C. Abdul Hakeem College (Autonomous), Melvisharam.

CourseScheme M.Sc - Zoology												
Academic Year 2017-2018												
S.No	**E/D**	**Category**	**Type**	**Subject Code**	**Subject Name**	**In. Max**	**Int. Min**	**Ext. Max**	**Ext. Min**	**Pass Marks**	**Credits**	**Part**
Semster	**1**	**Subject Count**	**4**									
1	E	Theory	Main	P17MZL101	Life and Diversity of Invertebrates	25	0	75	38	50	4	I
2	E	Theory	Main	P17MZL102	Life and Diversity of Chordates	25	0	75	38	50	4	I
3	E	Theory	Main	P17MZL103	Cell and Molecular Biology	25	0	75	38	50	4	I
4	E	Theory	Elective	P17EZL104	Biostatistics and Bioinformatics (Elective)	25	0	75	38	50	3	I
Semster	**2**	**Subject Count**	**8**									
1	E	Theory	Main	P17MZL201	Genetics	25	0	75	38	50	4	I
2	E	Theory	Main	P17MZL202	Environmental Biology	25	0	75	38	50	4	I
3	E	Theory	Main	P17MZL203	Biotechnology	25	0	75	38	50	4	I
4	E	Theory	Elective	P17EZL204	Biochemistry (Elective)	25	0	75	38	50	3	I
5	E	Practical	Main	P17MZLP21	Practical - I Life and Diversity of Invertebrates, Chordates, Cell and Molecular Biology	25	0	75	38	50	5	I
6	E	Practical	Main	P17MZLP22	Practical - II Genetics, Environmental Biology and Biotechnology	25	0	75	38	50	5	I
7	E	Practical	Elective	P17EZLP23	Elective Practical - Biochemistry	25	0	75	38	50	3	I
8	E	Theory	Main	P17CHR201	Human Rights	25	0	75	38	50	2	I

Course Scheme M.Sc - Zoology-IIndYear

Semster	**3**	**Subject Count**	**4**									
1	E	Theory	Main	P17MZL301	Animal Physiology	25	0	75	38	50	4	III
2	E	Theory	Main	P17MZL302	Developmental Biology	25	0	75	38	50	4	III
3	E	Theory	Main	P17MZL303	Immunology	25	0	75	38	50	4	III
4	E	Theory	Elective	P17EZL301	Biophysics (Elective)	25	0	75	38	50	3	III
Semster	**4**	**Subject Count**	**7**									
1	E	Theory	Main	P17MZL401	Research Methodology	25	0	75	38	50	5	III
2	E	Theory	Main	P17MZL402	Evolution	25	0	75	38	50	4	III
3	E	Theory	Main	P17MZL403	Entomology	25	0	75	38	50	5	III
4	E	Theory	Elective	P17EZL401	Sericulture (Elective)	25	0	75	38	50	3	III
5	E	Practical	Main	P17MZLP41	Practical - III Animal Physiology, Developmental Biology and Immunology	25	0	75	38	50	5	III
6	E	Practical	Main	P17MZLP42	Practical - IV Research Methodology, Evolution and Entomology	25	0	75	38	50	5	III
7	E	Practical	Elective	P17EZLP41	Elective Practical - II Sericulture	25	0	75	38	50	3	III

Course Scheme M.Sc - Zoology-IIndYear
(Modified as per BOS meeting 29-01-2019)

	Type	Subject Code	Type	Sub. Code	Subject Name	In.Max	Int. Min	Ext.Max	Ext. Min	Pass Marks	Credits	Part
Semster	**3**	**Subject Count**	**4**									
1	E	Theory	Main	P19MZL301	Animal Physiology	25	0	75	38	50	4	III
2	E	Theory	Main	P19MZL302	Developmental Biology	25	0	75	38	50	4	III
3	E	Theory	Main	P19MZL303	Immunology	25	0	75	38	50	4	III
4	E	Theory	Elective	P19EZL301	Biophysics (Elective)	25	0	75	38	50	3	III
Semster	**4**	**Subject Count**	**7**									
1	E	Theory	Main	P19MZL401	Research Methodology	25	0	75	38	50	5	III
2	E	Theory	Main	P19MZL402	Evolution	25	0	75	38	50	4	III
3	E	Theory	Main	P19MZL403	Entomology	25	0	75	38	50	5	III
4	E	Theory	Elective	P19EZL401	Sericulture (Elective)	25	0	75	38	50	3	III
5	E	Practical	Main	P19MZLP41	Practical - III Animal Physiology, Developmental Biology and Immunology	25	0	75	38	50	5	III
6	E	Practical	Main	P19MZLP42	Practical - IV Research Methodology, Evolution and Entomology	25	0	75	38	50	5	III
7	E	Practical	Elective	P19EZLP41	Elective Practical - II Sericulture	25	0	75	38	50	3	III

