parasitology, Piakarsky G. L., Springer Verlag, Berlin.
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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– IV)

Paper Code: ZOO: 5403

Paper: III Title of Paper: Pest Control and toxicology

Credit: 4 No. of Lectures: 60

Learning objectives:

- To understand various agricultural and domestic pests.
- To understand the control measures for various pests.
- To understand the pesticides their mechanism of action and related toxicology.
- To design toxicological bioassays for the assessment of toxicants.

Learning outcomes:

- After successful completion of this course, students are expected to:
- Understand the consequences of chemical pesticides.
- Acquire knowledge about the importance of integrated pest management.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Introduction of the pest control , types of pests and their importance, Damage caused by pests.	02 L
2.	Brief outline of medical and veterinary entomology with reference to important measures to control the vectors. House hold and stored grain pest and their control measures.	06 L
3.	Principles and methods of pest control: Cultural control measures, Physical control measures, Mechanical Control measures, Chemical control measures. Types and mode of action. Insecticidal formulations and dilutions. Drawbacks of chemical control. Biological control measures: Biological agents, Advantages and Drawbacks of Biological control, Biological, Control Management.	12 L
4.	Autocidal control , Chemosterilents, Kniplings model, Pheromonal and hormonal control. Concept of Integrated pest management	06 L
5.	Non- insect pest and their control: Rat, Bandicoots, Crabs, Snails, Slugs, Birds and Squirrels	02 L
6.	Pesticide- Appliances: Sprayers and Dusters, Hazards of Pesticides and Antidotes.	02 L
7.	Basic Concept of Toxicology: Introduction of toxicology, history of toxicology, definition of toxicology, definition of poison, definition of toxicity and classification of toxicants.	02 L
8.	Toxic agent and their mode of action: Introduction, Toxic agent and mode of action of toxic agents.	03 L
9.	Xenobiotics: Introduction, Important of Xenobiotics concerned to Human health, Adverse effects of Xenobiotics through Biological Magnification and Biotransformation, mechanism of Xenobiotics Translocation, Membrane permeability and mechanism of chemical transfer, absorption of Xenobiotics, distribution of Xenobiotics, accumulation of Xenobiotics, elimination, biotransformation and excretion.	08 L
10.	Pesticides and Heavy Metal Toxicity: Pesticides and their toxicological effects: Classification of Pesticides, Insecticides, Mode of action of Insecticide	04 L
11.	Heavy Metal Toxicity: Introduction, dispersion, general principal of metal toxicity, sources, toxic metals and their toxicity. Arsenic, Aluminium, Cadmium (Itai-Itai disaster), Chromium Lead, Mercury, Manganese, Zinc and Nickel.	06 L
12.	Evaluation of toxicity. Acute sub Acute and chronic assays LD50, LC50, NOEL	03 L
13.	Maintenance and general handling of animals for toxicological laboratory.	02 L
14.	Ecotoxicology , clinical toxicology, occupational and nanotoxicology.	02 L

REFERENCES

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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– III)

Paper Code: ZOO: 5404

Paper: IV Title of Paper: Environmental Biology and Animal Systematics & Diversity

Credit: 4 No. of Lectures: 60

Learning Objectives:

- To Understand different concept of ecology
- Demonstrate knowledge and understanding of theories in the field of Biodiversity and systematic, in the broad sense as well as at a more detailed level in a limited part of the field.
- This course develops concepts in animal taxonomy and systematic and their application.
- To understand the critical issues facing the environment at local, regional, national and global scales.

Learning Outcomes:

After successful completion of this course, students are expected to:

- Describe different systematic principles and what the classification system of animals is based on
- Understand the ecological and statistical techniques and approaches used in the study of Environmental biology.
- Appreciate the impact of human activities on other life and environment.

