

MAHARAJA KRISHNAKUMARSINHJI

BHAVNAGAR UNIVERSITY

BHAVNAGAR



Detailed curriculum

For

Master of Science (M.Sc.): Zoology

Faculty: Science

PG Centre: Zoology Department,

Sir P.P. Institute of Science, Bhavnagar

Semester System

In force from June-2017

Website: mkbhavuni.edu.in

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DETAILED CURRICULUM M. Sc. Zoology Sem. – III Effective from June – 2017

SEMESTER PATTERN: Sem-III

Sr. No	PAPER No.	SEM.	Name of Paper	Total Marks (Ext.+Int.*)=Total	Passing Standard (Ext.+Ent.*)=Total	Total Teaching Hours	University Exam hours	Credits
1	9	III	Developmental Biology and Histology	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
2	10	III	Ecology and Wildlife Biology	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
3	11	III	Cytogenetics, Methods used in molecular biology and Physiology, Bas of bioinformatics	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
4	12	III	Practical	100	40 + 00=40	15 weeks x 15 hours =225	12	15

Internal component	Marks
1. Test	15
2. Seminar / Assignment	10
3. Attendance/ Study Tour	05
Total Marks	30

	Correlation of bone structure and some of its properties Formation of bone Blood supply of bone		
IV	Nervous tissue Tissue constituting nervous system Neuron structure Peripheral nerves Degeneration and regeneration of neurons Sensory receptors Neuromuscular junctions Ganglila Neuroglia Respiratory system The nasal cavities The pharynx The larynx The trachea and principal bronchi The lungs Basic pattern of the structure of the Alimentary canal The oesophagus The stomach The small intestine The large intestine The endocrine cells of the gut The urinary organs The kidney The ureters The urinary bladder The urethra	15	17

M.Sc. Zoology Semester-III

Paper: Zoo-10: Ecology And Wildlife Biology

Semester end Examination: 70 marks.

Internal : 30 marks.

Credits: 4

Unit	Name of Unit	Teaching hours	Mark/weight
I	<p>Biostatistics Introduction Population and sample Collection of data Classification and tabulation of data Diagrams and graphs Frequency distribution Descriptive statistics Measure of central tendency- Average Measure of dispersion Skewness and curtosis Inferential statistics Probability Theoretically probability distribution Chi square test Binomial distribution Poission distribution Normal distribution Sampling methods Hypothesis testing Student's t – test ANOVA Correlation Regression Demography</p>	15	18
II	<p>Distribution of flora and fauna in India -- Introduction -- Ecological subdivision 1. The Himalayan mountain system 2. The peninsular India subdivision 3. The tropical evergreen forest The mangrove forest of sunderban</p>	15	18

	<p>Endangered fauna of India Endangered flora of India Biosphere and Bio reserve Ecotourism.</p>		
III	<p>Brief introduction on: -- Wild life (Protection) Act 1972 -- International Union for Conservation of Nature(IUCN) -- Convention on International Trade in Endangered Species(CITES) -- Coastal Regulation Zone(CRZ) --Wildlife conservation method - In situ conservation method - Ex situ conservation method Special conservation programs in India: -- Project Tiger -- Project Hangul -- Crocodile Breeding Project -- Gir lion Sanctuary Project -- Himalayan Musk deer ecology and conservation Project -- Manipur Brow- antler deer conservation project</p>	15	17
IV	<p>Bird census methods Introduction 1. Distance sampling method a. Line transect method b. Point count method 2. Species richness method a. Encounter rate b. Mc Kinnon Species richness method c. Timed species count d. Mist netting 3. Breeding bird count a. Territory mapping b. Call counts c. Nest count 4. Counting water birds -Preparing bird skins</p>	15	17

M.Sc. Zoology Semester-III

Paper: Zoo-11: Cytogenetics, Methods Used In Molecular Biology and Physiology,
Basics of Bioinformatics

Semester end Examination: 70 marks.

Internal : 30 marks.