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZL301 Semester : III

Major - 7 Title: **Animal Physiology**

Credits: 4 Max. Marks. 75

Objectives

To derive an unified knowledge of the functions of animals, their parts, organs and their behaviour, through and understanding of their nutrition, respiration, circulation, excretion and physico-chemical coordination with a phylogenetic tinge.

Course outcomes

CO1: To understand the physiological mechanisms of nutrition
CO2: To describe the physiology of digestive and respiratory system of human beings.
CO3: To understand the blood composition, types, groups and circulatory system.
CO4: To describe the physiology of excretory system and nervous system of human beings.
CO5: To know the physiology of sense organs, muscles and reproductive system.

UNIT I: NUTRITION

Nutrition - nutrients - digestion and adsorption of proteins, carbohydrates and lipids.Role of gastrointestinal hormones in digestion.

UNIT II: RESPIRATION AND CIRCULATION

Comparison of respiration in different invertebrates and vertebrates- Physiology of respiration in Man-mechanism, role of pigments and control, BMR and its significance.

Circulation - physiology of cardiac muscle - blood coagulation and theories-cardio-vascular diseases and its prevention.

UNIT III: EXCRETION AND OSMOREGULATION

Excretion – excretion of metabolic waste products in relation to the environment – physiology of excretion in Man. Iono – osmoregulation in Invertebrates (crustaceans), fishes, birds and terrestrial animals –hormonal control.

UNIT IV: NEURO-MUSCULAR COORDINATION

Structure and Types of neurons.Molecular structure and chemical composition of muscle fiber and physiology of muscle contraction.Myoneural Junction.Physiology of endocrine glands-Hormones secreted.Physiology of mammalian reproduction - reproductive cycle - hormonal control of reproduction.

UNIT V: BEHAVIOURAL PHYSIOLOGY

Bioluminescence - chemistry and functional significance. Photo and phonoreceptors.Temperature regulation in poikilotherms, homeotherms and heterotherms - hibernation, aestivation - diapause.Biological clock and Rhythms.

REFERENCE BOOKS

1. Hoar, W.S.1991. General and Comparative Physiology.Prentice Hall of India, NewDelhi.

2. Prosser, C.L. 1973. Comparative Animal Physiology,3rdedn. W.B. Saunders & Co., Philadelphia.

3. Barrington, E.J.W.1975 .An Introduction to General and Comparative Endocrinology. Clarendon Press, Oxford

4. Bentley,P.J.1971. Endocrine and osmoregulation, Springer Verlag, New York.

5. Palmen,J.D. Brown, I.R and Hastings, J.W.1970. Biological clocks, Academic Press, London.

6. Welson, A. 1979. Principles of Animal Physiology.McMillan Publishing Co. Inc. New York.

7. Schmidt Nelssen, K.1985. Animal Physiology.Adaptation and Environment Club, London.

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZL302 Semester : III

Major - 8 Title: **Developmental Biology**

Credits: 4 Max. Marks. 75

Objectives

To imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through analyses based on modern biological tools.

Course outcomes

CO1: To understand and master on the basic concepts of developmental biology.
CO2: To understand how the fertilization, cleavage and gastrulating occur.
CO3: To understand the basic concepts of organogenesis.
CO4: To understand about the basic concepts of growth, regeneration and ageing
CO5: To describe the medical aspects of Development.

