

ZOOLOGY

CURRICULUM AND SYLLABI

**K.M. CENTRE FOR POST GRADUATE
STUDIES (KMCPGS)**

2018-19 ONWARDS

CBCS

M.Sc. – I, II, III & IV Semester

M.Phil- I & II Semester

AUTONOMOUS SCHEME

UNIVERSITY GRANTS COMMISSION

M.Sc. DEGREE EXAMINATION
SCHEME OF EXAMINATION (with effect from July 2018)

INTERNAL ASSESSMENT
THEORY (SEMESTER)

| | | |
|---------------------------------------|---|------------------|
| 1. The better three out of four tests | : | 5+5+5 = 15 Marks |
| 2. End Semester test | : | 15 Marks |
| 3. Seminar and Assignment | : | 10 Marks |
| Total | : | 40 Marks |

INTERNAL ASSESSMENT
PRACTICAL (END OF EACH SEMESTER)

| | | |
|---------------------------------------|---|----------|
| 1. The better three out of four tests | : | 15 Marks |
| 2. End Semester test | : | 15 Marks |
| 3. Record Submission | : | 10 Marks |
| Total | : | 40 Marks |

THEORY (END OF EACH SEMESTER) : 60 Marks

| | Maximum Marks | Minimum Marks 40% | Pass Mark |
|-----------------|----------------------|------------------------------------|------------------|
| Internal | 40 | 16 | 50 |
| External | 60 | 24 | |
| | | | |

**UNIVERSITY EXAMINATION
THEORY QUESTION PAPER (SEMESTER)**

Time: 3 hours.

Maximum: 60 Marks

SECTION – A (4 x 2.5 = 10 Marks)

Answer ALL questions,
Define / Explain / Describe the following (Minimum one question from each unit)

SECTION – B (4 x 5 = 20 Marks)

Answer ALL questions, (Internal Choice).
(Minimum one question from each unit)

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE questions, (5 questions to be given)
(Minimum one question from each unit)

PRACTICAL EXAMINATION (END OF EACH SEMESTER)

Time: 3 Hours

Maximum: 60 Marks

| | | |
|---------------|--------------------|------|
| Question I | Practical Exercise | - 15 |
| Questions II | Practical Exercise | - 10 |
| Questions III | Spotters | - 15 |
| Question IV | Record | - 10 |
| Question V | Viva Voce | - 10 |

M.Sc. Zoology
Scheme of Papers for all the four semesters under CBCS

| Semester | Course | Code | Title of Paper | Hours / Week (30) | Credits | Total Credits |
|--------------|--|----------|---|-------------------|---------|---------------|
| S1 | Hard Core Course I | ZOHT101 | Structure and function of Invertebrates | 3 | 3 | 22 |
| | Hard Core Course II | ZOHT102 | Structure and function of Chordates. | 3 | 3 | |
| | Hard Core Course III | ZOHT103 | Animal Physiology. | 3 | 3 | |
| | Hard Core Course IV | ZOHT104 | Genetics | 3 | 3 | |
| | Soft Core | ZOSC105 | Economic Zoology | 3 | 3 | |
| | Practical I | ZOHP106 | Practical - I. (ZOHT101 & ZOHT102) | 6 | 3 | |
| | Practical II | ZOHP107 | Practical – II (ZOHT103 & ZOHT104) | 6 | 3 | |
| | Seminar / Tutorial/ Field Training | | | 3 | 1 | |
| S2 | Hard Core Course I | ZOHT201 | Cell and Molecular Biology. | 3 | 3 | 22 |
| | Hard Core Course II | ZOHT202 | Molecular Endocrinology | 3 | 3 | |
| | Hard Core Course III | ZOHT203 | Animal Ecology and Ethology | 3 | 3 | |
| | Hard Core Course IV | ZOHT204 | Evolution and Conservation Biology | 3 | 3 | |
| | Soft core (Inter disciplinary) | ZOSC205 | Public Health and Hygiene (For others also) | 3 | 3 | |
| | Practical III | ZOHP206 | Practical – III. (ZOHT201 & ZOHT202) | 6 | 3 | |
| | Practical IV | ZOHP 207 | Practical – IV . (ZOHT203 & ZOHT204) | 6 | 3 | |
| | Seminar / Tutorial/ Field Training | | | 3 | 1 | |
| S3 | Hard Core Course I | ZOHT301 | Developmental Biology | 3 | 3 | 22 |
| | Hard Core Course II | ZOHT302 | Immunology | 3 | 3 | |
| | Hard Core Course III | ZOHT303 | Fisheries and Aquaculture | 3 | 3 | |
| | Hard Core Course IV | ZOHT304 | Biological Techniques and Bioinformatics. | 3 | 3 | |
| | Soft Core | ZOSC305 | Fish Preservation and Value Addition Techniques. | 3 | 3 | |
| | Practical V | ZOHP306 | Practical – V (ZOHT301& ZOHT302) | 6 | 3 | |
| | Practical VI | ZOHP307 | Practical – VI (ZOHT303& ZOHT304) | 6 | 3 | |
| | Seminar / Tutorial/ Field Training | | | 3 | 1 | |
| S4 | Soft Core | ZOSC401 | Soft Core – Environmental Education/ Aquariculture (For others also) | 3 | 3 | 17 |
| | Hard Core Course Individual Project | ZOPW402 | Project | 20 | 10 | |
| | | | Viva | | 1 | |
| | Seminar / Tutorial/ Field Training | | | 7 | 3 | |
| Total | | | | | | 83 |

DEPARTMENT OF ZOOLOGY, KMCPGS.

INDEX

| S.No. | Paper Code | Title of Paper (M.Sc.) | Page No. |
|---------------------|-------------------|--|-----------------|
| Semester I | | | |
| 1 | ZOHT101 | Structure and function of invertebrates and Biosystematics. | 1 |
| 2 | ZOHT102 | Structure and function of chordates. | 3 |
| 3 | ZOHT103 | Animal physiology. | 4 |
| 4 | ZOHT104 | Genetics | 5 |
| 5 | ZOSC105 | Economic Zoology | |
| 6 | ZOHP106 | Practical - I. | 6 |
| Semester II | | | |
| 7 | ZOHT201 | Cell and Molecular Biology. | 7 |
| 8 | ZOHT202 | Molecular Endocrinology | 8 |
| 9 | ZOHT203 | Animal Ecology and Ethology | 9 |
| 10 | ZOHT204 | Evolution and Conservation Biology | 10 |
| 11 | ZOSC205 | Public Health and Hygiene (For others also) | 11/12 |
| 12 | ZOHP206 | Practical – II. | 13 |
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| 13 | ZOHT301 | Developmental Biology | 14 |
| 14 | ZOHT302 | Immunology | 15 |
| 15 | ZOHT303 | Fisheries and Aquaculture | 16 |
| 16 | ZOHT304 | Biological Techniques and Bioinformatics. | |
| 17 | ZOSC305 | Fish Preservation and Value Addition Techniques. | 17/18 |
| 18 | ZOHP306 | Practical – III. | 20 |
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| 19 | ZOHT401 | Soft Core – Environmental Education/ Aquariculture (For others also) | 21 |
| 20 | ZOHT402 | Project | 22 |
| 21 | ZOHP 403 | Viva | 23 |
| M.Phil. | | | |
| Semester - I | | | |
| 25 | ZOHT | Research Methodology | 25 |
| 26 | ZOSC | Recent Advances in Zoology | 26 |

Semester – I
Code: ZOHT – 101
STRUCTURE AND FUNCTION OF INVERTEBRATES

UNIT I - TAXONOMY

International Code of Zoological Nomenclature. Connecting links in Invertebrates. Species concepts in Taxonomy. Trends in taxonomy - Chemotaxonomy, cytotaxonomy and molecular taxonomy, Dendrogram, Cladistics - 3 domain classification - Recent developments in animal taxonomy.

UNIT II – LOWER INVERTEBRATES I

General organization of animals - Parasites of Protozoa in relation to human health - Sponges – Canal system - Origin of Metazoa.

UNIT III – LOWER INVERTEBRATES II

Polymorphism - Evolutionary significance of larvae of Coelenterata - Origin of Bilateria - Adaptation of Helminth parasites - Helminth parasites.

UNIT IV – HIGHER INVERTEBRATES

Metamerism and excretion in Annelida, Significance of Trochophore - Parasitic Arthropoda - Larval forms of Arthropoda - Larval forms of Echinodermata - Economic importance of Mollusc.

Text Books/Course Book

1. Barrington, E.J.W. 1983. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
2. Hyman, L.H. 1962. The Invertebrates. Vol.1, 2 & 8. McGraw Hill Co., New York.
3. Barnes, R.D. 1987. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
4. Kapoor, V.C.2010. Theory and Practice of Animal Taxonomy. Oxford & IBH Pub. New Delhi
5. Jordan E.L.& Verma,P.S. 2015. Invertebrate Zoology. S. Chand Publications.
6. Kotpal R.L.2016. Modern Textbook of Invertebrates. Rastogi Publications.

Reference Books

5. Russel-Hunter, W.D. 1962.A Biology of higher Invertbrates, the Macmillan Co. Ltd., London.
6. Read, C.P. 1975. Animal Parasitism. Prentice Hall Inc., New Jersey.
7. Sedgwick, A.A. 1972. Student Text Book of Zoology. Vol. I, II and III. Central Book Depot, Allahabad.
8. Simpson, G.G. 1966. Principle of animal taxonomy Oxford IBH Publication Company.
9. Mayer, E. 1969. Elements of Taxonomy, Harvard Uni. Press, Cambridge.

Semester –I
Code: ZOHT – 102
STRUCTURE AND FUNCTION OF CHORDATES

Unit –I Origin and Characteristic features of Chordates:-

Protochordates – Classification upto orders:

Structural organization of Cephalochordates, Hemichordates and Urochordates – interrelationships and affinities.

Unit –II Pisces

Fins in Fishes; Evolution of fishes; Integumentary system in vertebrates; Jaw suspension.

Unit –III Amphibia & Reptilia

Origin of Amphibia; Neoteny in Amphibia; Terrestrial adaptations in Amphibia, reptiles; Dinosaurs – origin, evolution and extinction.

Unit – IV Aves & Mammalia

General characters of birds– feathers, beak and feet; Origin of evolution of birds. salient features of mammals, Prototheria, Metatheria and Eutheria, Flying Mammals with special reference to bat and aquatic mammals with special reference to dolphin.

