# Government Arts and Science College
## Ratlam (M.P.) 457001

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For the session 2020-21 the syllabus have been adopted from Central Board of Studies, Bhopal and Vikram University, Ujjian for UG and PG respectively.

Principal

Govt. Arts and Science College

Ratlam (M.P.)

Principal
Govt. Arts & Science College
Ratlam (M.P.)

Official Copy Acad Section V.U

Revised Syllabus only for SS in Zoology for 2018-20 Session

Ord-14 Ord-14 29.10.18

# Semester wise Syllabus For Postgraduates

9.7.18

Prof Dr. H.S.RATHORE
DEAN
Faculty of Life Sciences
Vikram University,
UJJAIN, 456 010. India

CBCS Pattern

Session

2018-20

M.Sc. Zoology

S.S. In Zoology & Biotechnology

Vikram University,

Ujjain

Pages
1 to 50

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# School of Studies in Zoology & Biotechnology
# Vikram University, Ujjain

## Syllabus
## M.Sc. Zoology as per ordinance 14
(For UTD)

## Revised course structure
## Choice based credit system (CBCS)
## 2018-20

29.10.18

30.10.2018

# Scheme of Examination 2018-2020

## M.Sc. Zoology Sem-I

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in SS in Zoology and Biotechnology wef 2018-20 Academic session

| S. No. | Course code | TITLE OF COURSE | Course type | MARKS | | | |
|---|---|---|---|---|---|---|---|
| | | | | Internal examination marks | University examination marks | Total marks | Credits |
| 01 | ZOL 101 | Paper1: Bio Systematics, Taxonomy and Evolution | Core | 40 | 60 | 100 | 5 |
| 02 | ZOL 102 | Paper 2: Structure and function of Invertebrates | Core | 40 | 60 | 100 | 5 |
| 03 | ZOL 103 | Paper 3: Biostatistics Biodiversity & Wild life | Core | 40 | 60 | 100 | 5 |
| 04<br><br>05 | ZOL 104<br><br>ZOL 105 | Paper 4: Biomolecules and Metabolism<br>OR<br>Microbiology | *Generic elective | 40 | 60 | 100 | 5 |
| 06 | ED 106 | Entrepreneurship Devpt. | **Skill Devpt. | 30 | 50 | 80 | 4 |
| 07 | ZOL 107 | Practical based on theory Papers | Core | 16 | 24 | 40 | 2 |
| 08 | ZOL 108 | Comprehensive *Viva-voce* (Virtual credits) | Core | - | 80 | 80 | 4 |
| | | Total Marks | | 206 | 394 | 600 | 30 |

*Any 01 out of 02 elective can be opted.

* Elective papers shall be taught only if faculty is available.

** Common course offered by University

M S Rao
30.10.2018

29.10.18

# Scheme of Examination 2018-2020

## M.Sc. Zoology Sem-II

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in SS in Zoology and Biotechnology wef 2018-20 Academic session

| S. No. | Course code | TITLE OF COURSE | Course type | MARKS | | | |
|---|---|---|---|---|---|---|---|
| | | | | Internal examination marks | University examination marks | Total marks | Credits |
| 01 | ZOL 201 | Paper1: Immunology and Animal Physiology | Core | 40 | 60 | 100 | 5 |
| 02 | ZOL 202 | Paper2: Population Ecology and Environmental Physiology | Core | 40 | 60 | 100 | 5 |
| 03 | ZOL 203 | Paper :3 Molecular Cell Biology and Genetics | Core | 40 | 60 | 100 | 5 |
| 04<br><br>05 | ZOL 204<br><br>ZOL 205 | Paper 4: Tools and Techniques in Biology<br>OR<br>Enzyme Technology/ MOOC/ Skill Devlopment | *Discipline specific Elective | 40 | 60 | 100 | 5 |
| 06 | CS 206 | Communication Skill | **Skill Devpt. course | 30 | 50 | 80 | 4 |
| 07 | ZOL 207 | Practical based on theory Papers | Core | 16 | 24 | 40 | 2 |
| 08 | ZOL 208 | Comprehensive *Viva-voce* (Virtual credits) | Core | - | 80 | 80 | 4 |
| | | Total Marks | | 206 | 394 | 600 | 30 |