UNIT I: Early Embryonic Development

- The beginning of Organisms-the structure and role of Sperm and egg
- Fertilization and its mechanism in Sea urchin and mammals
- Fate map and early development in Sea urchin, Amphibians, and Mammals

UNIT II: Organogenesis

- The stem cell concept and its origin
- Emergence of Central nervous system and epidermis-fate of neural crest cells-formation of eye
- Emergence of mesoderm -heart and blood vessels
- Emergence of endoderm-extra embryonic membranes
- Mammalian pattern of sex determination

UNIT III: Post Embryonic development

- Cellular and Nuclear differentiation-Nuclear transplantation experiments
- Metamorphosis-Amphibian metamorphosis-Insect metamorphosis
- Regeneration-Morphallactic regeneration in Hydra-compensatory regeneration in Mammalian liver
- Germ cell determination and gamete maturation-role of Y factor in male

UNIT IV: Cell communication in development

- Cell adhesion during development-role of cadherins and integrins
- Cell-cell signaling during development-mechanism and proteins involved
- Paracrine factors- induction and competence
- Signal transduction cascades during induction
- Role of extracellular matrix (ECM)

UNIT V: Medical aspects of Developmental biology

- Genetic errors of human development
- Cell death and Ageing-genes involved and causes
- Embryological therapies (cancer as disease during embryonic development)
- Stem cell therapy and its applications
- Developmental plasticity and symbiosis

References

1. Gilbert, S.F., 2011. Developmental Biology.Sinuaer Associates, USA
2. Balinsky, B. I., 1981. Introduction to Embryology, Saunders C. Philadelphia.

3. Karp,G. and Berrill,N.J.1981. Development. McGraw Hill, New York.
4. Saunders,J.W.1982. Developmental Biology. MacMillan Co., London.
5. Nagabhushanam,R. and Sarojini,R.2002 Invertebrate Embryology. Oxford and IBA Publishing Co.
6. Tyagi,Rajiv and Shukla,A.N.2002.Development of Fishes. Jaya Publishing House, New Delhi.
7. Browder,W.1984.Developmental Physiology. Saunders College Publishing, Rinchert and Winston.

Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZL303 Semester : III

Major - 9 Title: **Immunology**

Credits: 4 Max. Marks. 75

Objective

To Understand the Structural and functional basis of immunoglobulins, the mechanism, mediators, detection and application of antigen-reaction in the immune system.

Course outcomes

CO1: Imparts in depth knowledge of tissues, cells and molecules involved in host defense mechanisms
CO2: Understanding of types of immunity
CO3: Interactions of antigens, antibodies, complements and other immune components
CO4: Understanding of immune mechanisms in disease control, vaccination, process of immune response
CO5: To learn the clinical aspects of Immunology

UNIT-I: IMMUNE BIOLOGY

The cellular constituents of the lympho reticular system-phagocytic cells, polymorpho nuclear neutrophils, mono nuclear phagocytes,eosinophils and lymphocytes.

UNIT-II: IMMUNOGLOBULINS

Immunoglobulins-structure, isotypes and biological function.Antigenic determinant on immunoglobulin-isotype, allotype and idiotype.Immunoglobulin superfamily, monoclonal and polyconal antibodies.organization and expression of immunoglobulin genes. Synthesis of immunoglobulin and disorders of immunoglobulin synthesis.

UNIT-III: DETECTION AND APPLICATION OF ANITGEN ANTIBODY REACTION

Precipitiation - agglutination - complement fixation - immunoassay using labelled reagents (RIA). Immunochromatography Test.

UNIT-IV: MECHANISM OF IMMUNE SYSTEM

Antigen-antibody interaction and immunodiagnostics.MHC- Restriction organization and inheritance of MHC, Antigen processing and presentation.T-cell receptors, B-cell Receptors, cytokine, adhesion molecules.

UNIT-V: CLINICAL IMMUNOLOGY

Immunity against viral, bacterial and parasitic infection –immunological basis of hypersensitivity – Graft rejection.

Vaccines and Immunotherapy: Types and use-prevention of post natal diseases –Tetanus, Diphtheria, Whooping cough, Cholera, Japanese Encephalitis, Measles and HIV infection.

REFERENCE BOOKS

1. Roitt,I.M.1994. Essential Immunology. Blackwell Scientific, Oxford.

2. Richard A.Goldsby, Thomas T.Kindt and Barbara A. Osborne. 2000. KubyImmunology.Freeman and Co., New York.

3. Stites,D.P.,Terr,A.I. and Parsloio,T.G. 1997.Medical Immunology. Prentice Hall, New Jersey.

4. Janeway,C.A and Travers,P. 1997.Immunobiology.Current Biology Ltd., London.

5. Paul,W.E.M.1989. Fundamentals of Immunobiology. Raven Press, New York.

6. Srivastava,R.,Ram,B.P. and Tyle,P.1991. Molecular Mechanism of Immune Regulation.VCH Publishers, New York.

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8. Kannan,I.2007. Immunology.MJP Publishers, Chennai.