Text books/Course Books

1. Alexander, R.M. 1998. The Chordates – Cambridge University press, London.
2. Young.J.Z. 2006. Life of Vertebrates . Third edition.
3. Ekambaranatha Ayyer and Ananthakrishnan. 2008. Manual of Zoology- Chordata. Volume II.
4. Jordan E.L.& Verma,P.S. 2016.Chordate Zoology. S. Chand publications.

Reference Books

5. Bourne, G.H. 2001. The structure and Functions of Nervous tissue, AP/NY.
6. Kenneth V. Kardong,2010. Vertebrates: Comparative Anatomy, Function, Evolution IV Edition.Tata McGraw Hill Education Pvt. Ltd.
7. Arnold G.K and Frye.B.E. 1977. Chordate structure and function. Second edition.

Semester – I
Code: ZOHT – 103
ANIMAL PHYSIOLOGY

Unit – I: Nutrition and Locomotion :-

Types of feeding: mucoid , ciliary and flagellar feeding. Types of digestion: Extra cellular and intra cellular digestion, digestion and absorption of carbohydrates, proteins and fats. Structure of voluntary muscle fibres, Neuro-muscular junction, Physiology of muscle contraction.

Unit – II: Circulation and Respiration

Types of transport mechanism: Blood and its components; Physiology of heart, cardiac cycle, neural and hormonal control of heart beat; Blood pressure and ECG- principle and interpretation. Respiration: Types of respiration, chemistry of respiratory pigments, Physiology of respiration, Transport of oxygen and carbon dioxide, neural and chemical regulation of respiration.

Unit – III: Excretion and Osmoregulation:-

Organs of excretion in animals, Formation of nitrogenous wastes- Ammonia, Urea and Uric acid and their relationship, Urine formation in man; Regulation of water, electrolyte and acid – base balance. Factors influencing urine formation.

Unit – IV: Control and Co-ordination:-

Neuron structure, Physiology of nerve conduction, Central Nervous system – Autonomic- Peripheral nervous system.

Sense organs - Simple receptors – organs of olfaction and taste – Acoustico – lateralis system – Electoreception, vision and hearing in mammals.

Nervous System: Comparative anatomy of the brain and spinal cord of vertebrates

Text Books/Course Book

1. Hoar, W.S.1991. General and Comparative Physiology. Prentice Hall of India, New Delhi.
2. R. Eckert and D. Randall, 2005. Animal physiology – Mechanisms and adaptations, CBS Publishers and Distributors Pvt Ltd, New Delhi.
3. Knut Schmidt-Nielsen.2002. Animal Physiology: Adaptation and Environment. Cambridge University Press.

Reference Books

3. John.E.Hall& Arthur,C.Guyton.2015. Medical Physiology. Saunders Elsevier.
4. Schmidt Nelssen, K.1985. Animal Physiology. Adaptation and Environment Club, London.
5. Herkat, P.C.and Mathur, P.N.1976. Text Book of Animal Physiology.S.Chand Co. Pvt,Ltd., New Delhi.

Semester-I
Code: ZOHT 104
GENETICS

Unit- I: Basics of Genetics:-

Mendel's law of inheritance, chromosomal theory of inheritance- dominance, co-dominance and incomplete dominance-pleiotropism- lethal and sublethal genes-genetic interactions: epistasis-mechanism of epistasis.

Unit- II: Chromosome structure – Genetic disorders

Histone, non histone proteins –DNA- nucleosome morphology-heterochromatin, euchromatin, Chromosomal rearrangement. Inborn errors of metabolism-one gene-one enzyme hypothesis, Chromosomal basis of genetic disorder- PKU- Alkaptonuria, Galactosemia. Genetic counselling – ethics and principles.

Unit – III Human genetics

Sex determination, dosage compensation of X-linked genes– inactivation of X-linked genes in female. Genetic analysis of complex traits - complex pattern of inheritance, quantitative traits, chromosome anomalies and diseases- chromosomal anomalies in malignancy (chronic myeloid leukemia, Burkitt's lymphoma, retinoblastoma and Wilms' tumor).

Unit – IV Recombinant DNA Technology,

Basic recombinant DNA techniques, restriction modification systems, various enzymes used in recombinant DNA technology, nucleic acid probes, blotting techniques, DNA fingerprinting, construction of genomic and cDNA libraries.

Text Books/Course Book

1. Klug W.S. and Cummings M.R. 2004. Concepts of Genetics,– Prentice Hall.
2. Gupta.P.K.2008. Molecular Biology and Genetic Engineering. Deep and Deep Publications.
3. Verma.P.S. and Agarwal. 2012.Genetics.S.Chand Ltd.
4. Watson et al.,Recombinant DNA: Genes and Genomics - a short course, W. H. Freeman and Company, New York, USA
5. Primrose, S. B. and Twyman, R. M., Principles of Gene Manipulation and Genomics, (7th Ed. 2006), Blackwell Publishing, West Sussex, UK
6. Bernard R. and Jack. Molecular Biotechnology: Principles and application of recombinant DNA, ASM Press, Herndon, USA
7. Gardiner

Reference Books

4. Pierce B.A .2001. Genetics: a Conceptual Approach,– Freeman

5. Hartle D.L. and Jones E.W. 2010. Genetics: Analysis of Genes and Genomes,– Jones and Bartlett
5. D. Peter Snustad, Michael J. Simmons.2003. Principles of Genetics,– John Wiley & Sons
6. Griffith AF et al., 2003. An introduction to Genetic Analysis, - Freeman6. The Darwinian Tourist: Viewing the World Through Evolutionary Eyes, Wills C – Oxford Univ. Press

Semester – I
(Soft Core)
Code: ZOSC-105
ECONOMIC ZOOLOGY

Unit I Medical entomology

Parasites of domestic animals and human, structures, life cycles, pathogenicity, diseases, symptoms and control. Insects as vectors– mode of disease transmission – Malaria, Filaria, Dengue, chikunguniya, Plague, Leishmaniasis, - Surveillance, control measures – Biological, environmental, chemical, mechanical; Integrated vector management.

Unit II: Veterinary Biology

Animal Breeding, Breeds of cattle, sheep, swine and poultry. Economic importance and control of fleas, lice, bugs, mosquitoes, flies and parasitoids. Vector-parasite interaction; host-pathogen interaction, Insect transmitting bacteria and viruses of animals - control of insect vectors of animals.

Unit– III: Farming Practices:

Aquaculture: Prawn culture, Pearl oyster farming, Pisciculture, Poultry farming, Sericulture, Apiculture, Lac-culture.

Unit– IV: Pest Management

Household pests, pests of crops (paddy, sugarcane, mango). Classification of pesticides– mode of action- Integrated Pest Management (IPM): Physical, Chemical, Biological control– Resistance development in insects.

Text Books/Course Book

1. Mani, M.S.1982. General Entomology. Oxford & IBH Publishing CO.
2. Vasantharaj David.B. 2012. Elements of Economic Entomology. Namrutha Publications
3. Prasad.T.V.2014. Handbook of Entomology. New vishal Publishers.

Reference Books

4. Temphare, D.B, 1984. A text book of insect morphology, physiology and endocrinology. S.Chand &Co., New Delhi
5. Chapman, R.F,2013. The Insects: Structure and Functions. Cambridge University Press.
6. Gullan, P.J.& Cranston, P.S.2004.The Insects: An Outline of Entomology. John Wiley & Sons.

Semester – I
Code: ZOHP - 106
PRACTICAL – I
Papers covering ZOHT 101-104

Invertebrates:

1. Study of water balance in Paramecium PC based (Demo).
2. Observation and identification of microscopic slides. Models of coelom, gills, booklungs, trachea, gill books, nephridia, malpighian tubules and nerve cells.
3. Observation and identification of larval forms of free living invertebrates
4. Observation and identification of parasites.
5. Study of museum specimen related to theory.
6. Mounting of mouthparts of mosquito/cockroach/ Radula/ Setae.
7. Identification, collection and submission of any 5 economically important insects.

Chordates:

8. Osteology – skull, lower jaw and vertebrae.
9. Observation and identification of microscopic slide and museum specimen related to chordates.
10. Mounting of olfactory rosette in a fish.
11. Mounting of different types of scales of fishes / fins of fishes.
12. Observation of larvivorous fishes.

Physiology:

13. Measurement of blood pressure – sphygmomanometer.
14. Estimation of haemoglobin content in the blood.
15. Differential count of WBC.
16. Recording and interpretation of ECG (Demo).
17. Quantitative estimation of ammonia/ urea/ uric acid/ creatine.
18. Study on enzyme activity – temperature/substrate concentration.
19. Study on oxygen consumption /salt loss or salt gain by fish.
20. Study of Fauna through field visits.

Semester – II
Code: ZOHT – 201
CELL AND MOLECULAR BIOLOGY

Unit – I: Organization of Eukaryotic cells:-

Structural organization and function of Plasma Membrane, Mitochondria (Kreb's Cycle, ETC) Endoplasmic reticulum, Golgi Complex and Ribosomes. Cell-cell interactions- intercellular junctions: Ca⁺⁺ dependent and Ca⁺⁺ independent cell-cell adhesion.

Unit – II: Cell cycle and Signal transduction:-

Structural organization of DNA, Mitosis and Meiosis - control mechanism of cell division, Cell cycle and its regulation. Cell signalling and transduction, cell surface receptors, G protein and second messenger system.

Unit- III: Transcription and Translation in Eukaryotes:

Genetic code- degeneracy and universality of genetic code. DNA Replication, different models of replication for linear and circular DNA. Transcription, Post transcriptional modifications and inhibitors of transcription. Translation, Post translational modification of proteins, inhibitors of translation.

Unit – IV: DNA repair and mutagenesis:-

DNA damage, Nucleotide excision repair, Mismatch repair, Recombination repair, Double strand break repair. Tumor Vs Cancer, Types of Cancer, Protooncogenes, oncogenes, tumor suppressor genes. Ageing and apoptosis.

Text Books/Course Book

1. De Robertis. E.D.F. and De Robertis. E.M.F. 2001. Cells and Molecular Biology, B.I Publications Pvt Ltd, India.
2. Powar.C.B 2002. Cell Biology. Himalaya Publishing House.
3. Verma.P.S. and Agarwal. 2004. Text book of Cell Biology.S. Chand Ltd.

Reference Books

4. Lewin's GENES X, Volume 10.2011. Oxford University Press, New York.
5. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons.
6. Avers. C.J., 1986. Cell Biology. Addison-Wesley Publishing Company.
7. Lodish, H., Berk A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, S.L. and Darnell, J. 2004. Molecular Cell Biology. W.H. Freeman & Co., New York.
8. Keith Wilson, John Walker.2010. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press.