*Any 01 out of 02 elective can be opted.
* Elective papers shall be taught only if faculty is available.
** Common course offered by University

MSR-Rao
30.10.2018

29.10.18

# Scheme of Examination 2018-2020

## M.Sc. Zoology Sem-III

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in SS in Zoology and Biotechnology wef 2018-20 Academic session

| S. No. | Course code | TITLE OF COURSE | Course type | MARKS | | | |
|---|---|---|---|---|---|---|---|
| | | | | Internal examination marks | University examination marks | Total marks | Credits |
| 01 | ZOL 301 | Paper1: Comparative Anatomy of Vertebrates | Core | 40 | 60 | 100 | 5 |
| 02 | ZOL 302 | Paper2: Developmental Biology | Core | 40 | 60 | 100 | 5 |
| 03 | ZOL 303 | Paper 3: Animal Behaviour. | Core | 40 | 60 | 100 | 5 |
| 04<br><br>05 | ZOL 304<br><br>ZOL 305 | Paper:4 Aquaculture OR Genomics and Proteomics | *Discipline specific Elective | 40 | 60 | 100 | 5 |
| 06 | PD 306 | Personality Development | **Skill Devpt. course | 30 | 50 | 80 | 4 |
| 07 | ZOL 307 | Practical based on theory Papers | Core | 16 | 24 | 40 | 2 |
| 08 | ZOL 308 | Comprehensive *Viva-voce* (Virtual credits) | Core | - | 80 | 80 | 4 |
| | | Total Marks | | 206 | 394 | 600 | 30 |

*Any 01 out of 02 elective can be opted.
* Elective papers shall be taught only if faculty is available.
** Common course offered by University

30.10.2018

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# Scheme of Examination 2018-2020

## M.Sc. Zoology Sem-IV

Scheme of teaching and examination under semester pattern Choice Based Credit System (CBCS) for M.Sc. Program in SS in Zoology and Biotechnology wef 2018-20 Academic session

| S. No. | Course code | TITLE OF COURSE | Course type | MARKS | | | |
|---|---|---|---|---|---|---|---|
| | | | | Internal examination marks | University examination marks | Total marks | Credits |
| 01 | ZOL 401 | **Paper 1** Neurophysiology and Ecotoxicology | Core | 40 | 60 | 100 | 5 |
| 02 | ZOL 402 | **Paper 2** Ichthyology | Core | 40 | 60 | 100 | 5 |
| 03 | ZOL 403 | **Paper3:** Molecular Endocrinology and Reproductive Technology | *Generic elective | 40 | 60 | 100 | 5 |
| | | **OR** | | | | | |
| 04 | ZOL 404 | Limnology and Fish Productivity | | | | | |
| 05 | ZOL 405 | **Paper 4** Economic Zoology | Core | 40 | 60 | 100 | 5 |
| 06 | TM 406 | Tourism Management | **Skill Devpt. course | 30 | 50 | 80 | 4 |
| 07 | ZOL 407 | Practical Based on theory Papers | Core | 16 | 24 | 40 | 2 |
| 08 | ZOL 408 | Comprehensive *Viva-voce* (Virtual credits) | Core | - | 80 | 80 | 4 |
| | | Total Marks | | 206 | 394 | 600 | 30 |

*Any 01 out of 02 elective can be opted.

* Elective papers shall be taught only if faculty is available.

** Common course offered by University

Grand Total M.Sc. Biotechnology 2018-20

Marks: 2400

Credits: 120 (Each credits is equal 20 marks)

# VIKRAM UNIVERSITY, UJJAIN

## ENTREPRENEURSHIP DEVELOPMENT CELL

Courses offered by Entrepreneurship Development Cell for P.G. students of U.T.D. of Vikram University.

| S.NO. | NAME OF COURSE | CREDIT | SEMESTER |
|---|---|---|---|
| 1 | ENTREPRENEURSHIP DEVELOPMENT | 4 | I |
| 2 | COMMUNICATION SKILLS | 4 | II |
| 3 | PERSONALITY DEVELOPMENT | 4 | III |
| 4 | TOURISM MANAGEMENT | 4 | IV* |

*Optional

**Note:** These classes will be conducted tentatively from 1st Nov 2018 from Monday to Thursday between 10 A.M to 11 A.M in School of studies in Commerce Vagdevi Bhavan.