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Year: II Year Subject Code : P19EZL301 Semester : III

Elective - 3 Title: **Biophysics (Elective)**

Credits: 3 Max. Marks. 75

Objectives

To imbibe the principles of physics involved in the structure of biomolecules, energy transformation in living systems and the modern physical instruments for the exploration of knowledge in biology

Course outcomes

CO1: To study the basic structure of molecules of life
CO2: To study the thermodynamic principles
CO3: To learn the principles behind microscopes
CO4: To study the photo biophysics
CO5: To study the biophysical principles behind physiology

UNIT- I: STRUCTURE OF BIOMOLECULES

Electron configuration of an atom. Bonds - Covalent bond, Hydrogen bond. Forces between Molecules - Van der Waal's forces - hydrophobic and hydrophilic - biological importance.

UNIT- II: THERMODYNAMICS AND BIOLOGICAL OXIDATION

Laws of Thermodynamics - Concept of free energy and entropy - Exergonic and Endergonic reactions.
Diffusion - Fick's Laws, constant laws.
Oxidation and reduction reactions - Redox potentials in biological system, High energy phosphate group.

UNIT- III: MICROSCOPY

Electron microscope (SEM and TEM), Polarising microscope, Fluorescent microscope, Phase contrast microscope, Dark field microscope.

UNIT- IV: PHOTO BIOPHYSICS

Electromagnetic spectrum - visible and invisible region. Principles involved in Photoelectriccolorimetry. Principle of Spectroscopy - UV & IR Spectroscopy in biological investigation.
Radioactive isotopes - measurements - GM counter, Liquid Scintillation counters, alpha and beta counters. Autoradiography-principle and applications.Effects of radiation in Biological systems.

UNIT- V: BIOPHYSICAL PRINCIPLES APPLIED TO PHYSIOLOGY

Biophysical aspects of vision, hearing, ECG and EEG.

REFERENCE BOOKS

1. Bose, S. 1982. Elementary Biophysics.Jyoth Books,

2. Bums, D.M. and MacDonald, S.G.G. 1979. Physics for Biology and Premedical students.ELBS and Addisson - Wesley Publishers Ltd., London.

3. Casey, E.J. 1962. Biophysics concepts and Mechanism.Affiliated East-West Press Pvt. Ltd., New Delhi.

4. Das, D. 1982. Biophysics and Biophysical Chemistry.Academic Publishers. New Delhi.

5. Epstein, H.T. 1963. Elementary Biophysics, selected topics.Addisson - Wesley Publishing Company Inc. London.

6. Palanichamy, S and Shanmugavelu, M. 1991. Priniples of Biophysics.Palani Paramount, Publication; Tamil Nadu.

7. Roy, R.N. 1996. A Text Book of Biophysics, New Central Book Agency Ltd, Calcutta.

Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZL401 Semester : IV

Major - 10 Title: **Research Methodology**

Credits: 5 Max. Marks. 75

Objectives

The main objectives of this paper are to expose students to state of the art instrumentation, to introduce them to the principles and methods of various instruments used in biology and to prepare them to use these techniques in their own research. The course is a combination of lectures and demonstrations on basic principles and applications of the Spectrophotometers, Chromatographs and Electrophoresis system. With the aid of computer system and software, the students are also given hands on training in bioinformatics. Also, this paper is to acquire knowledge on the preparation of research manuscripts etc.

Course outcomes

CO1: To understand the scientific method, concepts and steps in research
CO2: To Differentiate between the Quantitative and Qualitative Research and understand different types of Research Design
CO3: To understand the various techniques of Data Collection- Observation, Questionnaire, Interview
CO4: To Describe the various types of Sampling
CO5: To Elaborate on Data Processing and Data Analysis

UNIT-I: AN INTRODUCTION TO RESEARCH METHODOLGY

Meaning and objective of Research
Types of Research (Basic, Applied, Inter-disciplinary and Trans-disciplinary)
Research Designs
Funding Agencies (UGC, CSIR, DST, DBT ICMR and ICAR).