Semester – II
Code: ZOHT – 202
MOLECULAR ENDOCRINOLOGY

Unit-I: Scope of Molecular Endocrinology:-

Classification of hormones: Peptide, Steroid and Amines.

Mechanism of hormone action: Cellular hormone receptors – membrane, cytosolic and nuclear receptors. G-protein – structure and signal transduction mechanism; Second messengers (cAMP, cGMP, DAG, IP3 and Calmodulin).

Unit-II: Neuro Endocrinology:-

Hypothalamo – hypophyseal gonadal axis, Feedback regulation – Positive and Negative. Structure, functional relationship between Adenohypophyseal hormones and Neurohypophyseal hormones; Indolamine , Endorphin and Enkephalin.

Unit-III : Hormones and Metabolism:-

Structure, function and regulation of Thyroid hormones, catecholamine, Corticosteroid and Pancreatic hormones, Role of hormones in carbohydrate and lipid metabolism; Role of hormones in mineral homeostasis. Renin Angiotensin System, Gastrointestinal hormones.

Unit-IV: Hormones and Reproduction:-

Structure and functional relationship of Sex steroid hormones - Androgen, Estrogen and Progesterone; Reproductive cycles in mammals (Estrous and Menstrual cycles). Hormones of Pregnancy, Parturition and Lactation; Contraception.

Text Books/Course Book

1. Haris, G.W. and B.T. Donovan. 1968. The Pituitary Gland. S. Chand and Co.,
2. Bentley, P.J. 1998. Comparative vertebrate endocrinology, Second Edition, Cambridge University Press. Cambridge.
3. Mac Hadley. 1992. Endocrinology, 3rd Edition. Prentice - Hall Inc. A Simon & Schuster company, Englewood Cliffs, New Jersey. USA.
4. Ingleton, P.M. and J.T. Bangara. 1986. Fundamentals of comparative vertebrate endocrinology, Kluwer Academic Publishers.
5. Turner, C.D. and J.T. Bangara. 1986. General endocrinology. Saunders International Student edition. Toppan Company Limited. Tokyo.

Reference Books

6. Barrington, E.J.W. 1985. An introduction to general and comparative endocrinology. Clarendon Press Oxford.
7. Mac E.Hadley, 1997. Endocrinology. Pearson Education, Indian Reprint. 8.Hormones, 2nd Ed. Anthony W. Norman and Gerald Litwack. Academic press, New York.

Semester - II
Code: ZOHT – 203
ANIMAL ECOLOGY AND ETHOLOGY

Unit- I: Concept of ecosystem:-

Structure and functions of ecosystems- freshwater, marine, energy flow-food chain-food webs.

Population Ecology: Population characteristics (natality, mortality, density, growth – k and r species, age distribution, dispersion - survivorship curves); Life table.

Unit - II : Species interactions:-

Types- intra and inter specific interaction (Parasitism, Predation, commensalism, amensalism, competition - mutualism-symbiosis- proto-cooperation). Concepts of Biodiversity: Principles and management of biodiversity, Project Tiger; biosphere reserves- Use of Remote Sensing - hot spots of biodiversity- India (western ghat & Himalayas) and global - red data book-*insitu* and *exsitu* conservation- Role of National Biodiversity Authority (NBA) of India; Environment laws and Bioethics.

Unit – III: Development of Behaviour:-

Approaches and methods in study of behavior, communication-chemical, light, visual, audio; songs of birds. Learning and Memory: Instinct, habituation, conditioning (classical and operant), imprinting, reasoning, insight and cognitive learning.

Unit – IV: Social behaviour:-

Group selection, kin selection, Altruism, Reciprocal altruism, social communication in insects, aggressive behavior, habitat selection and foraging. Biological rhythms: Circadian, circannual rhythms; Migration, Orientation and Navigation (fishes and birds); sexual conflict- Selfishness-mating systems, parental care, parental investment and reproductive success.

Text Books/Course Book

1. Verma P.S. and Agarwal. V.K., 2000. Environmental Biology, S. Chand Publishers.
2. Agarwal. V.K., 2010. Animal Behaviour. S. Chand Publishers.
3. Arora.C.K. and Harjindra Singh, 2003. A text book of animal behavior, Anmol publications Pvt.Ltd.
4. Odum.E.P. 1988. Fundamentals of Ecology. Saunders. Co.
5. Wilson,E.O 2001.Sociobiology: The New Synthesis.Harward Univ Press.Cambridge.Mass.USA.
6. Chapmann,J.L and Reiss,M.J. 1995. Ecology Principles and Applicaion.Cambridge Univ. Press.
7. James W.Crier 1984.Biology of Animal Behaviour. Times Mirror/Mosby.College Pub.U.S.A.
8. Begen /Harper/ Townsend 1990. Ecology: Individuals, Populations and Communities. Blackwell 2nd ed.

Reference Books

4. Alock,J. 1997. Animal behavior: An evolutionary approach. Sinauer assoc. Sunderland Mass . U.S.A.
5. Aubrey Manning. 1995. An introduction to animal behavior.ELBS.

6. David McFarland. 1987. Animal Behaviour, Psychobiology, Ethology and Evolution. ELBS /Longman.
8. Krebs,J.R and Davies,N.B .1991 Behavioural Ecology. Blackwell. Oxford.U.K.
9. Ludwig,J.A and J.F.Reynolds.1988. Statistical Ecology. John Wiley and Sons. New York.

Semester-II
Code: ZOHT – 204
EVOLUTION AND CONSERVATION BIOLOGY

Unit – I: Concepts of evolution:-

Concept of organic evolution during pre- and post Darwin era. Theories of organic evolution, Adaptive radiation and modification- isolating mechanism, Speciation- allopatric and sympatric speciation – convergent evolution-sexual selection and gene flow- co-evolution.

Unit – II: Origin and evolution of gene:-

Molecular evolution- amino acids and nuclear substitutions, causes of variation, Origin of new genes and proteins, gene duplication and divergence. Hardy-Weinberg equilibrium - Genetic drift

UNIT-III: Conservation of biodiversity

Valuation of biodiversity, consumptive and productive use values; threats, global ecosystem services; An overview of global conservation efforts- Earth Summit, Hotspots, Protected areas and functions; UNESCO, biosphere reserves; conservation agencies and programmes: *In situ* and *ex situ* conservation. IUCN, IBWL, BNHS, UNEP, UNDP.

UNIT-IV Habit Fragmentation and Extinction

Theory of island biogeography- habitat fragmentation: area and edge effect, Causes for extinction: habitat loss, industrialization, hunting and invasive species. Extinction through geological time scale: mass extinction and impact on flora and fauna- Current extinction trends- rarity and endangered species conservation-

References:

Text Books

1. Barton, N. H., Briggs, D. E.G., Eisen, J. A., Goldstein, A. E., Patel, N. H., Evolution, Cold Spring Harbor Laboratory Press, New York, USA
2. Futuyma, D. J., Evolution, Sinauer Associates, Inc., Sunderland, USA
3. Andrew S. Pullin Conservation Biology. 2002., Cambridge University Press, UK.
4. R. B Primack, Essentials of conservation Biology. 1998. Sinauer Associates, (latest edition).
5. Conservation biology 1986. Ed. M. E. Soule, Sinauer Associates.
6. Dobzhansky
7. Dodson
8. Websites

Semester-II
(Interdisciplinary for others) (Soft Core)
Code: ZOSC-205
PUBLIC HEALTH AND HYGIENE

Unit-I : Communicable diseases and remedial measures:-

Food and Water borne diseases - cholera, polio, jaundice and remedial measures. Air borne diseases - Chicken pox, influenza, tuberculosis and remedial measures.

Unit-II : Non Communicable diseases and remedial measures:-

Vector borne diseases – mechanism of transmission – malaria, filaria, chickunguniya, dengue. Contact diseases -leprosy, scabies. Inherited disorders of blood -haemophilia, sickle cell anemia. Sexually Transmitted Diseases –Syphilis, gonorrhoea, AIDS and remedial measures.

Unit-III : Environmental health:-

Pollution –Air, water and e-waste, Industrial wastes, Solid Waste management; Modern gadgets and human health; Water quality – sentinel organisms - coliform groups.

Unit-IV : Human epidemics:-

Carcinogen, carcinogenesis – Radiation hazards- Metabolic disorders (Obesity, Diabetes) and Life style associated diseases in man (Alcoholism and Drug abuse) Heart Diseases- Hypertension; Occupational health Hazards.

Text Books/Course Book

1. Sharma, P.D, 1995. Ecology and Environment. Rastogi Publication, Meerut.
2. Wyler, D.J, 1990. Modern parasite Biology. W.H. Freeman and Company, New York.
3. Gupta, P.K, and V. Ramprakash, 1985. Advance in Toxicology and Environmental Health. Jagmender Book GENCY, New Delhi.
4. William Hobson, 2006. Theory and practice of Public Health. Oxford Medical Publishers.

Reference Books

5. Roger. Detels et al., 2009. Oxford Textbook of Public Health, Oxford University Press
6. Mcgraw Hill, 2010. Public Health and Preventive Medicines.

Semester – II
PRACTICAL – II
Code: ZOHP 206
Papers covering ZOHT 201-204.

Cell Biology:

1. Observation of cell and sub cellular organelles.
2. Measurement of cell dimensions.
3. Study of various stages of Mitosis and Meiosis.
4. Mounting of Polytene chromosome in Chironomous larva / *Drosophila*.

Genetics:

5. Study of wild and mutant forms of *Drosophila melanogaster*
6. Preparation of Karyotype / ideogram of normal and syndromes (Human).
7. Identification of Barr body.
8. Estimation of frequency of genetic traits in human population.

Bio-molecules and Structural Biology:

9. Estimation of serum glucose.
10. Estimation of serum protein
11. Estimation of serum cholesterol.

Endocrinology:

12. Histological study of endocrine glands.
13. Test for pregnancy.
14. Visit to research institutions and laboratories.

Semester - III
Code: ZOHT- 301

BIOMOLECULES AND STRUCTURAL BIOLOGY

Unit – I: Proteins and Nucleic acids :Chemical bonds – Biological importance of biomolecules
Amino acids – structure , classification - uncommon amino acids; Proteins - structure (primary, secondary, tertiary and quaternary), classification, properties – protein denaturation and folding – chaperons – Prion. Nucleic acids – structure, base composition of DNA, double helix, A, B and Z forms of DNA, super coiled DNA, types of RNA.

