

# BARKATULLAH UNIVERSITY, BHOPAL

## THIRD SEMESTER

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|---------------------------------------|---|
| 1. Course Code : .....                | 6. Practical : 02                               |
| 2. Course Name : <b>M.Sc. Zoology</b> | 7. Practical passing mark: <b>18 each marks</b> |
| 3. Total Paper : <b>04</b>            | 8. Maximum marks : <b>500</b>                   |
| 4. Compulsory Paper : <b>04</b>       | 9. Minimum Passing percentage : <b>36</b>       |
| 5. Optional Paper : <b>00</b>         |   |

Sub. code	Subject Name	Theory									Practical		Total	
		Paper					CCE		Total Marks					
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
<b>Compulsory paper Theory</b>														
	(I) Comparative anatomy of vertebrates	85	0	0	85	31	15	5	160	36	0	0	180	36
	(II) Limnology	85	0	0	85	31	15	5	160	36	0	0	180	36
	(III) Ecotoxicology	85	0	0	85	31	15	5	160	36	0	0	180	36
	(IV) Aquaculture	85	0	0	85	31	15	5	160	36	0	0	180	36
	<b>Practical</b> Related to I & II Theory papers	0	0	0	0	0	0	0	0	0	50	18	50	18
	<b>Practical</b> Related to III & IV Theory papers	0	0	0	0	0	0	0	0	0	50	18	50	18

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स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम  
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## Subject - Zoology

Class	: M.Sc
Semester	: III
Subject	: Zoology
Title of Subject Group	: Comparative Anatomy of Vertebrates
Paper No.	: Paper- I
Max. Marks	: 85

<b>Unit-1</b>	<ol style="list-style-type: none"><li>1. Origin of Chordata: Concept of Protochordata</li><li>2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs)</li><li>3. Respiratory system : Characters of respiratory tissue, external and internal respiration. Comparative account of respiratory organs.</li><li>4. Comparative account of Digestive System.</li></ol>
<b>Unit-2</b>	<ol style="list-style-type: none"><li>1. Evolution of heart.</li><li>2. Evolution of aortic arches and portal systems.</li><li>3. Blood circulation in various vertebrates groups.</li><li>4. Comparative account of jaw suspensorium and vertebral column.</li></ol>
<b>Unit-3</b>	<ol style="list-style-type: none"><li>1. Evolution of urinogenital system in vertebrates.</li><li>2. Comparative account of organs of olfactory and taste.</li><li>3. Comparative anatomy of brain and spinal cord (CNS).</li><li>4. Comparative account of peripheral and autonomous nervous system.</li></ol>
<b>Unit-4</b>	<ol style="list-style-type: none"><li>1. Comparative account of lateral line system.</li><li>2. Comparative account of electroreception.</li><li>3. Flight adaptations in vertebrates.</li><li>4. Aquatic adaptations in birds and mammals.</li></ol>
<b>Unit-5</b>	<ol style="list-style-type: none"><li>1. Origin, evolution general organization and affinities of Ostracoderms.</li><li>2. General organization, specialized, generalized and degenerated characters of Cyclostomes.</li></ol>

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|  | <ol style="list-style-type: none"> <li>3. Origin, evolution general organization of early Gnathostomes .</li> <li>4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossoptergii.</li> </ol> |
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### SUGGESTED READINGS :

1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates, Central Book Depot. Allahabad,
3. Kent, C.G. Comparative anatomy of vertebrates
4. Malcom Jollie, Chordata morphology. East – West Pres Pvt. Ltd., New Delhi.
5. Milton I lildergrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.
6. Smith, H.S. Evolution of Chordata structure. Hold Rinchart and Winstoin Inc. New York.
7. Sedgwick, A.A. Students Text Book of Zoology, Vol.II.
8. Walter, H.E. and Sayles, L.D. Biology of vertebrates, MacMillan & Co. New York.
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia
10. Young J.Z. life of vertebrates. The oxford University Press, London
11. Parker & Haswell to III Rev. by Marshall willians latested Macmillan Co. ltd.
12. Young J.Z. Life of mammals. The Oxford University Press, London
13. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4<sup>th</sup> Edn. McGraw Hall Book Co., New York.