UNIT-II: PREPARATION OF MANUSCRIPTS

Preparation of index cards- Reference collection - preparation of thesis - preparation of Scientific paper for publication in a Journal. Internet and e-journals. Computer aided techniques for data analysis, data presentation and slide preparation.

UNIT-III: BIOSTATISTICS & BIOINFORMATICS

Student't' test, Skewness, Kurtosis, Chi – square (Computation required), Correlation analysis (Computation required), Regression analysis (Computation required) and ANOVA.
Internet - Worldwide Web - Search Engines - their functions. Boolean searching - file formats.
Biological data bases - searching source data bases - sequence similarity searches - FASTA and BLAST and Clustal-W.

UNIT-IV: SPECTROSCOPY

Absorption and Emission principles - Principle and application flame photometer, Atomic Absorption and emission spectrophotometers, FTIR, GCMS, NMR and Mass spectrometer

UNIT-V: CHROMATOGRAPHY & ELECTROPHORESIS

Principles and Application of Chromatography: Paper, Thin layer, column, Ion Exchange, Gel filtration, Gas Liquid, HPLC and affinity.
Principles and Application of Electrophoresis: Paper, Agarose, AGE, SDS-PAGE and Iso-Electric focusing.

REFERENCE BOOKS

1. Anderson, Durston and Polle.1970. Thesis and Assignment writing. Wiley Eastern Ltd., New Delhi.
2. Comir and Peter Wood Ford.1979. Writing scientific papers in English. Pitman Medical Publishing Co., London.
3. Ewing, G.W. 1988. Instrumental methods of chemical analysis, McGraw Hill Book Company.
4. Daniel, M. 1989. Basic biophysics for biologists.Agro-Botanical Publishers, India.
5. Skoog, A., Douglas, J. and Leary, J.J. 1992. Principles of Instrumental Analysis.Sanders Golden Sunberst Series, Philadelphia.
6. Day, R.A. 1994. How to write and publish a scientific paper. Cambridge University Press, London.
7. Palanichamy, S. and M. Shanmugavelu.1997. Research methods in biological sciences.Palani Paramount Publications, Tamil Nadu, India.
8. Wilson and Walker. 2000. Practical biochemistry - principles and techniques. Cambridge University Press.
9. Milton, J.S. 1992. Statistical methods in Biological and Health Sciences. McGraw Hill Inc., New York.
10. Gupta, S.P. 1988. An easy approach to statistics. Chand & Co., New Delhi.
11. Gurumani, N. 2006. Research Methodology for Biological Sciences.MJP Publishers, Chennai.
12. Veerakumari, L. 2006. Bioinstrumentation.MJP Publishers, Chennai.
13. Kothari, C.R. 2004. Research Methodology: Methods and Techniques, New Age International Publishers Limited. New Delhi.

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Year:	II Year	Subject Code :	P19MZL402	Semester :	IV
Major - 11	Title:	**Evolution**			
Credits:	4			Max. Marks. 75	

Objectives

To comprehend the scientific concepts of animal evolution through an understanding of its evidences, its mechanics, process and products.

Course outcomes

CO1: To understand the historical background and patterns of evolution
CO2: To explain the adaptation, providing examples from several different fields of biology
CO3: To explain how the molecular record provides evidence for evolution
CO4: To know the evolution of behaviour
CO5: To Understood the Human origin, animal behavior and evolution.

UNIT I: Historical Background and patterns of Evolution

- Importance of Evolutionary Biology and its application
- Evolution before Darwin and Evolution after Darwin
- Principles of evolutionary change based on systematics
- Evidences for evolution from taxonomy and fossils
- Trends and rates of evolution
- Theory of gradualism, Saltation and Punctuated equilibria

UNIT II: Evolutionary processes in Population and Species

- Variation and its sources
- Hardy-Weinberg principle and its significance
- Genetic variation in natural populations and its estimation
- Origin of Genetic variation-mutation-recombination-karyotype alterations
- External sources of variation-Hybridization, Horizontal gene transfer
- Genetic drifts and Neutral hypothesis

UNIT III: Natural Selection, Adaptation and Evolution above species level

- Natural Selection theory-experimental studies and methods of studying Natural selection
- Isolating mechanisms-barriers to gene flow-reproductive isolation-pre and post zygotic isolating mechanisms
- Species concept-modes of speciation (Allopatric, Parapatric, Sympatric, Polyploidy and Hybrid speciation)