Unit – II: Carbohydrates and lipids: Structure and classification (mono, di and polysaccharides), properties: glycoconjugates (proteoglycans, glycoproteins, glycolipids). Lipids – structure and classification (simple, derived and conjugated).

Unit – III: Laws of Thermodynamics: Concepts of free energy in biology – Redox potentials – high energy phosphate bonds. Enzymes – classification, nomenclature, Kinetics, effect of pH, temperature and substrates; enzyme inhibitors.

Unit – IV: Metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis. Glycolysis – Embden - Meyerhoff pathway, Citric acid cycle, oxidative phosphorylation, hexose monophosphate shunt; Lipids – biosynthesis and oxidation of fatty acids – energetics.

Text Books/Course Book

1. Jain.J.L. 2013. Biochemistry.S.Chand Publication.
2. Ambika Shanmugam.2012. Fundamentals of Biochemistry for Medical Students: Indian Edition. Lippincott Williams & Wilkins.
3. Voet, D. and J.G. Voet.2010. Biochemistry John Wiley & Sons.
4. Freifelder, D. 1996. Physical Biochemistry W.H. Freeman & Co.
5. Segal, I.H. 1972. Biochemical calculations John Wiley and Sons.

Reference Books

7. Creighton, T.E. 2010. Protein Structure and Molecular Properties W.H. Freeman & Co.
8. Freifelder, D. 2008. Essentials of Molecular Biology.
9. Wilson, K. and K.H. Goulding. 2011. A Biologists Guide to Principals and Techniques of Practical Biochemistry.
10. Cooper, T.G. 2006.Tools in Biochemistry .
11. Hawk, 2002. Practical Physiological Chemistry
12. Garret, R.H. and C.M. Grisham.2004. Biochemistry. Saunders College Publishers.
13. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer.2010. Biochemistry. W. H. Freeman.
14. David L. Nelson, Michael M. Cox.2017. Lehninger Principles of Biochemistry. W. H. Freeman.

Semester- III
Code: ZOHT - 302
DEVELOPMENTAL BIOLOGY

Unit- I: Early Development:-

Fertilization - Structure of the gametes- sperm and egg; recognition of sperm, egg and sperm attraction; acrosome reaction, contact of gametes in mammals. Species-specific recognition, gamete fusion and prevention of polyspermy; fusion of genetic material, activation of egg metabolism, rearrangement of egg cytoplasm.

Unit – II: Morphogenetic movements:-

General features of cleavage, blastula and gastrula of fruitfly and Chick. Morphogenetic movements- Epiboly, Emboly, Invagination, Ingression, Delamination; Axes formation in fruitfly and Chick.

Unit- III: Organogenesis:-

Primary Embryonic Induction, Mechanism of Primary Induction, Function of Organizer, Regional specificity of Induction. Organogenesis – Brain, limb, heart, haematopoiesis , kidney and formation of extra embryonic membranes (Chick).

Unit- IV : Post Embryonic Development :-

Morphological and biological changes associated with metamorphosis (Insect). Hormonal regulation of metamorphosis. Epimorphic and Morphallactic regeneration.

Text Books

1. Balinsky B.I. Developmental Biology, W.I. Saunders
2. Sastry.K.V. and Vinita Shankar, 2012. Developmental Biology.
3. Subramaniam.,T, 2013. Molecular developmental Biology. Narora publishing House.
4. Scott F. Gilbert. 2014. Developmental Biology, 9th Edition, Sinauer Assoc. Inc. Sunderland, MA.

Reference Books

5. Mary S. Tyler, 2000. Developmental Biology: A guide for experimental study, 2nd Edition, Sinauer Assoc. Inc. Sunderland, MA.
6. Richard M. Twyman, 2001. Instant notes on Developmental Biology, Springer Verlag, BIOS Scientific.
7. Fred H. Wilt and Sarah C. Hake, 2001. Principles of Developmental Biology, W.W. Norton & Comp. Inc. NY. 2004.
8. Lewis Wolpert, 2012. Principles of Development, Oxford Univ. PressSlack J. M.W. Essential Developmental Biology, Blackwell.
9. Slack J. M.W. . 1992. 2nd Edition. From Egg to Embryo, Cambridge

Semester – III
Code: ZOHT – 303
IMMUNOLOGY

Unit –I: Immune system:-

Overview of immune system. Types of immunity: innate and acquired immunity, humoral and cell mediated immunity. Lymphoid organs: Primary and secondary lymphoid organs. CD marker cells, Macrophages, Dendritic cells, NK cells.

Unit –II: Antigen and antibody:-

Antigen: Properties, immunogen, super antigen and haptens. Antibody: Structure and types, autoantibodies. Antigen and antibody interactions. Major Histocompatibility Complex (MHC): haplotypes, Types and mechanism of antigen presentation.

Unit –III: Differentiation of Immune cells and immune response:-

T cell- types, maturation, activation, differentiation and receptors. B cell- maturation, activation, differentiation and receptors. Cell mediated and humoral immune response; Cytokines; Complement system- Classical and alternate pathway.

Unit – IV: Immunity and Human Health:-

Hypersensitivity reactions: Types with examples. Autoimmunity and its disorders. Vaccines: Properties, types and immunisation. Immunodeficiency disorders- AIDS, SCID.

Text Books

1. Srivastava, R., Ram, B.P. and Tyle, P. 1991. Molecular Mechanism of Immune Regulation. VCH Publishers, New York.
2. Kannan, I. 2007. Immunology. MJP Publishers, Chennai.
3. Rao, C.V., 2005. Immunology. Alpha Science publishers.
4. Madhavee Latha, P., 2012. Textbook of Immunology. S.Chand Publishers.
5. Roitt, I.M. 1994. Essential Immunology. Blackwell Scientific, Oxford.

Reference Books

6. Richard A. Goldsby, Thomas T. Kindt and Barbara A. Osborne. 2000. Kuby Immunology. Freeman and Co., New York.
7. Stites, D.P., Terr, A.I. and Parsloio, T.G. 1997. Medical Immunology. Prentice Hall, New Jersey.
8. Janeway, C.A and Travers, P. 1997. Immunobiology. Current Biology Ltd., London.
9. Paul, W.E.M. 1989. Fundamentals of Immunobiology. Raven Press, New York.
10. Champion, M.D. and Cooke, A. 1987. Advanced Immunology. J.B. Lippincott Ltd., Philadelphia.

Semester - III
Code: ZOHT – 304
FISHERIES AND AQUACULTURE

Unit-I: Fish Biology:- Systematic classification and basic anatomy of fishes. Morphometric and Meristic characters, Food and feeding habits. Population dynamics, Length and weight relationship, Age and growth determination, Reproductive cycles - fertility and fecundity, Hybridization and induced spawning.

Unit- II: Capture fisheries of India:- Present status and scope of inland and marine capture fisheries- Riverine, estuarine, off-shore and deep sea fisheries. Migration, Fish tagging and marking. Major fisheries of India- oil sardine, mackerel, Bombay duck and shrimp, Stock-recruitment.

Unit- III: Fishing technology and survey of fishery resources:- Principal methods of exploitation of fishes- Indigenous and modern gears and crafts- spawn collection. Transport of seed and brooders- Methods of surveying the fishery resources- acoustic and aerial methods. Survey of fish eggs and larva. Role of R and D institutions of fisheries and Aquaculture - (CMFRI, CIBA, MPEDA, CIFRI, CIFNET, CIFE, NIO, NBFGR, FSI, CIFT).

Unit- IV: Culture fisheries of India:- Present status and scope of aquaculture in India. Types of culture- Criteria for selection of fishes for culture. Culture practices of carp, sea bass, prawn and shrimp. Construction, maintenance and management of aquaculture farms. Fish diseases and control in culture ponds.

Text Books/Course Books

1. R.Santhanam, N. Sukumar, P. Natarajan, 1990. A Manual of Fresh Water Aquaculture.V. Oxford & IBH Publications
2. Kamaleshwar Pandey and J.P.Shukla, 2005. Fish and fisheries. Rastogi Publication
3. Ranjith Daniel , 2002. Freshwater fishes of Peninsular India
4. Jhingram, 1991. Fish and Fisheries of India- Hindustan Pub. Corpn.
5. T.V.R. Pillay, 2005. Aquaculture principles and practices. Wiley
6. Karl F. Lagler. 1977. Ichthyology 2nd edition .New York: Wiley.

Reference Books

7. Peter.B.Moyle.2004.An Introduction to Ichthyology.PHI Learning Pvt.Ltd.
8. Sharma and Grover, 1942. An Introduction to Indian Fisheries-
9. Sharma and Grover, 1982. Marine Fisheries.
10. Alikunhi, 1957.Fish culture in India. Indian Council of Agricultural Research.
11. Francis Day.1883. Indian Fish and Fishing. W. Clowes and Sons.
12. Fischer.W. & Bianchi.G.1984. FAO Species identification sheet for fishery purposes Vol. I-VI.FAO of the United Nations.
13. Dr.S.Ayyapan, Dr.J.K.Jena, Dr.A.Gopalakrishnan.Dr. A.K. Pandey(Editors) ,2006. Hand book of fisheries and Aquaculture.Indian Council of Agricultural Research. New Delhi.

Semester – III
SOFT CORE
Code: ZOHT- 305

BIOLOGICAL TECHNIQUES AND BIOINFORMATICS

Unit – I: Microscopy and Histochemistry:-

Microscopy – Light, Phase Contrast, Fluorescence and Electron - principle, structure and application; Histology: histochemical and immunochemical techniques, Autoradiography.

Unit-II: Quantification and Separation Techniques:-

Centrifugation (High Speed & Ultracentrifugation ; Spectrophotometer (UV –Visible), Fluorimetry and, Flame photometry, atomic absorption spectroscopy. Quantification of molecules and trace elements –Molecular separation by Chromatography (GLC and HPLC), Electrophoresis (PAGE and Agarose) and DNA Sequencing, Blotting, PCR, Microarray. ELISA; Radiochemical – types, uses of tracer technique, RIA.

Unit-III: Biostatistics:-

Collection of data; Diagrammatic and Graphical representations; Measures of central tendency and dispersal; Probability distributions (Binomial, Poisson and normal); Sampling distribution; Parametric and non parametric statistics; Confidence Interval; Standard errors; levels of significance; Regression and correlation; students t-test; ANOVA, Chi square test. Evaluation of biodiversity indices; Shannon-Weiner index, Dominance index.