Credits: 4

Unit	Name of Unit	Teaching hours	Mark/weight
I	Cell, tissue and organ culture, Suspension and monolayer cultures Study of cell using tracer techniques with radioactive isotopes and antibodies. (ELISA , RIA) Immunoprecipitation Auto radiography In situ localization by techniques such as FISH and GISH Flow cytometry	15	18
II	Cell- cell interactions, cell adhesion, cell junctions Cell transformation Cytogenetics and molecular genetics of cancer Cell ageing, cell death, cellular communication Intra cellular interactions Receptor ligand interaction, recycling and metabolism Signal transduction, role of second messenger and G-proteins Ion channels	15	18
III	ELECTRO PHYSIOLOGICAL METHODS Single neuron recording, patch-clamp recording, ECG, Brain activity recording, Lesion and stimulation of brain, Pharmacological testing, PET, MRI, fMRI, CAT. BIOPHYSICAL METHODS Molecular analysis using UV/ visible, fluorescence, circular dichroism, NMR, and ESR spectroscopy Molecular structure determination using X ray diffraction and NMR , Molecular analysis using light scattering Different types of mass spectrometry and surface plasma resonance methods. METHODS IN MOLECULAR BIOLOGY Isolation and purification of RNA, DNA and proteins Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD, and AFLP techniques DNA fingerprinting, DNA foot printing, DNA sequencing, and protein sequencing Southern, Northern and Western blotting technique Microarray technique	15	17

IV	Bioinformatics Introduction and applications Basics of genomics Basics of proteomics Difference between genomics and proteomics Limitations of genomics and proteomics studies Database type in bioinformatics Software and tools used in Bioinformatics.	15	17
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M.Sc. Zoology Semester-III

Paper: Zoo-12: Practical Based on theory paper Z - 09 to Z - 11

Semester end Examination: 100 marks.

Credits: 15

The University Practical examination comprises of 12 hours which will be completed in two days (each day 6 hours) and it is based on the theory papers.

There shall be Local Excursion and Zoological study tour in any part of India for the subjective study. It may include visit to Forest, Desert, Sea coast, Zoological Park, Nature Park, Animal science based Research institutes, government institutions etc. Students shall have to submit field report / Tour report in their Journal.

REFERENCE:

1. Developmental Biology. 2nd Edition. Leon W. Browner Saunders College publishing.
2. Current Topics in Developmental Biology eds. R. A. Pedersen and G. P. Schatten.
3. Principles of animal developmental biology: S. C. Goel, Himalaya Publishing House.
4. Developmental Biology, S.F. Gilbert. 4th Edn. Sinauer Associates Inc. Publishers.
5. An Introduction to Developmental Biology: D. A. Ede.
6. Principles of developmental: Paul Weiss edited by Hafner publishing company New York.
7. Cells into organs. 2nd Edition. The forces that shape the Embryo. John Philip Trinkaus. Tom Aloisi.
8. Principles of development: Lewis Wolpert et al. 1998. Oxford University Press.
9. Foundations of Embryology. B. M. Patten & B. M. Carlson. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. An Introduction to Embryology: Balinsky (1981) 5th Ed. (CBS College Publishing).
11. Embryonic and foetal development. Cambridge University Press by Austin and Short, 1982, 1994 2nd Ed.