UNIT IV: Evolution of behavior

- Behavior as phenotypic traits-variation within and among species
- The theory of foraging

- Evolutionary Stable Strategies (ESS)
- Sexual selection-concept-contests-paternity insurance-sperm competition-mate choice
- Social interaction and evolution of cooperation- theories of cooperation and altruism-inclusive fitness and reciprocation
- Interaction among related individuals-evidence for evolution by kin selection

UNIT IV: Patterns and Process of Behavior

- Micro-evolutionary changes in behavior
- Macro-evolutionary changes in behavior
- Behavior and Adaptive radiation
- Use of phylogeny in studying behavior-Cladistics and Phenetics
- Origin and evolution of sociality in insects, mammals and primates
- Human behavior and Sociobiology- selfish gene and behavior
- Advantages of social behavior

References

1. Agarwal, V.K., 2012. Animal Behavior (Ethology). S. Chand and Co, New Delhi

2. Futuyma, D.J., 1998. Evolutionary Biology.Sinauer Associates, USA.

3. P.A.Moody. 1978. Introduction to Evolution. Harper International.

4. G.L. Stebbine. 1979. Process of Organic Evolution. Prentice Hall India, New Delhi.

3. E.O.Dodson. 1990. Evolution. Reinhold, New York.

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZL403 Semester : IV

Major - 12 Title: **Entomology**

Credits: 5 Max. Marks. 75

Objectives

To catch up with the tremendous strides of expansion of knowledge in Entomology, this paper is meant to comprehend the classification of insects, economic importance of Entomology with special reference to beneficial insects, sericulture, insect pests and their control, vector borne diseases etc.

Course outcomes

CO1: Imparts knowledge of Insect classification
CO2: Knowledge of physiology of structures
CO3: To study the beneficial insects
CO4: Role of insects in spread of diseases
CO5: Role of insects as vectors

UNIT- I : CLASSIFICATION

Classification and General Characters of insects up to order level.

UNIT- II: PHYSIOLOGY OF INSECTS

Physiology of Flight Muscle, Insect respiration, Structure of Secretory glands, Pheromones and Moulting Hormones

UNIT- III: BENEFICIAL INSECTS

Species of Honey bees, Chemical composition of Honey, Biology of Honey bees and their management, By-products.
Lac insects and their management.

UNIT- IV: INSECT PESTS AND THEIR CONTROL

Insects as crop pests
(Paddy: Rice earhead bud bug-*Leptocorisaacuta*, Rice stem borer- *Scripophagaincertulas*
Sugarcane: Leaf hopper – *Pyrillaperpusilla*, Shoot borer – *Chiloinfuscatellus*
Groundnut: Red hairy caterpillar – *Amasctaalbistriga*, Pod bug - *Elasmolomussordidus*
Cotton: Cotton aphid – *Aphis gossypii*, Bollworms – *Platyedragossypiella* and *Helicoverpaarmigera*)
Types of injuries and loss caused to plants in general. Factors governing the outbreak of pests.
Principles and methods of pest suppression: Conventional and Non- conventional, Biological and Integrated pest management.

UNIT- V: INSECTS AS VECTORS

Insect Vector borne diseases (Protozoan – Malaria, Viral - Dengue, Chiekenguniya and Zika).
Method of transmission and adaptation of parasitic agents.
REFERENCES BOOKS

1. William S. Romoser and John G. Stoffolano.W. M.1994. The Science of Entomology C.Brown Publishers, England.

2. YataroTazima, Kodarsha .1978.The silkworm.An important laboratory tool. Scientific Book Ltd., Japan.

3. Ananthakrishnan, T.N. 2002. Insect Plant Interactions. Oxford and I.B.H, New Delhi.

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5. Nayar, K.K., Ananthakrishnan, T.N. and B.V.David. 1989. General and Applied Entomology. Tata McGraw Hill Publications, New Delhi.

6. Larry P.Pedigo. 1989. Entomology and Pest Mangement. Prentice Hall, New Jersey.

7. Metcalf, C.V. and Flint, W.P. 1979. Destructive and useful insects, their habitats and control.Tata McGraw Hill Publications, New Delhi.

8. Daniel Altman Robets. 1978. Fundamental of Plant Pest Control. C.R.S. Publishers and Distributors,Delhi,

9. Chapman, R.F.1988. The insect structure and Function. Cambridge University Press, U.K.

10. Richards, O.W. and Davies, R.G. 1997. Imm's General Text Book of Entomology Tenth Edition.Vol I and II.R.I Publications, New Delhi.