Unit-IV: Bioinformatics:-

Introduction- Biological database- types, tools, Internet basics; Database management system; Sequence alignments (basis-dot matrix-multiple sequence) & web site designing; Phylogenetic analysis, dendrogram, Genomics, Proteomics; Molecular modeling and drug designing; Preparation of a manuscript for research.

Text Books/Course Book

1. A.Gurumani, 2004. An Introduction to Biostatistics –, MJP Publishers,.
2. D.Srinivasa Rao. 2010. Biotech Pharma,. Bioinformatics .

Reference Books

3. Wilson and Walker.2001. Practical biochemistry- Cambridge Low Price Edition.
4. Zar .2014. Biostatistical Analysis. Pearson Education Limited.
5. David, 2001. Mount Bioinformatics-Sequence and Genome Analysis- –CSHL.
6. Upadhay and Upadhay, 2009. Biophysical chemistry- principles and techniques. Himalaya publishing House.

Semester – III
SOFT CORE
Code: ZOSC- 306
FISH PRESERVATION AND VALUE ADDITION TECHNIQUES

Unit-I: Fish Biochemistry:-

Fish as healthy food. Major and minor constituents of fishes - Distribution and function of Protein, Lipid , Carbohydrates, Vitamins, Minerals, Moisture. Toxins and toxic substances in fishes.

Unit- II: Fish spoilage and Quality management :-

Post-mortem changes and phenomena of rigor mortis. Criteria for assessing the freshness of fishes and fish spoilage. Factors affecting spoilage of fish- Autolytic spoilage, Microbial spoilage, Auto- oxidation. Sources of contamination. Concepts of total quality management- HACCP, Hazards in seafood, Food safety and Standards Act of India 2006, Role of BIS and EIA.

Unit –III: Fish processing technology:-

Principles of fish preservation. Preservation of fish by curing (Drying, Salting and Smoking), Chilling, freezing of fish, accelerated freeze drying, Canning of fish and fish products, Modified Atmosphere Packaging (MAP) of fish and fish products.

Unit –IV: Fishery products and value addition:--

Fishery products, by-products and value added products. Exports of fish and shrimp, fish meal, fish oil, protein concentrate, fish wafers, ensilage, fish pickles, surumi, roe, chitosan, ready to cook and ready to eat products. Additives and classes of additives. Packaging and transportation of fish and fishery products. Marketing and economics.

Text Books/Course Books

1. Govindan, T.K., 1985. Fish Processing Technology. Oxford and IBH publishing Company Private Ltd.,
2. Gopakumar, K.1997. Tropical Fishery Products. Oxford & IBH Publications.
3. Ravindran, K., N. Unnikrishnan Nair, P.A., O. Panicker and Mary Thomas. Proc. Of the Symposium on Harvest and Post- Harvest Technology of Fish. Society of Fisheries Technologists (India), Cochin.
4. Chandran, K.K., 2000. Post Harvest Technology of Fish and Fish Products. Daya publishing House, New Delhi.
5. Charles L .Cutting.2002.Fish processing and preservation- Laurier Books Limited.
6. Ayyappan et al., 2012. Fisheries of India. Directorate of Information and Publications of Agriculture, Indian Council of Agricultural Research.

Reference Books

7. Kreuzer, R., 1965. The Technology of Fish Utilisation. Fishing News (Books) Ltd., London.
8. Kreuzer, R., 1965. Freezing and Irradiation of Fish. Fishing news (Books) Ltd., London.
9. Burges, G.H.O., C.L. Cutting, J.A. Lovern and J.J. Waterman, 1965. Fish Handling and processing Her majesty's Stationery Office, Edinburg
10. Kreuzer, R., 1974. Fishery Products. FAO Fishing News (Books) Ltd., England.
11. Anon, 1979. Handling, Processing and Marketing of Tropical Fish. Tropical Products Institute London.

PRACTICAL III
Code: ZOHP - 306
(PAPERS COVERING – ZOHT 301-304)

Ecology and Ethology

1. Determination/Estimation of dissolved oxygen by Winkler's method.
2. Determination/Estimation of dissolved carbondioxide by Winkler's method.
3. Determination/Estimation of Salinity
4. Observation of animal association – Intra and Intrerrelationship among animals.
5. Observation of population growth pattern of Drosophila in the laboratory.
6. Observation of beehive/bird nest/ termite hill/ male to male aggregation/ male and female attraction in mouse.
7. Observation of feeding mechanism in insects.

Developmental Biology

8. Observations of permanent slides – testis, ovary, fertilized egg, gastrula and neural stages of frog.
9. Mounting of chick blastoderm.
10. Observation of various stages in chick (18, 24, 33, 48, 72, 96 hours).

Immunology

11. Observation of lymphoid organs – Thymus, Spleen, Bone marrow, Tonsil, Lymph node.
12. Agglutination reaction of ABO and Rh blood groups.
13. Widal test.

Fisheries & Aquaculture

14. Observation of common edible fishes.
15. Identification of aquatic weeds.
16. Observation of ichthyoplanktons.
17. Analysis of gut/stomach content in a fish.
18. Observation of fish parasites.
19. Mounting of scales in fishes.
20. Morphometric and meristic charecterstics in fishes.
21. Study tour to area of Biodiversity & Ecological Interest (Sanctuary, Zoo)
22. Fish farm visit/ bird watching/zoo visit.

Semester – IV
SOFT CORE
Code: ZOSC - 401
ENVIRONMENTAL EDUCATION

Unit-I: Introduction to Environment: Ecosystem – structure, function, types, food chain, food webs, ecological pyramids and energy flow.

Unit-II: Natural resources: Land, air and water. Rivers and lakes water conservation. Rain water harvesting, sustainable development, role of information technology in environment, Environmental value education.

Unit-III: Environmental pollution: Definition, causes, effects and control measures of air and water. Solid waste management – urban and industrial. Environment and human health.

Unit – IV: Biodiversity: levels of biodiversity, values, threats and endangered species. Wildlife conservation (wildlife habitat, management, National parks and Sanctuaries). Red data book. environmental organizations, agencies, National Programmes on environmental law- environmental protection- public awareness.

Text books/Course Book

1. Erach Bharuacha, Orient Blackswan,2013.A Text book of Environmental studies. Universities Press.
2. Verma, P.S. and Agarwal ,V.K. 2000. Environmental Biology. S. Chand Publishers.
3. William, P. Cunningham and Mary Cunningham. 2011. Principles of Environmental Sciences, , Tat McGraw Hill.
4. Shyam Diwan. 2001. Environmental law and Policy in India. OUP India.

Reference Books

1. Chapmann,J.L and Reiss,M.J. 1995. Ecology Principles and applicaion.Cambridge Univ. Press
2. Mahesh Rangarajan. Pearson Longman, 2009.Environmental issues in India. Pearson Education India.
3. J.L. Chapman and M.J. . 1999.Reiss Ecology- Principles and Applications.2nd Edn.. Cambridge University Press.
4. K.C. Agarwal.. 1996.Biodiversity – Agrobotanical Pub.
5. Andrew R.W. Jackson and Julie M. Jackson., 1996.Environmental Science Pearson Longman.
6. P.R. Trivedi and U.K. Singh .1996.Environmental Laws on Wild Life.. Commonwealth Pub.,.

Semester – IV
Code: ZOSC - 402
SOFT CORE
AQUARICULTURE

UNIT-I:

Importance of ornamental fish culture; Ornamental fishes in India/globe; Aquatic ornamental plants in India/globe; Marketing strategies in aquaculture; National and international trade in ornamental fishes and plants.

UNIT-II:

Water quality management in ornamental fish culture; Biological, Chemical and Physical properties of water; Nitrification and conditioning of Aquaria; Aquarium fabrication and aquascaping; Implements in aquaculture and their uses.

UNIT-III:

Basic breeding techniques in ornamental fishes. Selection of brood stock and rearing; Natural breeding facilitation; Induced breeding. Taking care of hatchlings; Breeding techniques for live bearers; Breeding techniques for egg layers. Feeding – livefeed and supplementary feed. Feed preparation and feeding; Diseases management in aquaculture. Packing and transport of aquarium fishes and plants.

UNIT-IV:

Marine aquarium – special features; Outdoor aquaculture ponds; Planted aquarium.

Textbooks/Course Book

1. Mary Bailey and Gina Sandford. 2015. Ultimate encyclopedia of Aquarium Fish and fish care. South Water Publisher.
2. Frank H. Hoffand Terry W. Snell, 2007. Florida Aqua Farms Publishers.
3. David Alderton, 2011. Encyclopedia of Aquarium and Pond fish. Penguin UK Publishers.
4. Mary Bailey and Gina Sandford, 2000. Manual of Fish Health. Anness publishers.

DEPARTMENT OF ZOOLOGY
KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDIES
M.Phil. ZOOLOGY
PAPER-1-RESEARCH METHODOLOGY

Unit-I: Centrifugation, Chromatography and Spectrophotometric methods:-

Centrifuge- principles and application- Ultracentrifuge; Principles and applications of Chromatography- Paper, thin layer, ion exchange, absorption, affinity chromatography and HPLC. Spectrophotometer-Principles and application- UV- VIS, GC-MS and NMR.

Unit-II: Microscopy and Electrophoretic techniques:-

Types of Microscopes and their applications- Electron microscope (SEM and TEM) Tissue processing and Microtomy: Staining Techniques. Electrophoretic techniques:- Types of Electrophoresis–paper and Gel electrophoresis- Applications of Electrophoresis.

Unit – III: Thesis writing and Bibliography:-

Problem identification- approaches- data and literature collection- methodology and experimental design- data generation; Analysis and interpretation; Selection of journals- national and international- science direct, open access journals and e- journals- Citation index- impact factor- h- index; plagiarism

Unit- IV: Biostatistics and Bioinformatics:-

Collection and Analysis of data; Diagrammatic and graphical representation; Measurement of Central tendency and dispersion; probability distribution; Correlation and regression; Anova; Student's t-test; Chisquare test; Biological data base-Data base management System-Genomics, Proteomics; Molecular modeling and drug designing; Uses of Internet in biological research; IAEC-CPCSEA;Funding agencies for Research (Govt. of India).

Reference Books

- D.Rickwood 1984 Centrifugation, TRL Press Oxford.
J.Somerville, 1987.Electron Microscopy in Molecular Biology Oxford Press.
A.T.Andrews 1986.Electrophoresis,OxfordUniv.Press,England.
D.D.Humes.1981 Gel Electrophoresis.IRLPress,Oxford.
D.A.Hurrys.1987.Spectrophotometry and Spectrofluorometry,IRLPRESS,Oxford.