12. Marshall's Physiology of Reproduction Longmont, Green and Co. London Vol. 1 & 2. Lamming 1984, 2000.

Structure and function of Vertebrates

1. Alexander R.N., The Chordata, Cambridge University Press London.
2. Barrington EJW, The Biology of Hemichordates and Protochordates, Oliver and Boid Edinberg.
3. Bourne G.H., The structure and function of nervous tissue Academic press New York.
4. Kingslay J.S, Out lines of Comparative anatomy of vertebrates, Central Book Depot, Allahabad.
5. Honyelli A.R. The Chordates Cambridge University Press, London
6. Smith H.S. Evolution of Chordate structure, Hold Rinehart and Wintoin Inc. New York
7. Walter H.A. and Sayles L.D. Biology of Vertebrates Macmillan and co. New York
8. Romer A.S. Vertebrate body W.P. Sanders co., Philadelphia.
9. Young J.Z. Life of Vertebrates Oxford University Press, London.
10. Young J.Z. Life of Mammals Oxford University Press, London.
11. Colbert E.H. Evolution of Vertebrates John Wiley and sons Inc. New York.
12. Kent C.J. Comparative anatomy of Vertebrates.
13. Waterman A.J. Chordate Structure and Functions Macmillan Co. New York.
14. Montagna W. Comparative anatomy clarendon press, Oxford
15. Weichert C.K. Preach W. Elements of Chordates anatomy McGraw-Hill book co., New York.
16. Lovettrup S. The phytoeny of Vertebrates John Wiley and sons Inc., London.
17. Joysey K.A. and Kemp T.S. Vertebrate Evolution Oliver and Boyd, Edinberg.
18. Romer A. S. Vertebrate Paleontology University of Chicago Press, Chicago.
19. Newman Phylum Chordata.
20. Goodrich E.S. Structure and development of vertebrates. Dover publications Inc., New York
21. Hard disty M.W. and Potter I.C. Biology of Lampreys Academic Press Newyork
22. T.B. of Zoology Parker and Haswell W.A. Mac millon co. Ltd. London
23. The Biology of Amphibia Noble G.K. Dover Publication Inc Newyork

Biostatistics

1. Biostatistics-Arora and Malhan

2. Biostatistics- Jasraj and Gurudeep Raj
3. Biostatistics- P. Ramkrishan
4. Methods in Biostatistics-Mahajan

Ecology and wild life biology:

1. The Science of Ecology: Brewer, A. (1998), Sanders Pub. New York.
2. The Science of Ecology: Ehrlich, P. R. & Roughsrden, J. (1987) McMillan Pub. Co. New York.
3. Population Biology: Emlein, J. M. (1984). McMillan Pub. London.
4. Current Ecology: Pattern & Progress: Killawa, J. & Anderson, G.J. (1986), Blackwell Science Publication, Oxford.
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7. Ecology with Special Reference to Animals and Man: Kendelgh, Prentice Hall Co.
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9. Elements of Ecology: Smith, R. L. (1986), Harper & Row Pub. New York.
10. Environmental Physiology: Sonim, N. B. (1974), C. V. Mosby Pub. St. Louis, USA.
11. Environmental Physiology: Philips, J. G. (1975), Blackwell Science Publication, Oxford.
12. Ecology: Ricklefs, R. E. (1973), Thomas Nelson & Sons Ltd.
13. Threatened Animals of India: Tikader, B. K. ZSI Calcutta.
14. Ecology & Field Biology: Smith, R. L. Harper & Rw Pub. New York.
15. Wildlife in India: Sharin, V. B. (1985), Natraj Pub. Dehradun.
16. Fresh Water in India: Kulkarni, K. H. (1957), ICAR, New Delhi.
17. Marine Fishes: Bal, D. V. & Rao, K.V. (1989), Tata McGraw Hill, New York.
18. Textbook of Marine Ecology: Balkrishnan, N. A. & Thumpy, D. N. (1980), McMillan Co.
19. Marine Ecology & Fishes: Cushly, B. H. (1980), Cambridge University Press.
20. Treatise on Limnology: Hutchinson, G.E., (1967), John Willy Pub. New York.
21. Methods of Soil Analysis: De, S. K. (1962), Narayan Pub. House, Allahabad.
22. Fish & Fishes of India: Jhingran, V. G. (1985)
23. Aquatic Pollution: Edward A. (2000) Laws. 3rd edition. John Wiley and Sons, New York.
24. A Manual of Fresh Water Ecology: Santhanam, R., Velayntan, P. & Jagathesan, G. (1989), Daya Pub.

House, Delhi.

25. Limnology: Welch, P. S. (1957), McGrall & Hill Co. New York.

26. Air Pollution: Perkins, H.C., (1974) McGraw-Hill, New York.

Bioinformatics

1. Mount W. 2004. Bioinformatics and sequence genome analysis 2nd Edition CBS Pub. New Delhi.

2. Bergman, N. H. Comparative Genomics. Humana Press Inc. Part of Springer Science+BusinessMedia, 2007.

3. Baxevanis, A. D. Ouellate, B. F. F. 2009. Bioinformatics: A Practical Guide to the analysis of genes and proteins. John-Wiley and Sons Publications, New York.