11. Rajeev K.Upadhyay, Mukerjii K.G. Chanda, B.P. and Dubey, O.P. 1998. Integrated Pest and Disease Management. APH Publishing Corporation, New Delhi.

12. David B.V., Muralirangan M.C. and MeeraMuraliRangan. 1992. Harmful and Beneficial Insects. Popular Book Depot, Chennai.

13. Ramakrishna Ayyar T.V. 1989. Handbook of Economic Entomology for South India.Books and Periodicals Supply Service, New Delhi.

14. Frost S.W.1994. General Entomology. Narendra Publishing House, Delhi.

15. Dennis S.Hill. 1993. Agricultural Insect Pests of the Tropics and their Control. Second Edition, Cambridge University Press, U.K.

16. Saxena. A.B. 1996.Harmful Insects.Anmol Publications, New Delhi.

17. Patton. W.S. and Cragg F.W.1981.A Text Book of Medical Entomology. International Books and Periodicals Supply Service, New Delhi.

18. Rathinaswamy, T.K.1986. Medical Entomology.S.Viswanathan and Co., Madras.

19. Sundari, M.S.N. and Santhi, R. 2006. Entomology. MJP Publishers, Chennai

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year: II Year Subject Code : P19MZLP41 Semester : IV

Practical - 3 Title: **Animal Physiology Developmental Biology and Immunology**

Credits: 5 Max. Marks. 60

Course outcomes

- Understanding of stress physiology in animals and human physiology
- To study the various embryological parameters
- To learn various immunological techniques

ANIMAL PHYSIOLOGY

1. Salt loss- salt gain with reference to hypotonic & hypertonic condition – Fish (every half an hour –up to one hour).
2. Study of Respiratory Quotient (RQ) with reference to temperature
3. Estimation of total carbohydrate and protein in fish muscle tissue by standard graph
4. Estimation of blood urea and cholesterol
5. Blood clotting time, Bleeding time and Preparation of Haemin crystals
6. Principle and Application of Sphygmomanometer, Kymograph, Electrophoresis, Haemoglobinometer, ESR
7. Estimation of Haemoglobin and ESR

DEVELOPMENTAL BIOLOGY (slides/Models/Charts/Xerox)

1. Structure of sperm and egg of Seaurchin and a Mammal
2. Fatemap of Seaurchin, tunicate, frog, fish and mammal
3. Different stages in frog development – (2-cell stage, 4 cell stage, 8 cell stage, blastula and gastrula)
2. Development of chick stage – (Blastodisc stage, primitive streak, 24hrs embryo, 48hras embryo, 72hrs embryo and 96hrs embryo)
3. Demonstration of uterine cycle in a mammal (Rat).
4. Study of slides showing of larval forms: Trochophore, Nauplius, Zoea, Bipinnaria,

IMMUNOLOGY (slides/charts/Demonstration/spotters)

1. Lymphoid organs of Rat
2. Principles of Antigen-Antibody interactions
3. Blood typing by agglutination
4. Quchterlony diffusion on gels of antibody titration
5. Immunoelectrophoresis
6. Westernblot
8. Spotter- Spleen, T.S. of bone, Thymus and Lymph node.

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year:	II Year	Subject Code :	P19MZLP42	Semester :	IV

Practical - 4 Title: **Research Methodology Evolution and Entomology**

Credits: 5 Max. Marks. 60

(This Core Practical Paper is compulsory for those not choosing Project / Dissertation with viva voce)

Course outcomes

- Understanding of various statistical and instrumental applications
- To study the various proofs of evolution
- To learn various physiological structures of insects

RESEARCH METHODOLOGY

1. Calculation of measures of Central tendency and deviation using neem leaf length/serrations or length and weight of fishes (if available)
2. Problems relating to test of significance (Chi - square test and t - test)
2. Problems relating to correlation and regression.
3. Familiarization of biological and bioinformatics web sites.
4. BLAST search for similar nucleotide sequences (demo).
5. Spectrophotometric estimation of any biological constituent.
6. Electrophoresis - Paper / Agarose gel / PAGE
7. Preparation of index and reference cards.