The detailed syllabus of all courses is attached.

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**VIKRAM UNIVERSITY, UJJAIN (M.P.)**
**SCHOOL OF STUDIES IN COMMERCE**

# ENTREPRENEURSHIP DEVELOPMENT

**Marks: 100** **Credit for each course** **Credit: 04**
**30 hours/semester**

| Lectures-03/week | Tutorial-01/week | Total-04 classes/week |
|---|---|---|

**Course Objectives:**
To prepare the budding entrepreneurs and to provide the students seedbeds of entrepreneurship at the entry level and enhance their entrepreneurial skills.

**Course Contents:**

**Unit I: Introduction**
Entrepreneurship - meaning, nature, importance, specific traits of Entrepreneurs, role of entrepreneurs in Indian Economy.

**Unit II: Analysis of Entrepreneur opportunities**
Defining, objectives, identification, process of sensing, accessing the impact of opportunities and threats.

**Unit III: Search of business idea**
Preparing for business plan, legal requirements for establishing of a new unit-procedure for registering business, starting of new venture, product designing / branding, research and development, selection of forms of business organization.

**Unit IV: Role of Supportive Organizations**
D.I.C and various government policies for the development of entrepreneurship Government schemes and business assistance, subsidies, role of banks.

**Unit V: Market assessment**
Meaning of market assessment, components and dimensions of market assessment, Questionnaire preparations, survey of local market, visit to industrial unit, business houses, service sector etc. Submission of survey based report on one successful and unsuccessful entrepreneurs.

**Suggested Readings:**


1 Entrepreneurship Development — Dr.C.B.Gupta
2 Dynamics of Entrepreneurial Development and Management — Vasant Desai
3 Innovation and Entrepreneurship — Peter F.Drucker
4 Entrepreneurship Development — G.A.Kaulgud
5 Entrepreneurship-Need of the Hour — Dr.Vidya Hattangadi
6 Entrepreneurship Development — Dipesh D. Uike


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VIKRAM UNIVERSITY, UJJAIN (M.P), SCHOOL OF STUDIES IN COMMERCE

# COMMUNICATION SKILLS

**Marks: 100** **Credit for each course** **Credit: 04**

**30 hours/semester**

| Lectures-03/week | Tutorial-01/week | Total-04 classes/week |
|---|---|---|

## Course objective:

The objective of this paper is to make students aware of the practical significance of good communication skills and help them in acquiring competence in reporting ,drafting and development of negotiations skills.

**Course Contents:**

**Unit I: Introduction:**
Definition, nature, objects, elements and importance of communication, principles and practices, models of communication, types of communication,.

**Unit II: Communication skills and soft skills**
Interviewing and group discussion, resume preparation , etiquette and manners, self management, body and sign language, presentation skills, feedback & questioning technique: objectiveness in argument (Both one on one and in groups).

**Unit III: Concept to effective communication**
Dimensions and directions of communication, means of communication, 7C's for effective communication.

**Unit IV: Listening skills**
Importance of listening skills, good & bad listening , communication channels, types of communication medium- audio, video, digital, barriers of communication.

**Unit V: Public speaking and reporting**
effective public speaking and its principles, interpretation and techniques of report writing, letter writing, negotiation skills.

**Suggested Reading:**

Business Communication- Royan and V.lesikar, John D. Pettit, JR.Richard D.Irwin, INC
Business communication- K.K. Sinha
Business Etiquettes – David Robinson
Business communication – Dr. Nageshwar Rao and Dr. R.P. Das
Effective business communication- Morphy Richards

VIKRAM UNIVERSITY, UJJAIN (M.P), SCHOOL OF STUDIES IN COMMERCE

# PERSONALITY DEVELOPMENT

**Marks: 100** **Credit for each course** **Credit: 04**

**30 hours/semester**

| Lectures-03/week | Tutorial-01/week | Total-04 classes/week |
|---|---|---|

**Course Objectives:**

To prepare student with the aim of developing personality for leadership & awareness to develop an ideal citizenship values.