4. Campbell A. M. and Heyer, L. J. 2007. Discovering Genomics, Proteomics and

5. Bioinformatics, 2nd Edition. Benjamin Cummings.

6. Des Higgins and Willie Taylor 2000. Bioinformatics: Sequence, structure and databanks. Oxford University Press.

7. Rashidi H. H. and Buehler 2002. Bioinformatics Basics: Applications in Biological Science and Medicine, CRC Press, London.

8. Developing Bioinformatics Computer Skills : Gibas Cynthia and Jambeck P. 2001.: Shroff Publishersand Distributors Pvt. Ltd. (O'Reilly), Mumbai.

Cytology

1. The cell theory, QAMS: Vol. 89,96,1948-55,Bakar.

2. Synthetic activity of polythene chromosomes: Berendes (Int. Rev. Cytol. vol. 35,1973)

3. The Nucleolus in the cell Metabolism: Bimstiel, Ann. Rev. Plant Physical vol.111967.

4. Elements of cytology: Cohen.

5. The nucleic Acid: Chargaff & Davidson.

6. The Bio-chemistry of DNA: Davidson.

7. Cell Biology- De Reoberts.

8. The cell-Biology: Dowbwn Haper.

9. Cell Biology: C. B. Powar.

10. DNA & Chromosomes, D.Praw.

11. Mitochondria structure & function: Ernster & Drahota.

12. Nuclear Envelope: Franke.
13. The structure of cell membrane: Fox.
14. Energy & Mitochondria: Green & H Baum.
15. Biological membrane: structure & function: Harrison & Lunt.
16. Studies in basic Genetics & Molecular Biology: Hayes & Wiley.
17. Cell Biology: Johan Paul.
18. The Mitochondria: Loghinger.
19. Hand book of Molecular Cytology: Lirna-de-Paria.
20. Cell structure & function: Loewy & Siskevit P.
21. Structure & function of biological membranes: Roth Field.
22. Molecular Genetics: Stent.
23. Cytogenetic: Swanson J, Yount Yodyrdan Metz & W.J.
24. The molecular basic of membrane function: Yodyrdan.
25. Molecular Biology of Gene: W. Son.
26. The Chromosomes: White.
27. The Nuclear Envelope, Its ultra structure & functional Significance: Wisctinitzers, S.
28. Tissue Culture methods & Application: Kruse, P. F. Jr. Academic Press, M. KS Pattersron, New York, San Francisco, London, 1973.
29. Tissue culture technique: 2nd Ed. Cameron G. Academic press, N. Y.
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31. An Introduction to cell and tissue culture: Free, W. F. Burgess, Minneapolis.
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38. Gene Regulation: A Eukaryotic Perspective, Latchrnan, Davin (1990), Un winHyman, London.
39. Gene Cloning: Brown.
40. Biotechonolgy: Higgins.
41. Essentials of Cytology: C.B. Powar (1996), Himalaya Pub. House, Bombay.
42. Cell Biology: David E. Sadava (1993), Jones & Bartlett Pub. Boston (London).
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44. Microbial Genetics, David Freifelder (1987), NAROSA Pub. House, (India).
45. Molecular Biology: David Freifelder (1987), NAROSA Pub. House, Delhi, India
46. Molecular Cell Biology, Lodish et. al., (2007), W.H. Freeman and Company, New York, USA.
47. Molecular Biology of the cell, Alberts et. al., (2008), Graceland Science, Taylor & Francis Group, New York, USA.
48. Cell Physiology Source Book: A Molecular approach, Sperelakis, (2001), Academic Press, New York, USA.
49. Principles of Genome Analysis and Genomics, Primrose, S.B. and Twyman R.M., (7th Ed., 2006), Blackwell Publishing Company, Malden, USA
50. Genomes 3, Brown, T. A., Garland Science Publishing, London, UK.
51. Bioinformatics: sequence and Genome Analysis, Mount, D.W., Cold Spring Harbor Laboratory Press, New York, USA.