EVOLUTION

1. Observation of forelimbs or hindlimbs of vertebrates (Amphibian, reptiles, aves and Mammal) to demonstrate the common pattern of pentadactyl limb and common ancestry of vertebrates.
2. Observation of fossils for paleontological evidences of evolution.
3. Observation of leaf insects and stick insects in the museum to demonstrate adaptation by cryptic colouration and natural selection.
4. Observation of Monarch and Viceroy butterflies to demonstrate Batesian mimicry.
5. Visit to a natural history museum (compulsory)

ENTOMOLOGY

1. Study of morphology of an insect (local insects to be used).
2. Dissection of digestive, nervous, systems of a typical insect – Silkworm/Mylabris
3. Mounting of different types of mouthparts to understand the mode of feeding.
4. a. Field study to collect insect species
   b. Identification and preservation of at least 10 insects belonging to different orders.
   c. Submission of insect box.
5. Field study for various methods of pest management.

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Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year:	II Year	Subject Code :	P19EZL401	Semester :	IV
Elective - 4	Title:	**Sericulture (Elective)**			
Credits:	3			Max. Marks. 75	

(This Paper is compulsory for those not choosing Project / Dissertation with Viva voce)

Objectives
To infuse sound knowledge about the silkworm, their economic importance and diseases and to disseminate Sericulture as a need - based curriculum.

Course outcomes

- Described the Taxonomy, Morphological sex differences in larva and adult of beneficial
- and harmful insects.
- Understood the culture of mulberry plants**,** mulberry silk and silk gland.
- Came to known the culture methods of *B.mori*
- Described the diseases and pests of *B.mori*and plants.
- Studied the quality of silk and marketing strategies of silk.

UNIT -I: ECONOMIC IMPORTANCE AND SILKWORM BIOLOGY

Prospects and status - Trends of production and its economic importance - demand and utilization. Silk producing species - their distribution - Bombyxmori - life cycle - organization of larvae, pupae and moth - structure of the silk gland.

UNIT-II: MORICULTURE

Mulberry - varieties - distribution - methods of cultivation and preparation - Harvest - Transport and preservation of leaves. Feeding and nutrition - specificity of diet - Factors of nutrition - Diet and growth. Pest and diseases.

UNIT-III: SILKWORM REPRODUCTION AND GENETICS

Reproduction - Growth and Development of silkworms - Physiology of molting in different varieties (Uni, bi and multivoltine) - Endocrinology of reproduction and development. Genetics - mutation breeding and development of new strains.

UNIT-IV: PATHOGENIC DISEASES AND PEST

Pathology - Viral, bacterial, fungi and protozoan diseases - control mechanisms. Uzifly menace.

UNIT-V: SILKWORM REARING AND SILK REELING

Rearing operations - Selection and construction of rearing house - Incubation - Hatching - brooding, Harvesting etc.Reeling techniques - lacing - skinning. Re-reeling etc,

REFERENCE BOOKS:

1. Ganga, G. and SulochanaChetty, J. 1997.An Introduction to Sericulture. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Ganga, G. 2003. Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

3. HisaoAruga. 1994.Principles of Sericulture (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Veda, K., Nagai, I. and Horikomi, M. 1997. Silkworm Rearing (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

5. Otsuki, R. and Sato, S.1997. Silkworm Egg Production (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

6. Eikichi Hiratsuka. 1999. Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

7. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., 2000.

Mulberry Silk Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

8. Soo-Ho Lim, Young-Taek Kim, Sang-Poong Lee. 1990. Sericulture Training Manual - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

9. Wu Pang-Chuan and Chen Da-Chuang. 1994. Silkworm Rearing - Published by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

10. Lu Yup-Lian and Liu-Fu-an. 1991. Silkworm Diseases – Published by
by FAO - USA. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Syllabus for M.Sc., Zoology effective from the year 2019-2020

Year:	II Year	Subject Code :	P19EZLP41	Semester :	IV
Elective Practical - 2	Title:	**Sericulture**			
Credits:	3			Max. Marks. 40	

Course outcomes

To study the various morphological and physiological aspects

SERICULTURE

1. Study of external morphology of silkworm moth, larvae and pupae.

2. Dissections of digestive, nervous system of silkworm.

3. Mounting of silk gland of silk worm

3. Study of silkworm rearing and reeling operations (Field visit and photographs to be pasted)

4. Study of silkworm pathology - viral - bacterial - fungal diseases (Field visit-slides specimens/Xerox)