Topic No.	TOPICS / CONTENTS	Lectures
1.	Introduction: Fundamentals of Ecology, Ecosystems: Definition and, concept of ecosystems, energy flow in ecosystems, Nutritional Flux. Development and evolution of the ecosystems. Biogeochemical cycles, Food-chains, ecotone, edge effects, ecological niche, and ecosystem stability	06 L
2.	Environmental Microbiology: Microbes - classification and their applications in the environmental sciences. Cultivation and growth of microorganisms. Microorganisms and their association with man, animals and plants. Microbes as anti-microbial agents.	02 L
3.	Biomes and Habitat Diversity: Classification of biomes, major biotic elements of each biome and their characteristics. Human impact on the natural environment.	02 L
4.	Biological diversity of India: Definition and nature, India's biogeographically history, physiography, climate and its impact on biodiversity. Indian forest and vegetation types and diversity of flora and fauna.	04 L
5.	Population and Community Ecology.	02 L
6.	Wetlands Forests and Semi-arid Habitats of India: Definition and types of wetlands, important wetlands of India and their conservation issues. Forests and semi-arid habitats of India: their distribution in India, ecological status of forests and arid lands, and their conservation.	04 L
7.	Endangered, Endemic and Extinct Species of India: Threatened species categories of IUCN, threatened species of plants and animals in India and their reasons, Red data books.	03 L
8.	Wildlife management and conservation. Protected Areas Network in India: Goals of management, Strategies for planning. Factors influencing wildlife management such as habitats, population, behavior, food-habits, health, etc., tools for data collection and analysis. Human land-use and wildlife management units, important projects for the conservation of wildlife in India, Role of local communities in wildlife management.	07 L
9.	Fundamental of Systematics: Biological classification, Hierarchy of categories and higher taxa, Taxonomic characters – procedures and keys, Species concepts: varieties, subspecies, sibling species, race etc.	07 L
10.	Kingdoms of Life : General outline of kingdoms including Monera& Protista; Broad outline & Diversity in kingdom Animalia	03 L
11.	Methodologies in Systematics: Morphology based taxonomy, Numerical taxonomy, Cyto-taxonomy and chemotaxonomy, Molecular Systematics, DNA fingerprinting & Molecular markers for detection/evaluation of polymorphism,RFLP, RAPD etc.	08 L
12.	Taxonomic keys: Types of taxonomic keys, their merits and demerits International code of Zoological nomenclature. Its operative principles, interpretation and application of important rules, zoological nomenclature, formation of names and various taxa	06 L
13.	Taxonomic procedures: taxonomic collection preservation, curation process and identification.	03 L
14.	Molecular phylogenetics and phylogeography.	03 L

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2. Modern concepts in Ecology: H: D. Kumar
3. Microbes, Man and Animals: The Natural History of Microbial Interactions: Linton, A. H. and Burns, R.G. John Wiley and Sons.
4. Elements of Microbiology: Pelszar, M.J. and Chan ECS, McGraw Hill.
5. General Microbiology: Steiner, R.Y., Adelberg, EA and Ingraham, J.L. Macmillan Press.
6. Microbial Methods for Environmental Biotechnology: Grainer, J.M. and Lynch, J.M. .Academic Press.
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8. Kato., The biology of biodiversity, Springer.
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SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)**(Autonomous)****Academic Year 2020 - 2021****Class: M.Sc. II (Semester– IV)****Paper Code: ZOO: 5405****Paper: V****Title of Practical: ZOOLOGY PRACTICAL - 7****(Based on Courses: ZOO: 5401, ZOO: 5402, ZOO: 5403, ZOO: 5404)****Credit: 4****No. of Lectures: 60****Section I: Practical based on: ZOO: 5401 – Entomology II**

Practical No.	Title of Practical	No. of Practicals
1.	Study of different types of insect Eggs.	1 P
2.	Early embryology of insect: egg, cleavage, blastula, germ band, gastrula, embryo- 1day old, 2 day old and 3 day old in suitable insect.	1 P
3.	Study of post embryonic development of insects: Collection and study of types of larvae, pupae, Nymph (Aquatic and Terrestrial).	2 P
4.	Histological studies of male reproductive system (Testes, Vasa deference, Ejaculatory duct, Accessory gland and spermatogenesis).	1 P
5.	Histological studies of female reproductive system (Ovariole, oviduct, common oviduct, Accessory glands and bursa copulatrix, spermatheca).	1 P
6.	Dissection of House fly: The digestive system, Nervous system, Male and Female Reproductive System, Temporary mountings of antenna, halteres, legs and ovipositor.	3 P
7.	Dissection of butterfly: The digestive system, Nervous system, Male and Female Reproductive System, Temporary mountings of antenna, scales and ovipositor.	3 P
8.	Study of Beneficial Insects: Any 5 insects to be studied inclusive of their Systematics, Habit and Habitat, Diagnostic features, Economics and Ecological significance, Threats and Conservation measures.	1 P
9.	Study of Harmful Insects: Any 5 insect Pests, Predators, Parasites and Vectors of diseases to be studied inclusive of their Systematics, Habit and Habitat, Diagnostic features, Nature of damage and control measures.	1 P
10.	Morphological and taxonomic study of insect pest of agricultural importance. (any 10).	1 P
11.	Study of insect pests and veterinary and public health importance. Nonconventional pests.	1 P
12.	Study of effects of contact poison on pests: a) Chlorinated hydrocarbons, b) Organophosphates c) Carbamate. Calculation of LD50 and effects on behavior.	1 P
13.	Study of respiratory poisons (fumigants)-Carbon tetrachloride, ethylene dichloride, Nicotine.	1 P
14.	Study of insect repellants (any two).	1 P
15.	Study of insect attractants (any two).	1 P