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DETAILED CURRICULUM M. Sc. Zoology Sem. – IV

SEMESTER PATTERN: Sem-IV

Sr. No	PAPER No.	SEM.	Name of Paper	Total Marks (Ext.+Int.*)=Total	Passing Standard (Ext.+Ent.*)=Total	Total Teaching Hours	University Exam hours	Credits
1	13	IV	Biotechnology	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
2	14	IV	Entomology and Agricultural ornithology	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
3	15	IV	Ecology	70+30*=100	28+12*=40	15 weeks x 4 hours =60	2.5	04
4	16	IV	Dissertation & Practicals	100	40	15 weeks x 15 hours =225	12	15

Internal component

Marks

1. Test	15
2. Seminar / Assignment	10
3. Attendance/ Tour	05
Total Marks	30

M.Sc. Zoology Semester-IV

Paper: Zoo-13: Biotechnology

Semester end Examination: 70 marks.

Internal : 30 marks.

Credits: 4

Unit	Name of Unit	Teaching hours	Marks/Weight
I	<p>Basic principles of recombinant DNA technology</p> <ul style="list-style-type: none"> -Cutting and Joining DNA -Separating restriction fragments and visualizing DNA -Cell Transformation <p>Cloning vectors</p> <ul style="list-style-type: none"> -Bacterial vectors -Vectors for other organisms <p>Constructing and Screening a DNA Library</p> <p>Library</p> <ul style="list-style-type: none"> Genomic Library cDNA Library Screening Libraries Expression Libraries <p>Southern Blot Hybridization</p> <p>Polymerase Chain Reaction</p> <p>DNA sequencing</p> <p>Protein methods</p> <ul style="list-style-type: none"> Protein Gel Electrophoresis Protein engineering Monoclonal antibodies Protein sequencing <p>Application of Recombinant DNA technology</p>	15	18
II	<p>Animal Biotechnology</p> <p>Gene transfer methods in Animals</p> <ul style="list-style-type: none"> -Microinjection -Embryonic stem cells gene transfer -Retro virus and gene transfer <p>Transgenic animals</p> <ul style="list-style-type: none"> -Mice -Cows -Pigs , Sheeps, Goats -Insects -Birds <p>Animal disease</p> <p>Animal propagation</p> <ul style="list-style-type: none"> -Artificial insemination -Animal clones 	15	18

	Conservation biology -Embryo transfer -Regulation of transgenic animals -Patenting genetically engineered animals		
III	Medical Biotechnology Gene therapy Gene delivery methods Viral delivery -Ritro viral vectors -Adenovirus vectors -Non viral delivery methods Gene therapy models -Liver disease -Lung disease -Haemetopoietic disease -Circulated gene products -Cancer and Autoimmune disease Commercialization of gene therapy Vaccines -Vaccine vectors -Nucleic acid vaccine Immunoenhancing technology Synthetic DNAs Therapeutic Ribozymas Synthetic drugs Tissue engineering -Skin -Liver -Pancreas Xenotransplantation Antibody engineering Cell Adhesion-Based Therapy -Integrins -Inflamations -Cancer and metastasis Drug delivery	15	17
IV	A Introduction to evolutionary theory Biological background of evolutionary theories Molecular clock hypothesis Theory of evolution Mechanism of evolution Evolutionary tree of life Structure and functions of gene Mutational changes of DNA sequences Types of phylogenetic trees Topological differences	15	17

<p> Rooted trees Unrooted trees Scaled and unscaled Conversion of scaled to unscaled species tree Gene tree Case studies The tree of life web project Tree pattern matching in phylogenetic trees Branch clust Phyutility Phylofinder Review or orginal research paper Discusion on phylogenetics B The human genome project The Human Genome Goals of the human genome project Genetic linkage maps Polymorphic DNA markers Physical maps Sequence-tagged sites Integrating genetic linkage and physical maps Human genome progress DNA sequencing Ethical , Legal, and Social implications </p>		
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M.Sc. Zoology Semester-IV

Paper: Zoo-14: Entomology

Semester end Examination: 70 marks.