DEPARTMENT OF ZOOLOGY
KANCHI MAMUNIVAR CENTRE FOR POST-GRADUATE STUDIES
M.Phil. ZOOLOGY
PAPER II-RECENT ADVANCES IN ZOOLOGY

Unit I: Endocrinology:

Hypothalamo – hypophyseal gonadal axis - feedback regulation; hormone synthesis and disorders – thyroid, adrenal, parathyroid; pancreatic hormones and its biological functions.

Unit II: Fishery Biology

Biology and fishery of commercially important marine and brackish water fishes (Oil Sardine, Indian Mackerel, Shrimp and molluscan fisheries). Fish population dynamics – Growth and age of fishes – Regulation of fish population – Recruitment – stock assessment; Aquaculture and importance of fish production – status and scope – recent advances.

Unit III: Ecotoxicology.

Methods of toxicology: toxicity tests – types – acute, sub-acute, chronic toxicity test; dose – response relationship- LC_{50} , LD_{50} , Probit analysis. Surveillance of pesticide poisoning, biochemical aspects of copper, cadmium and mercury poisoning, endocrine disrupting chemicals.

Unit IV: Entomology

Reproductive system of male and female vector of malaria, biological, environmental, chemical and mechanical control measures of vectors; application of pheromone in insect pest management (Attractant and aggregation pheromones); Pests of crops (Paddy, sugarcane, cotton, mango, coconut). Integrated Pest Management – Biological Control, Resistance Development in insects; Beneficial insects – Honeybee, Silkworm, Lac insect.

Text Books.

1. Mc. Hadley, 2006, Endocrinology.
2. Jhingran, 1985, Fish and Fisheries of India,
3. S. Iyyappan et al 2012, Fisheries of India.
4. Gupta, P.K. and V. Ramprakash , 1985, Advances in Toxicology and Environmental Health.
5. Vasantharaj David, 1994, Economic Entomology.

Reference Books

1. Bentley, P.J. 1985, Comparative Vertebrate Endocrinology.
2. Chapman, R.F. 1982, The Insect Structure and Function
3. Subramanian, M.A. 2007, Toxicology – Principles and Methods.

MODEL QUESTION PAPER
M.Sc.- ZOOLOGY I SEMESTER
STRUCTURE AND FUNCTION OF INVERTEBRATES AND BIOSYSTEMATICS
(ZOHT 101)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

- | | |
|---------------------|-----------------------|
| 1. Biosystematics | 6. Holozoic |
| 2. Ecospecies | 7. Malpighian tubules |
| 3. Deutrostomia | 8. Heteronereis |
| 4. Pseudo coelomate | 9. Miracidium |
| 5. Book Gills | 10. Cysticercus |

SECTION – B (5 x 4 = 20 marks)

Answer all the FIVE questions, each in not more than 200 words

11. List out some useful hints for the successful use of “Taxonomic Keys”.

OR

Give an account of Molecular Taxonomy.

12. Describe the Hydrostatic movements in coelenterates.

OR

Briefly explain the filter feeding mechanism in polychaetes.

13. Describe the Reproductive structures of Unio.

OR

Comment on the Organisation of Nervous system of an Arthropod.

14. Briefly explain the general organization of Brachiopoda.

OR

Describe any two Crustacean larvae with a note on evolutionary significance.

15. Explain the mechanism of Tracheal respiration.

OR

Describe the reproductive system of starfish.

SECTION – C (3 x 10 = 30 Marks)

Answer any three questions, each in not more than 1000 words

16. What is Binomial Nomenclature? Give a detailed account on the salient features of International Code of Zoological Nomenclature.
17. Explain the flagellar and ciliary movements in Protozoa.
18. Describe the structure and function of Nephridia and coelomoducts.
19. Discuss in detail the affinities of Rotifera.
20. Write a detailed account on Echinoderm larvae and their evolutionary significance.

MODEL QUESTION PAPER
M.Sc .ZOOLOGY I SEMESTER
STRUCTURE AND FUNCTION OF CHORDATES
(ZOHT 102)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 100 words.

- | | |
|--------------------------------|-----------------------|
| 1. Retrogressive Metamorphosis | 6. Ampullary Heart |
| 2. Endostyle | 7.Seminal Vesicle |
| 3. Ceruminous glands | 8.Vomero-Nasal organ |
| 4. Chondroblasts | 9.Lateral line system |
| 5. Heterocoelous Vertebra | 10. Trigeminal Nerve |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE Question, each in not more than 200 words

11. Describe the salient features of chordates

OR

Briefly explain the structural organization of Amphioxus.

12. Compare the forelimb of a frog with a pigeon.

OR

Describe any two types of Jaw suspension you have studied.

13. Describe any two accessory respiratory organs of fishes

OR

Draw a neat labeled diagram of female urino-genital system of shark.

14. Compare the brain of Calotes with the Rabbit and account for the differences.

OR

Give an account of Electroreception.

15. Explain the V.S of skin of a mammal with a diagram

OR

What are the taste buds? Explain

SECTION – C (3 x 10 = 30 Marks)

Answer any Three questions, each in not more than 1000 words

16. Discuss the structural peculiarities and affinities of Hemichordata
17. Describe the epidermal derivatives of Amniota
18. Discuss the evolution of Aortic arches in vertebrates.
19. Describe the sympathetic Nervous system of a Mammal.
20. Trace the evolution of Kidney.

MODEL QUESTION PAPER
M. Sc. ZOOLOGY I SEMESTER
ANIMAL PHYSIOLOGY
(ZOHT 103)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

- | | |
|-------------------------|-------------------------------|
| 1. Respiratory Quotient | 6. Juxta glomerular apparatus |
| 2. Basal Metabolic Rate | 7. Micturition |
| 3. Coprophagy | 8. Neuro-Muscular Junction |
| 4. Blood Pressure | 9. EEG |
| 5. Semilunar valve | 10. Acclimatization |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE Questions.

- 11.(a) Explain briefly ciliary and flagellar feeding mechanism in animals.
or
(b) Describe the chemistry of any two Respiratory pigments you have studied.
12. a) Write an account of the cardiac cycle
or
b) Discuss the Neural and chemical regulation of heart functions.
13. a) Describe the physiology of urine formation
or
b) How is salt and water balance maintained in the body?
14. a) Explain synaptic transmission of Nerve Impulse
or
b) Write a note on Physiology of sleep
15. a) Describe the detritivorous and coprophagous feeding mechanism
or
b) Describe the physiology of digestion in various animals.

SECTION – C (3 x 10 = 30 marks)

Answer any THREE questions:

16. Explain in detail the transport of gases in mammals
17. What are the principle and characteristics of Normal ECG; Add a note on Cardiac arrhythmias
18. Write a detailed account of the formation of Ammonia, Urea and Uric acid and discuss their Inter relationship.
19. Describe the Physiological events and mechanisms that occur during muscle contraction.
20. How do Homeotherms regulate their body temperature? Explain.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY I SEMESTER
PUBLIC HEALTH AND HYGIENE
(ZOHT 104)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 2 = 20 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|-------------------|--------------------------|
| 1. Health | 6. Leprosy |
| 2. Tetanus Toxoid | 7. Tuberculosis |
| 3. Polio | 8. Japanese encephalitis |
| 4. Gonorrhoea | 9. Chloroquine |
| 5. Eutrophication | 10. Hypertension |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE questions, each in not more than 200 words

11. Write a note on vaccination and Immunisation

OR

Give an account of amoebiasis

12. What is Zoonotic disease? Explain the mode of transmission, control and preventive measures of plaque.

OR

Describe the life history of *Wuchereria bancrofti*

13. What are the Non-degradable pollutants? Give examples.

OR

Write a note on urbanization stress and health.

14. Describe the ill effects of alcoholism and Drug abuse on health.

OR

Describe the various short term and long term effects of the use of Tobacco.

15. What is Cancer? Briefly mention the risk factors and causes and preventive measures of cancer.

OR

What are the symptoms and control measures of CHD and RHD

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE question, each in not more than 1000 words

16. What is Immunity? Explain in detail the different types of Immunity with examples.

17. Describe the structure of HIV. Add a note on the symptoms, control and management of AIDS

18. Describe the various sources of Air pollution and their effects on man and other animals.

19. Malaria is a major public health problem-Discuss

20. What is Diabetes? Mention the symptoms and possible treatment for Diabetes mellitus.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY I SEMESTER
APPLIED ENTOMOLOGY
(ZOSC 105)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|-----------------------|----------------------------|
| 1. Coleoptera | 6. Xenopsylla |
| 2. Alary muscles | 7. Mechanical transmission |
| 3. Ommatidia | 8. Fumigant |
| 4. Malpighian tubules | 9. Pest outbreak |
| 5. Dengue fever | 10. Lac Insect |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE questions, each in not more than 200 words (Internal Choice)

11. List out the salient features of order Lepidoptera

OR

Describe the mouth parts of Housefly with suitable diagram

12. Describe the female reproductive system of an Insect.

OR

Explain the term “Complete Metamorphosis” with reference to any one of Insects studied by You.

13. What are the symptoms, control and preventive measures of scrub typhus?

OR

Describe the biology of a vector that transmits filarial worm.

14. What is pest? Describe the life cycle of any one pest of cotton

OR

Explain the life cycle of *Bombyx mori*

15. What is Zoonotic disease? Explain the mode of transmission, control and preventive measures of Japanese encephalitis.

OR

Describe the components and Mechanism of circulation in Insects.

SECTION – C (3 x 10 = 30 marks)

Answer any THREE questions, each in not more than 1000 words.

16. Describe the respiratory system of an Insect. Add a note on its variations.

17. Discuss the Neuro-endocrine control of reproduction in Insects.

18. Write an essay on Integrated vector Management.

19. Explain the role of Beneficial Insects in Indian Economy.

20. Classify in detail the pesticides based on the mode of action.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY II SEMESTER
CELL AND MOLECULAR BIOLOGY
(ZOHT 201)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions , Define/Explain/Short notes on the following

- | | |
|-------------------|--------------------|
| 1. Antiport | 6. Mismatch repair |
| 2. Hemidesmosomes | 7. GAL 4 Protein |
| 3. Protooncogene | 8. Ligase |
| 4. Myosin | 9. Primer |
| 5. Ribozyme | 10. Microarray |

Part – B – (5 x 4 = 20 Marks)

Answer all questions, each is not more than 200 words

11. a) Write an account on transport across the cell membrane
or
b) Briefly describe the collagen biosynthesis
12. a) Write an essay on cytoplasmic movements
or
b) Explain the role of oncogenes and proto-oncogene in the cancer cell formation
13. a) Describe the transcription factors in Eukaryotes
or
b) Discuss chromatin and its role on transcription
14. a) Explain the restriction mapping
or
b) Describe different types of blotting techniques.
15. a) Write a detailed account on role of fibronectin
or
b) Write about DNA sequencing

PART – C (3 x 10 = 30 Marks)

Answer any THREE questions each in not more than 1000 words.