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## Subject - Zoology

<b>Class</b>	: M.Sc
<b>Semester</b>	: III
<b>Subject</b>	: Zoology
<b>Title of Subject Group</b>	: Limnology
<b>Paper No.</b>	: Paper- II
<b>Max. Marks</b>	: 85

<b>Unit-1</b>	1. Limnology – Definition, historical development and scope of Limnology. 2. Types of freshwater habitats and their ecosystem - (a) Ponds, Streams and rivers. (b) Lakes – Origin and classification. 3. Morphometry – Use of various morphometric parameters and Zonation.
<b>Unit-2</b>	Physico – Chemical Characteristics. 1. Light and Temperature- (a) Light as an ecological parameter in freshwater. (b) Temperature- Radiation, Stratification and Heat Budget. 2. (a) Dissolved Solids – Carbonate, Bicarbonates, Phosphate and Nitrate. (c) Physico – Chemical characteristics of freshwater with special reference to different parameters- Turbidity, dissolved gases( Oxygen, Carbon dioxide, Hydrogen Sulphide), Seasonal changes in dissolved gases and pH.
<b>Unit-3</b>	1. Study of Biota (a) Phytoplankton, Zooplankton and their inter-relationship. (b) Aquatic insects, birds and their environmental significance. 2. Ecological classification of aquatic fauna higher aquatic plants and their significance.
<b>Unit-4</b>	1. Methods of water quality testing BOD and COD. 2. Sewage – Definition, composition and its treatment. 3. Bioindicators- Aquatic flora and fauna in relation to water quality in an aquatic environment.

<b>Unit-5</b>	<ol style="list-style-type: none"> <li>1. Causes of pollution of Aquatic Resources, their management and conservation.</li> <li>2. Resource Conservation – Aquatic pollution, control, legislation, regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs.</li> <li>3. Use and misuse of inland waters.</li> </ol>
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**Suggested Readings :**

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|-----------------|---|---|
| Anathakrishnan  | : | Bioresources Ecology  |
| Goldman         | : | Limnology   |
| Odum            | : | Ecology   |
| Pawlosuske      | : | Physico- chemical methods for water                         |
| Wetzel          | : | Limnology   |
| Trivedi & Goyal | : | Chemical and biological methods for water pollution studies |
| Welch           | : | Limnology Vols. I-II  |
| Perkins         | : | Ecology   |
| Arora           | : | Fundamentals of environmental biology                       |

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## ~~Subject - Zoology~~ Subject – Zoology

<b>Class</b>	: M.Sc
<b>Semester</b>	: III
<b>Subject</b>	: Zoology
<b>Title of Subject Group</b>	: ECO- TOXICOLOGY
<b>Paper No.</b>	: Paper- III
<b>Max. Marks</b>	: 85

<b>Unit-1</b>	<ol style="list-style-type: none"> <li>1. General principles of Environmental Biology with emphasis on ecosystems.</li> <li>2. Abiotic and biotic factors of ecosystems.</li> <li>3. Communities of the environment, their structure &amp; significance.</li> <li>4. Energy flow in environment : Ecological energetics.</li> </ol>
<b>Unit-2</b>	<ol style="list-style-type: none"> <li>1. Productivity, Production and analysis.</li> <li>2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation.</li> <li>3. Remote sensing –basic concepts and applications of remote sensing techniques in environmental conservation.</li> <li>4. Environmental indicators and their role in environmental balance.</li> </ol>
<b>Unit-3</b>	<ol style="list-style-type: none"> <li>1. Kinds of environmental pollution and their control methods.</li> <li>2. Radioactive compounds and their impact on the environment.</li> <li>3. Vehicular exhaust pollution, causes and remedies.</li> <li>4. Noise pollution.</li> </ol>
<b>Unit-4</b>	<ol style="list-style-type: none"> <li>1. Toxicology- Basic concepts, Principles and various types of toxicological agents.</li> <li>2. Toxicity testing principles, hazards, risks and their control methods.</li> <li>3. Food toxicants and their control methods.</li> <li>4. Public Health Hazards due to environmental disasters.</li> </ol>



<b>Unit-5</b>	<ol style="list-style-type: none"><li>1. Pesticides, types, nature and their effects on environment.</li><li>2. Important heavy metals and their rôle in environment.</li><li>3. Agrochemical use and misuse, alternatives.</li><li>4. Occupational Health Hazards and their Control.</li></ol>
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**SUGGESTED READINGS :**

1. Clark : Elements of ecology
2. Odum : Fundamentals of Ecology
3. South Woods : Ecological methods
4. Trivedi and Goel : Chemical and biological methods for water pollution studies

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~~Session 2019-20~~

## Subject - Zoology

Class	: M.Sc
Semester	: III
Subject	: Zoology
Title of Subject Group	: Aquaculture
Paper No.	: Paper- IV
Max. Marks	: 85