Section I: Practical based on: ZOO: 5401– Animal Physiology II

Practical No.	Title of Practical	No. of Practicals
1.	Effect of exercise on breathing rate, pulse rate and blood lactate of man	1 P
2.	Determination of bleeding time and clotting time in man	1 P
3.	Study of invertebrate (earthworm and crab) heart	1 P
4.	Ionic effects on perfused heart of frog	1 P
5.	Effect of vagotomy on frog heart	1 P
6.	Effect of adrenalin and acetylcholine on perfused heart of frog	1 P
7.	Capillary circulation in frog and cockroach/Fish.	1 P
8.	Study of glycerinated muscles fibers	1 P
9.	LDH isoenzymes isolation and detection using agarose gel electro phoresis in heart / skeletal muscle of rat	2 P
10.	Phosphagen kinase in mouse and crab muscle phosphagen	1 P
11.	Effect of load on muscles contraction in frog	1 P
12.	Cobalt back filling of cockroach ventral nerve cord	1 P
13.	Detection and measuring of heart beats(Manually) in Drosophila larva/Daphnia	1 P
14.	Estimation of Respiratory Quotient by Warburg's Respirometer	1 P
15.	Mapping of taste areas on human tongue.	1 P
16.	Study of Types of heart (Myogenic and Neurogenic)	1 P
17.	Effect of pH, temperature and incubation on human salivary amylase activity.	1 P
18.	Determination of protein, glucose in Urine	1 P
19.	Determination of protein, glucose in Urine from diabetic patient	1 P
20	Qualitative Analysis: 1) Preparation and study of Urine crystals. 2) Estimation of serum urea.	1 P

Section I: Practical based on: ZOO: 5401 – Genetics II

Practical No.	Title of Practical	No. of Practicals
1.	Methodology for constructing Human Pedigree	1 P
2.	Analysis and construction of typical pedigrees for autosomal dominant and recessive genes, sex linked dominant and recessive genes.	1 P
3.	Preparation of metaphase chromosomal spreads of one vertebrate.	2 P
4.	Enzyme polymorphism in natural population.	2 P
5.	Visit to a medical genetics laboratory for cytogenetic, biochemical and other studies.	1 P
6.	G- banding on mouse metaphase spread	1 P
7.	In-silico design of PCR primers for a gene of interest.	1 P
8.	C banding on mouse metaphase chromosomes.	2 P
9.	Study of courtship behavior in wild type and mutant Drosophila.	1 P
10.	Study of maternal effect mutants for genes- Bicoid and Nanos.	1 P
11.	Preparation of metaphase chromosomal spread of 3'd instar larva of Drosophila (from brain Ganglion)	2 P
12.	Measurement of olfaction activity in Drosophila larvae and Adult Fly.	1 P
13.	Measurement of locomotory activity in Drosophila larvae and Adult Fly.	1 P
14.	Larval mechanosensation assay in Drosophila.	1 P
15.	Chromatography of Drosophila eye colour pigment.	1 P
16.	To Study effect of mitogen induction on lymphocytes.	2 P
17.	Concept of genetic disorder databases and demonstration of use of OMIM.	1 P
18.	Genetic monitoring (using immuno genetic marker) in laboratory animals.[by skin grafting]	2 P
19.	Open field Activity test and Elevated plus maze test for anxiety levels in laboratory mice.	1 P

Section I: Practical based on: ZOO: 5402 – Immunology

Practical No.	Title of Practical	No. of Practicals
1.	Ouchterlony technique of agar gel diffusion	2 P
2.	Immunoelectrophoresis	2 P
3.	Haemagglutination inhibition test	2 P
4.	Histology of Lymphoid organ- Skin, Spleen, Thymus, Ilium, Lymph node, Bone marrow2p	2 P
5.	Blood smear preparation to study various blood cells	2 P
6.	Blood group analysis with reference to cross matching	2 P
7.	To estimate the antigen concentration using rocket electrophoresis	2 P
8.	Dot immunobinding assay to detect antibodies in the serum	2 P
9.	To perform ELISA	2 P