16. Describe in detail about the roles of different adhesion molecules.
17. Explain the yeast as a model system for the study of growth and cell division.
18. Describe the various mechanism of DNA repair
19. Write an essay on different types of cloning vectors and their applications in the field of molecular biology
20. Describe the various steps involved in the polymerase chain reaction.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY II SEMESTER
GENETICS AND EVOLUTION
(ZOHT 202)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|-----------------------|--------------------------|
| 1. Hardy-Weinberg law | 6. Molecular clocks |
| 2. Genetic drift | 7. Molecular drive |
| 3. Gene families | 8. Molecular Phylogeny |
| 4. Heritability | 9. Cladogenesis |
| 5. Evolutionary tree | 10. Blending Inheritance |

SECTION – B (5 x 4 = 20 Marks)

Answer Any FIVE questions, each in not more than 200 words

11. a) Describe the destabilizing forces of Darwinism.
OR
b) Write a short account of the concepts of evolution, with an emphasis on Darwinism.
12. a) Describe the models of speciation.
OR
b) Write an account on the patterns and mechanisms of reproductive isolation.
13. a) How the genotype-environment interacts in nature?
OR
b) Describe the method of analyzing the complex traits.
14. a) Describe the protein polymorphism.
OR
b) Describe the method for estimation of evolutionary trees from the genetic data.
15. a) Describe the origin of higher categories.
OR
b) Discuss the combined nucleic acid-amino acid phylogenesis.

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE questions each in not more than 1000 words

16. Explain Epistasis mechanism with an example.
17. Write an essay on Hardy Weinberg equilibrium.
18. Explain the ways of determining molecular phylogenesis.
19. Write an account of Neo Darwinism
20. Give a detailed account on the genetics of speciation.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY II SEMESTER
BIOMOLECULES AND STRUCTURAL BIOLOGY
(ZOHT 203)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|------------------------|--------------------|
| 1. Vander waal's force | 6. Nucleotide |
| 2. Zwitter ion | 7. Z-DNA |
| 3. Prion disease | 8. Enthalpy |
| 4. Proteoglycons | 9. Gluconeogenesis |
| 5. Sphingomyelin | 10. Dehydrogenases |

SECTION – B (5 x45 = 20 Marks)

Answer ALL questions, each in not more than 200 words

11. Explain any two physical properties of water.
OR
Write an account of chaperons in Protein folding
12. Give an account on storage lipids
OR
Describe briefly A and B forms at DNA
13. Give an account on high energy phosphate bonds
OR
Write a note on allosteric regulation at enzyme activity.
14. Give an account on Beta Oxidation
OR
Explain HMP shunt pathway.
15. Write about the structure of t-RNA
OR
Give an account of Polysacchandes and its significance

SECTION – C (3 x 10 = 30 Marks)

Answer any Three questions, each in not more than 1000 words

16. Write about primary and secondary structure of Proteins
17. Carbohydrates act as informational molecules – Discuss
18. Define Laws of Thermodynamics and its application in biological system.
19. Explain Glycolytic pathway.
20. Describe the double helix structure and replication of DNA.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY II SEMESTER
MOLECULAR ENDOCRINOLOGY
(ZOHT 204)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 1 = 10 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain the following:

- | | |
|-----------------------------|-------------------------|
| 1. Membrane receptor | 6. Calmodulin |
| 2. Feed back regulation | 7. Cyclic AMP |
| 3. G protein | 8. Diabetes Mellitus |
| 4. Renin Angiotensin System | 9. Intra uterine Device |
| 5. Feed Back Regulation | 10. Seminal vesicle |

SECTION – B (5 x 4 = 20 marks)

Answer any FIVE questions, each in not more than 200 words.

11. Briefly explain the Mechanism of steroid hormone action.
or
Explain the structure of intracellular Receptor.
12. Write the structure and functional relationship between Glycoprotein hormones.
or
Discuss the relationship between Endorphin and Enkephalin
13. Trace the biosynthetic pathway of Thyroxine
or
Write down the steps involved in the synthesis of Catecholamines.
14. Discuss briefly the role of hormones in Calcium homeostasis
or
Explain the structure and function of prolactin
15. Discuss the structure and functional relationship between C₁₈ and C₁₉ steroids
or
Recent methods of Male contraception. Discuss.

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE questions, each in not more than 1000 words. All questions carry equal marks.

16. Describe Structure of G Protein and its role in hormone action.
17. Discuss the structure and functional relationship between neuro hypophyseal hormones.
18. Give a detailed account on the structure and functions of Gastrin, Pancreozymin, Enterogastrone and Secretin and discuss their Interrelationship.
19. Write an essay on Menstrual cycle.
20. Discuss the role of hormones in Lactation.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY II SEMESTER
PUBLIC HEALTH AND HYGIENE
(ZOSC 205)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 2 = 20 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|-------------------|--------------------------|
| 1. Health | 6. Leprosy |
| 2. Tetanus Toxoid | 7. Tuberculosis |
| 3. Polio | 8. Japanese encephalitis |
| 4. Gonorrhoea | 9. Chloroquine |
| 5. Eutrophication | 10. Hyper tension |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE questions, each in not more than 200 words

11. Write a note on vaccination and Immunisation

OR

Give an account of amoebiasis

12. What is Zoonotic disease? Explain the mode of transmission, control and preventive measures of plaque.

OR

Describe the life history of *Wuchereria bancrofti*

13. What are the Non-degradable pollutants? Give examples.

OR

Write a note on urbanization stress and health.

14. Describe the ill effects of alcoholism and Drug abuse on health.

OR

Describe the various short term and long term effects of the use of Tobacco.

15. What is Cancer? Briefly mention the risk factors and causes and preventive measures of cancer.

OR

What are the symptoms and control measures of CHD and RHD

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE question, each in not more than 1000 words

16. What is Immunity? Explain in detail the different types of Immunity with examples.

17. Describe the structure of HIV. Add a note on the symptoms, control and management of AIDS

18. Describe the various sources of Airpollution and their effects on man and other animals.

19. Malaria is a major public health problem-Discuss

20. What is Diabetes? Mention the symptoms and possible treatment for Diabetes mellitus.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY III SEMESTER
ANIMAL ECOLOGY AND ETHOLOGY
(ZOHT-301)

Time ; 3 hrs

Max. 60 marks

SECTION-A (10X1=10 Marks)

Answer all questions, each in not more than 50 words

- | | |
|--------------|--------------------------|
| 1. Natality | 6. Imprinting |
| 2. Symbiosis | 7. Kin Selection |
| 3. Altruism | 8. Migration |
| 4. Circadian | 9. Food web |
| 5. Symbiosis | 10. Ex situ Conservation |

SECTION –B (5x4=20 marks)

Answer FIVE questions, each in not more than 200 words

11 a) Explain the role survivorship curves in the study of population.

Or

b). Write an account on soil pollution.

12a) Describe Pond as an ecosystem.

OR

b) Explain the intra-specific and inter-specific competition.

13a) Describe the types of learning and memory.

OR

b) Write short notes on Bird Vocalization.

14a) Briefly describe the social communication in insects.

OR

b) Give an account on optimal foraging.

15a) Write an account on parental care in fishes.

OR

b) Describe the behavior of mating systems in animals.

SECTION – C (3x10=30 marks)

Answer any THREE questions of the following

16. Explain the population density and indices of relative abundance.

17. Define water pollution. Explain the source, effects and control of water pollution.

18. Explain in detail on the principles and management of conservation.

19. Give an account on the proximate and ultimate causation of behavior.

20. Write an account on the orientation and navigation behavior in animals.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY III SEMESTER
DEVELOPMENTAL BIOLOGY
(ZOHT 302)

Time: 3 hrs

Max. 60 marks

SECTION A (10X1=10 Marks)

Answer all questions, each in not more than 50 words

- | | |
|------------------------|--------------------|
| 1. Acrosome | 6. Gonidia |
| 2. Blastomere | 7. Bindin |
| 3. Emboly | 8. Homeobox |
| 4. Protostomes | 9. Hox gene |
| 5. Embryonic induction | 10. Haematopoiesis |

SECTION A (5x4=20 marks)

Answer FIVE questions, each in not more than 200 words

11a) Describe the developmental patterns among metazoans.

OR

b) Explain the structure of an egg.

12a) Describe the types and patterns of embryonic gastrulation in sea urchin.

OR

b) Explain the mesoderm differentiation of somites.

13a) Describe the autonomous and conditional specification in *Caenorhabditis*.

OR

b) Explain the mechanism of primary embryonic induction.

14a) Write an account on the gradients in *Hydra*.

OR

b) Explain on the limb regeneration in salamander.

15a) Describe the pattern formation in chick.

OR

b) Explain the inducers as diffusible molecules.

SECTION –C (3x10=30 marks)

Answer any THREE questions of the following

16. Describe in detail the sequential changes that occur during the activation of egg.

17. Describe the process of gastrulation in frog.

18. Explain Haematopoiesis.

19. Describe on the germ cell determination in amphibians.

20. Explain in detail the axes formation in *Drosophila*.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY III SEMESTER
IMMUNOLOGY
(Z0HT 303)

Time: 3 hrs.

Max. 60 marks.