<b>Unit-1</b>	<ol style="list-style-type: none"><li>1. Aquaculture: history, definition, scope &amp; importance.</li><li>2. Fishery resources of India in general &amp; Madhya Pradesh in particular.</li><li>3. Abiotic &amp; biotic factors of water necessary for fish life.</li><li>4. Ecological characteristics of lakes &amp; rivers.</li><li>5. General ecological characteristics of reservoirs of India.</li></ol>
<b>Unit-2</b>	<ol style="list-style-type: none"><li>1. Fish culture :- Mono, Poly, mixed and composite Fish culture.</li><li>2. Fresh water prawn culture and its prospects in India.</li><li>3. Culture of Mussels , clams,oysters &amp; pearl culture.</li><li>4. Sewage fed fish culture, paddy cum fish culture</li><li>5. Frog culture.</li></ol>
<b>Unit-3</b>	<ol style="list-style-type: none"><li>1. Fish breeding in natural conditions , bundh breeding, hypophysation &amp; stripping.</li><li>2. Transport of live fish &amp; seed.</li><li>3. Different types of crafts &amp; gears used for fish catching.</li><li>4. Plankton- its definition, culture &amp; indentification.</li><li>5. Common weeds of fish ponds and methods of their eradication.</li></ol>
<b>Unit-4</b>	<ol style="list-style-type: none"><li>1. Fresh water fish farm engineering: selection of site, construction of fish farm &amp; soil chemistry.</li><li>2. Designing, layout &amp; construction of different types of fish ponds.</li><li>3. Setting and management of fresh water aquarium.</li><li>4. Preservation &amp; processing of fish.</li><li>5. By products of fish Industry &amp; their utility.</li></ol>



<b>Unit-5</b>	<ol style="list-style-type: none"> <li>1. Water pollution, its effects on fisheries and methods of its abatement.</li> <li>2. Common fish diseases &amp; their control.</li> <li>3. Biochemical composition and nutritional value of fish.</li> <li>4. Fisheries economics and marketing.</li> <li>5. Fisheries managements and extension.</li> </ol>
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**Suggested Readings :**

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|------------------------|---|---|
| 1. C.B.L. Shrivastava  | : | Fishes of India                                       |
| 2. Jhingaran           | : | Fish and fisheries of India                           |
| 3. S.S. Khanna         | : | An Introduction to fishes                             |
| 4. R.S. Rath           | : | Fresh water Aquaculture                               |
| 5. Gopalji Shrivastava | : | Fishes of U.P. & Bihar                                |
| 6. H.D. Kumar          | : | Sustanibility & Management of Aquaculture & Fisheries |
| 7. A.J.K. Mainan       | : | Identification of fishes                              |
| 8. R. Sanatam          | : | A Manual of fresh water Aquaculture                   |
| 9. S.K. Gupta          | : | Fish & Fisheries                                      |
| 10. P.D. Pandey        | : | Fish & Fisheries                                      |
| 11. K.P. Vishwas       | : | Fish & Fisheries                                      |

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## Subject - Zoology

**Class** : M.Sc

**Semester** : III

**Subject** : Zoology

**Practical I** : Related to I & II Theory Papers

1. Study of Specimens, slides and bones related to theory papers.
2. Major Dissection- Various systems of Labeo , Wallago, Torpedo
3. Minor Dissection-
  - (a) Accessory respiratory organs of Anabas, Clarias, Heteropneustes.
  - (b) Herdmania
  - (c) Amphioxus.
4. Estimation of DO, chloride, BOD,COD,Hardness, pH and Alkalinity of water.
5. Study of fresh water ecosystem.

### Scheme for Practical Examination M.M. 50

1. Major Dissection	10 Marks
2. Minor Dissection	04 Marks
3. Spotting	12 Marks
4. Limnological exercise	10 Marks
5. Practical Record	05 Marks
6. Viva Voce	05 Marks
7. Collection	04 Marks
<b>Total</b>	<b>50 Marks</b>

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**Subject - Zoology**

**Class : M.Sc**  
**Semester : III**  
**Subject : Zoology**

**Practical II : Related to III & IV Theory Papers**

1. Study of plankton.
2. Preparation and Maintenance of Aquarium.
3. Study of common weeds of fish ponds.
4. Methods of culture related to theory papers.
5. Study of abiotic factors of water related to fish life.
6. Determination of different toxic chemicals in samples of soil, water and air.
7. Toxicological testing methods , General tests, acute toxicity test and LD 50 test.
8. Identification and comments on Aquaculture animals.



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**Practical II** : Related to III & IV Theory Papers

**Scheme of practical examination** M.M. 50

1. Spotting	16
2. Exercise on toxicology	10
3. Study of culture methods related to theory	05
4. Maintenance of aquarium	05
5. Practical Record	04
6. Viva Voce	05
7. Collection	05