Internal : 30 marks.

Credits: 4

Unit	Name of Unit	Teaching Hours	Marks/Weight
I	<p>Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation.</p> <p>Head- Origin, structure and modification;</p> <p>Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax;</p> <p>Wings: Structure and modifications, venation, and Mechanism of flight;</p> <p>Legs: structure</p> <p>Abdomen- Segmentation and appendages; Genitalia and their modifications;</p> <p>Embryonic and post-embryonic development;</p> <p>Insect sense organs (mechano-, photo- and chemoreceptors). Structure, modification and physiology of different systems- Digestive, Circulatory, Respiratory, excretory, nervous, sensory, reproductive, musculature, endocrine and exocrine glands.</p> <p>Moulting; growth and diapause.</p> <p>Types of immature stages in insect orders, Morphology of egg, nymph/larva and pupa, Identification of different immature stages of crop pests and stored product insects.</p>	15	18
II	<p>Classification of class Insecta and their following Orders.</p> <p>Thysanura – Silverfish , Dermaptera - Earwing, Diptera - Mosquito, Heteroptera – Bugs , Hymenoptera- Bees and wasp , Siphonoptera- flea, Lepidoptera - Butterfly, Moths Odonata – Dragon fly. Orthoptera – Grasshopper Coleoptera – Beetles Dictyoptera – Mantis , cochroaches Phasmida – Stick insects.</p>	15	18
III	<p>Scope of classical biological control and augmentative biocontrol; introduction and handling of natural enemies;</p> <p>Mass culturing techniques, insectary facilities and equipments,</p> <p>Basic standards of insectary,</p>	15	17

	<p>Viabie mass-production unit, designs, precautions, Colonization, techniques of release of natural enemies, recovery evaluation, conservation and augmentation of natural enemies, Scope of genetically engineered microbes and parasitoids in biological control,</p>		
IV	<p>Agricultural Ornithology Status of agricultural ornithology in India, Groups of birds associated with agro-ecosystems. Nature of damage caused by birds in different crops. Foraging ecology of birds in agricultural fields. Beneficial role of birds in agriculture and attracting them to field. Management of bird pests in agriculture: Physical, Cultural, Ecological and Chemical methods.</p>	15	17

M.Sc. Zoology Semester-IV

Paper: Zoo-15: Ecology

Semester end Examination: 70 marks.

Internal : 30 marks.

Credits: 4

Unit	Name of Unit	Teaching hours	Mark/weight
I	<p>Introduction to Ecology Experimental design Individual in ecology Autotrophs and heterotrophs. Metabolic rate: Factors effecting metabolic rate. Energy budget: Assimilation efficiency. Production and respiration. Allocation to reproduction. Drawing up complete energy budget. Autecology: The Autecology of Bracken fern and European Starling.</p> <p>Biomes: Introduction The world's terrestrial biomes Different types of biomes.</p> <p>Bioremediation: Oil spills Waste water treatment Chemical degradation: Heavy metals, Oil and mineral recovery Oil recovery Metal extraction Microorganisms and the future</p>	15	18
II	<p>Population Dynamics: Population and Population change. Dispersal of organism Dormancy Presentation of demographic data. Modular organism</p> <p>Population Regulation: Population growth Factors which regulates population size: Types of regulation: Space, Food and water, Territories Herbivores and predators Weather and climate</p>	15	18

	Parasite and diseases Self regulation and stress.	Natural disasters		
III	Behavioral Ecology: Optimization theory Growth versus reproduction Reproducing only once versus reproducing several times Parental care Habitats and Niches: Habitats Niches Gause's competitive exclusion principle Species co existence The importance of inter specific competition in natural communities. Community structure of fish on coral reef.	Optimal foraging	15	17
IV	Ecosystem: Introduction Wetland and aquatic ecosystem Water the important factor Types of wetland: Marine wetland ecosystem Mangrove swamp Salt marshes Flood land ecosystem Swamp and marsh ecosystem Bog ecosystem Inter relationship of ecosystem	Aquatic ecosystem,	15	17
V			12	14+6=20

M.Sc. Zoology Semester-IV

Paper: Zoo-16: Practical (Based on theory paper Z - 13 to Z – 15) and Dissertation.
Semester end Examination: 100 marks. **Credits:** 15

The University Practical examination comprises of 12 hours which will be completed in two days (each day 6 hours) and it is based on the theory papers.