SECTION. A

Answer ALL questions, each in not more than 50 words. (10 x 1 = 10)

- | | |
|---------------------------|------------------------|
| 1. Primary lymphoid organ | 6. Diphtheria |
| 2. Innate immunity | 7. Hapten |
| 3. Allergen | 8. Active immunization |
| 4. Symbiotic bacteria | 9. HIV |
| 5. Botulism | 10. Pasteurization |

SECTION. B

Answer any FIVE questions, each in not more than 200 words. (5 x 4 = 20)

11. Describe the various functions of antibodies

OR

Describe the various properties of antigen

12. Give an account on active and passive immunization

OR

Discuss different classes of immunoglobulin and explain about their role in immunity

13. Briefly mention about autoimmunity

OR

Describe different types of culture media

14. Explain briefly the structure and functions of bacterial cell wall

OR

Discuss the economic importance of fungi with examples

15. Mention about the microbial contamination of milk

OR

Describe the modes of transmission and control of amoebiasis

SECTION. C

Answer any THREE questions, each in not more than 1000 words. (3 x 10 = 30)

16. Describe different types of hypersensitivity reactions in detail

17. Discuss in detail the secondary lymphoid organs and their functions

18. Explain different types of fermentors and explain how alcohol is fermented

19. What is food poisoning? Discuss the mycotoxins and bacterial toxins in food

20. Describe the mechanism of nitrogen fixation and explain about nitrogen fixing bacteria

MODEL QUESTION PAPER
M.Sc. ZOOLOGY III SEMESTER
AQUACULTURE AND FISHERY BIOLOGY
(Z0SC304)

Time : 3 hrs

Max. 60 marks

Section- A (10x1=10)
(Answer all the Questions)

- | | |
|---------------------------|------------------|
| 1. Fecundity | 6. Hypophysation |
| 2. MSY | 7. Unit stock |
| 3. Long line | 8. Nasal bone |
| 4. Is-in-glass | 9. White spot |
| 5. Composite fish culture | 10. Algal bloom |

Section –B (5x4=20)

Answer any FIVE questions, each in not more than 200 words

11. Give a note on nutritional value of fish

OR

Write a note on various methods of age determination

12. Describe the various methods of surveying the fishery resources.

OR

Discuss the different methods employed in the estimation of fishery resources

13. Give a brief account of cold water fisheries

OR

Indicate the food and feeding habits of Rohu and Mugil

14. Discuss the importance of assessment of fish stock

OR

Briefly explain the desirable qualities of fishes for culture

15. Explain the control measures of aquatic weeds

OR

Comment on fishing gears and crafts

Section C (3x10=30)

Answer any THREE questions, each in not more than 1000 words

16. Give a detailed account on Maturation stages of fishes
17. Write an essay on Oil sardine
18. Describe the characteristics, distribution, biology and breeding of Catla
19. Outline the importance of water quality management in Aquaculture
20. Write an account on types, prevention and control of fish diseases.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY III SEMESTER
FISH PRESERVATION AND VALUE ADDITION TECHNIQUES
(ZOSC 305)

Time ; 3 hrs

Max. 60 marks

Section- A (10x1=10)
(Answer all the Questions)

- | | |
|-----------------|------------------|
| 1. Rigor mortis | 6. Surimi |
| 2. Toxin | 7. Chitosan |
| 3. HACCP | 8. Fish roe |
| 4. Pufa | 9. Fish spoilage |
| 5. MAP | 10. Additives |

Section –B (5x4=20)

Answer any FIVE questions, each in not more than 200 words

11. Give a note on criteria for assessing the freshness of fishes

OR

Write a note on lipids of fishes

12. Describe the various methods of surveying the fishery resources.

OR

Discuss the different methods employed in fish quality evaluation

13. Give a brief account on auto-oxidation

OR

Describe the various factors causing spoilage of fish

14. Discuss the importance of fish preservation

OR

Briefly explain the accelerated freeze drying process

15. Explain the various methods of fish packaging and transportation of fishes

OR

Comment on value added products of fishes

Section C (3x10=30)

Answer any THREE questions, each in not more than 1000 words

16. Give a detailed account on major and minor constituents of fishes
17. Write an essay on spoilage of fishes
18. Explain the principles of fish preservation and add a note on curing
19. Outline the importance of food safety and Standards Act of India 2006
20. Write an account on fishery by-products.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY IV SEMESTER
BIOLOGICAL TECHNIQUES AND BIOINFORMATICS
(Z0HT401)

Time : 3 hrs

Max. 60 marks

Section-A (10x1=10Marks)

Answer All Questions, each in not more than 50 words.

Define/Explain the following

- | | |
|---------------------|-------------------------|
| 1. Resolving Power. | 6. Test of Significance |
| 2. Acidic Stain. | 7. Standard deviation. |
| 3. Rf Value | 8. Dominance index. |
| 4. Beer-Lambert Law | 9. Genomics. |
| 5. Microarray | 10. Sequence alignment. |

Section-B (5x4=20Marks)

Answer any FIVE questions, each in not more than 200 words.

11.a) Explain Working Principle and application of phase contrast Microscope.

Or

b) Write an account on any two types of chemical fixatives.

12.a) Describe the operational process of GLC.

Or

b) Describe the Structure and function of NMR.

13.a) Differentiate Bar diagram and Histogram

Or

b) Explain the different types of Correlation.

14.a) Explain Shannon-Weiner Index

Or

b) Distinguish parametric and non-parametric statistics.

15.a) Give a brief account on drug designing.

Or

b) Write a short note on database management .

Section C. (3x10=30 Marks)

Answer any THREE questions of the following.

16. Describe in detail the principle, Structure and Processing of Sample for TEM.

17. Explain the Principle and Components of UV-Visible Spectrophotometer.

18. What is ANOVA? Explain the Steps involved in a single way ANOVA with a note on its applications.

19. Analyze the given data using t-Test.

X₁-5,10,15,20,25

X₂- 2,3,4,5,6

20. Give a detailed account on Phylogenetic analysis of DNA sequence.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY IV SEMESTER
ENVIRONMENTAL TOXICOLOGY
(Z0HT 402)

TIME: 3 hours

Max. 60
(10x1=10)

SECTION-A

Answer All Questions, each in not more than 100 words.

Define/Explain the following.

1. Fungicide.
2. Food Preservative
3. Chemical Carcinogen
4. Sub acute toxicity
5. Heavy metal
6. Xenobiotics
7. Minamata disease
8. Radioactive waste
9. Endocrine Disruptors
10. PAN chemicals

SECTION-B

(5x4=20 Marks)

Answer any FIVE questions, each in not more than 200 words.

11. a) Briefly classify Pesticides.

Or

b) Explain the term Biomagnification with suitable Example.

12. a) Discuss the mode of action of Carcinogens.

Or

b) List out the factors affecting the mode of action of Xenobiotics.

13. a) Distinguish and differentiate LC_{50} and LD_{50}

Or

b) Differentiate the features of acute and chronic Toxicity.

14. a) Many environmental toxicants are metabolic stressors-Discuss.

Or

b) Write an account on the Hazards of Radioactive Materials.

15. a) Briefly explain the causes and Prevention of "Goitre"

Or

b) Write a Note on "Environmental Risk Assessment".

SECTION-C (3x10=30 Marks)

Answer any THREE questions of the following.

16. Describe the various types of Industrial effluents in respect to metal toxicity.

17. Explain the mechanism of toxicants action on membrane permeability. Add a note on Storage depots.

18. Describe various parameters used to evaluate the combined toxicity of a mixture of pollutants.

19. Write an essay on the Histopathological changes caused by toxic chemicals on various tissues of an animal.

20. Describe the impact of Xenobiotics.

MODEL QUESTION PAPER
M.Sc. ZOOLOGY IV SEMESTER
ENVIORNMENTAL EDUCATION
(ZOSC - 406)

Time: 3 hours

Maximum: 60 Marks

Section – A – (10 x 2 = 20 Marks)

Answer All Questions each in not more than 50 words.

Define / Explain / Describe the following

- | | |
|--------------------------|-----------------------|
| 1. Ecosystem | 6. Biomagnification |
| 2. Producers | 7. Acid rain |
| 3. Food chain | 8. Green house effect |
| 4. Food web | 9.Red data book |
| 5. Exhaustable resources | 10. Ozone depletion |

SECTION – B (5 x 4 = 20 Marks)

Answer any FIVE questions, each in not more than 200 words

11. Write a note on pond ecosystem.

OR

Give an account on energy flow in grassland ecosystem.

12. Write an account on types of natural resources.

OR

Describe the role of information technology on environment.

13. Give an account on the air pollution and its control measures.

OR

Write a note on solid waste management.

14. Write an account on the endangered species of India.

OR

Write an account on the conservation of biodiversity.

15. Write an account on environment and human health.

OR

Describe on the methods of water conservation.

SECTION – C (3 x 10 = 30 Marks)

Answer any THREE question, each in not more than 1000 words

16. Write an account on the forest ecosystem with suitable examples.

17. Explain the mechanism of rain water harvest.

18. Describe on water pollution and control measures.

19. Enumerate on the levels of biodiversity and its values.

20. Describe the various environmental agencies and their functions.

MODEL QUESTION PAPER
M.Phil. ZOOLOGY
PAPER- I .RESEARCH METHODOLOGY

Time : 3 hrs

Max. :60 marks

Section – A

Answer any FIVE questions

5 x 4 = 20

1. Comment on density gradient Centrifugation
2. Explain the principle of Gel Electrophoresis
3. Describe the components and application of Phase Contrast Microscope
4. Briefly explain properties of Radioactive Emissions.
5. State the applications of Student's t test in the biological samples.
6. Give an account on Hierarchical data model
7. Explain any two histochemical staining techniques for detecting proteins in animal tissues.
8. Write on account on principle and applications of HPLC.

Section – B

Answer any FOUR Questions

4 x 10 = 40

9. Explain in detail the principle, components and applications of UV – Visible Spectrophotometer.
10. Write an elaborate account of Gel preparation and operative procedure involved in SDS – PAGE.
11. Describe the structure and uses of Electron Microscope.
12. Give an account on biological data bases and data retrieval.
13. What is ANOVA? Explain the theory and applications of ANOVA.
14. Describe the principles and application of Planar Chromatography.

MODEL QUESTION PAPER
M.Phil. ZOOLOGY
PAPER – II
RECENT ADVANCES IN ZOOLOGY

Time : 3 hrs

Max. : 60 marks

Section – A

Answer any FIVE questions

5 x 4 = 20

1. Comment on feed back regulation in Hormone Action.
2. Explain the structure of corticosteroids.
3. Comment on stock recruit.
4. Discuss the composition and nutritional values of fish
5. Elucidate the transport of seed and breeders
6. Examine critically the control methods of Aquatic Weeds
7. Write a note on Induced Breeding
8. Briefly explain the endocrine mechanism of reproduction in fishes.

Section – B

Answer any FOUR Questions

4 x 10 =40

9. Describe the hypothalamo hypophyseal Axis.
10. Present in detail the fishery resources and scope of aquaculture in India.
11. Explain in detail Hybridization techniques and their applications in fishery.
12. Describe any four diseases and parasites of fishes.
13. Write an essay on fishing gears and crafts.
14. Discuss the preparation and management of fish culture.
15. Comment on Blue Revolution.

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