Section II: Practical based on: ZOO: 5402– Parasitology

Practical No.	Title of Practical	No. of Practicals
1.	Study of life cycle, role as vector & control measures of: Ticks(<i>Argas</i> , <i>Boophilus</i>) Mosquito - anyone from- <i>Anopheles</i> / <i>Aedes</i> / <i>Culex</i> Any two flies: <i>Tabanus</i> / <i>Phlebotomus</i> / <i>Sarcophaga</i> . <i>Cyclops</i>	2 P
2.	Ectoparasites & Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta	2 P
3.	Study of life cycle of parasitic protozoa: <i>Trypanosoma</i> , <i>Leishmania</i>	1 P
4.	Study of life cycle of helminth parasites: <i>Schistosoma</i> . <i>Echinococcus</i> , <i>Ancylostoma</i> , <i>Dracunculus</i> .	2 P
5.	Culturing of <i>Entamoeba</i> & <i>Plasmodium</i>	2 P
6.	Study of Parasites from digestive tract of Cockroach /gut parasites of hen	1 P

Section II: Practical based on: ZOO: 5404– Environmental Biology

Practical No.	Title of Practical	No. of Practicals
1.	A visit to aquatic ecosystem and methods for water and plankton collection	2 P
2.	Plankton identification and quantification from river / lake water samples.	2 P
3.	Vegetation studies by line, quadrates and belt transect methods and their analysis.	2 P
4.	Preparation of media for microbial culture, Isolation and culturing of microbes from soil/water samples.	2 P
5.	Water analysis for physico-chemical characteristics.	1 P
6.	Physico-chemical analysis of soil.	1 P
7.	Minor phyla-specimen Study	1 P
8.	Study of museum specimens and slides(invertebrates,1-2 examples from each phyla)	1 P
9.	Study of museum specimens(protochordates and chordates,1-2 examples from each phyla)	1 P
10.	Identification of animals with the help of keys-House fly, Honey bee etc.	1 P
11.	Identification of animals with the help of keys- Cockroach, Earthworm.	1 P
12.	Method of collection, Preservation, and Curing of any insect Specimen	2 P
13.	Visits to Scientific Institute like Zoological Survey of India and Report writing	1 P

Section II: Practical based on: ZOO: 5404– Animal Systematics & Diversity

Practical No.	Title of Practical	No. of Practicals
1.	Minor phyla-specimen Study 1p	1 P
2.	Study of museum specimens and slides(invertebrates,1-2 examples from each phyla)	2 P
3.	Study of museum specimens(protochordates and chordates,1-2 examples from each phyla)	2 P
4.	Identification of animals with the help of keys-House fly, Honey bee etc.	1 P
5.	Identification of animals with the help of keys- Cockroach, Earthworm.	1 P
6.	Method of collection, Preservation, and Curing of any insect Specimen	2 P
7.	Visits to Scientific Institute like Zoological Survey of India and Report writing	1 P

SYLLABUS (CBCS) FOR M.Sc. ZOOLOGY (w. e. f. June, 2020)

(Autonomous)

Academic Year 2020 - 2021

Class: M.Sc. II (Semester– IV)
Paper Code: ZOO: 5406
Paper: VI Title of Practical: **RESEARCH PROJECT**
Credit: 4 No. of Hours: 60

RESEARCH PROJECT

The project course would involve:

1. Trainings to students in:

- Literature survey,
- Planning and execution of experimental work,
- Analysis of data and its presentation.

Studies would utilize few of the practicals from their course more intensively for this course. **Project should start at fourth semester and will be assessed at the end of fourth semester.**

The experimentation work during the project should be equivalent to minimum 20 practicals in the semester.

Examination:

[A] Pattern of Examination: Evaluation of Students:

- The In-semester and End-Semester examinations will be of 60 marks each.
- There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

In-semester Examination: Internal assessment for each course would be continuous and dates for each Tutorials/practical tests etc. will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity.

a) Theory Courses: Students should be encouraged to participate in various academic activities.

A teacher must select a variety of the procedures for conducting internal assessment suggested as follows:

- Multiple choice questions
- Combination of objective and subjective questions.
- Open book test (concerned teacher will decide the allowed books)
- Tutorial
- Surprise test specified topics in a given notified period
- Oral
- Assignments
- Review of research paper
- Seminar presentation
- Journal/Lecture/Library notes

Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the Responsibility of the student to preserve the documents.

b) Practical Courses: It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following:

- Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
- Assessment on practical course be conducted before the end-semester examination.
- Assessment of each experiment shall be done for each practical weekly