There shall be Local Excursion and Zoological study tour in any part of India for the subjective study. It may include visit to Forest, Desert, Sea coast, Zoological Park, Nature Park, Animal science based Research institutes, government institutions etc. Students shall have to submit field report / Tour report in their Journal.

Ecology:

1. The Science of Ecology: Brewer, A. (1998), Sanders Pub. New York.
2. The Science of Ecology: Ehrlich, P. R. & Roughsrden, J. (1987) McMillan Pub. Co. New York.
3. Population Biology: Emlein, J. M. (1984). McMillan Pub. London.
4. Current Ecology: Pattern & Progress: Killawa, J. & Anderson, G.J. (1986), Blackwell Science Publication, Oxford.
5. Basic Ecology: Odum, E. P. (1983), Sanders Pub. New York.
6. Systems of Ecology: Odum, H. T. (1983), John Wiley & Sons, New York.
7. Ecology with Special Reference to Animals and Man: Kendelgh, Prentice Hall Co.
8. National Resources & Conservation: Owen, O. S. (1985) McMillan Pub. New York.
9. Elements of Ecology: Smith, R. L. (1986), Harper & Row Pub. New York.
10. Environmental Physiology: Sonim, N. B. (1974), C. V. Mosby Pub. St. Louis, USA.
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12. Ecology: Ricklefts, R. E. (1973), Thomas Nelson & Sons Ltd.
13. Ecology & Field Biology: Smith, R. L. Harper & Rw Pub. New York.
14. Fresh Water in India: Kulkarni, K. H. (1957), ICAR, New Delhi.
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18. Methods of Soil Analysis: De, S. K. (1962), Narayan Pub. House, Allahabad.
19. Aquatic Pollution: Edward A. (2000) Laws. 3rd edition. John Wiley and Sons, New York.
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(1989), Daya Pub. House, Delhi.

21. Air Pollution: Perkins, H.C., (1974) McGraw-Hill, New York.

Entomology

1. Imms General text book of Entomology, Eds. O. W. Richards and R. G. Davis
Chapman and Hall, London.

2. General and Applied Entomology, K.K. Nayar, T. N. Ananthkrishan and B.V. Davis
Tata McGraw -Hill Co.Ltd. Bombay.

3. The Insect: Structure and function, R.F. Chapman, Cambridge University Press.

4. The Physiology of Insect , Ed. M.Rockstein ,Vol, 1-5, Academic Press, New York.

5. The Physiology of Insect Reproduction, F, Englemann, Pergamon Press, New York.

6. Comprehensive Insect Physiology , Biochemistry and Pharmacology , Eds. G.A.
Kerkut and I. A. Gillberd, VOL. 1-13, Pergamon Press, New York.

7. Analytical Biochemistry of Insect, Ed. R. B. Turner, Elsevier, Amsterdam.

8. Insect Hormone, M. J. A. Novak. Chapman and Hall, London.

9. Modern Entomology(Second edition): D. B. Tembhare, Himalaya Publication House,
Bombay.

10. Destruction and Useful Insect, Their Habits and Control, C. L. Metcalf, W. P. Flint
and R. I. Metcalf, Mc Grow Hill Co. New York.

11. Integrated Pest Management, J.L. Apple and R. E. Smith, Plenum Publication Co.,
New Delhi.

12. An Introduction Of Biological Control RVD Boarscho, P. S. Y. Messenger and A. P.
Gaiter, Plenum Publication Co.

13. Text Book of Entomology, K. P. Shivastava, Vol. 1 And 2 Kalyani Publication,
Ludhiana.

14. Agriculture Entomology, H. S. Dennis, Timber Press Inc.

15. Entomology and Pest Management, Larry P. Pedigo, Prentice Hall.

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