**Course Contents:**

**Unit I: Introduction**
Personality development- concept, types, role and impact, developing self awareness, projecting a winning personality.

**Unit II: Personality assessment**
Personality assessment and testing- resume writing- types, contents, formats, interviewing skill , group discussion, JAM sessions, persuasive communication .

**Unit III: Communication skill**
Practice on oral/spoken communication skill and testing-voice and accent, feedback and questioning techniques, objectives in a argument.

**Unit IV: Presentation skills**
Skills and techniques, etiquette, project/assignment presentation, role play and body language, impression management.

**Unit V: Personality development activities**
Leadership activities, motivation activities, team building activities, stress and time management techniques, creativity and ideation.

**Suggested Readings:**

Business Communication- Royan and V.lesikar, John D. Pettit, JR.Richard D.Irwin, INC.
Personality Development and soft skills- Barun K. Mitra, Oxford Publisher.
Personality Development –Rajiv K.Mishra, Rupa Publisher.

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# VIKRAM UNIVERSITY, UJJAIN (M.P.), SCHOOL OF STUDIES IN COMMERCE

## TOURISM MANAGEMENT

**Marks : 100** **Credit for each course** **Credit:04**

**30 hours/semester**

| Lectures-03/week | Tutorial-01/week | Total-04 classes/week |
|---|---|---|

**Course Objective:**

The course is of utmost importance when the industry is poised to take a leap forward and therefore, the cause assumes greater significance for understanding the resources development, modernization syndrome in the field of tourism.

**Course Contents:**

**UNIT I: Introduction**

Concept of tourism & importance in economy, types of tourism, tourism in Madhya Pradesh history and development ,Geography, Climate, Forest , River and Mountain.

**UNIT II: Overall Scenario**

Present scenario, planning, development and opportunities. Social and Economical impact of tourism, role of public and private sector in the promotion of tourism.

**UNIT III: Tourism Resources**

Physical and Biographical ,Tourist satisfaction and service quality-Transport accommodation, other facilities and amenities available in Madhya Pradesh. Role of tourist service provider, heritage site in M.P.

**UNIT IV: Financial aspects of Tourism**

Requirements of capital investment, sources of finance, Madhya Pradesh State Tourism Development Corporation Limited - funds, finance, policies, packages and its role for the development of tourism in madhyapradesh.

**UNIT V: Practical training**

Case studies of popular tourist places and tourist statistics in Madhya Pradesh, Analytical studies of tourist arrivals trends.

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**Suggested Readings:**

Ancient Geography of M.P-Bhattacharya D.K

All district Gazettes of M.P

Tourism planning –Gunn. Clare A

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Grand Total of all 4 Semesters: Total Credits = 120 Total Marks = 1200

TABLE: GRADES, GRADE POINTS AND RANGE OF PERCENTAGE OF MARKS

| Letter Grade | Grade Points | Percentage Range of Marks |
|---|---|---|
| O - Outstanding | 10 | Above 80.0% |
| $A^+$ - Excellent | 9 | Above 70.0 - 80.0% |
| A - Very Good | 8 | Above 60.0 - 70.0% |
| $B^+$ - Good | 7 | Above 55.0 - 60.0% |
| B - Above Average | 6 | Above 50.0 - 55.0% |
| C - Average | 5 | Above 45.0 - 50.0% |
| P - PASS | 4 | 40.0 - 45.0% |
| F - FAIL | 0 | Less than 40.0% |
| Ab - Absent | 0 | -- |

**Note:** While calculating percentage of Marks and for determination of the Grade rounding of Marks **shall not be done**.

**The Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)**

The UGC recommended the following procedure to The Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the Grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i. e

**SGPA** (Si) = $\Sigma$ (Ci x Gi) / $\Sigma$ Ci
Where, Ci - is the number of credits of the $i^{th}$ course and
Gi –is the Grade Point scored by the student in the $i^{th}$ course

ii The CGPA is also calculated in the same manner taking into account all the courses undergone by a student overall the semesters of a program, i. e.

**CGPA** = $\Sigma$ (Ci x Si) / $\Sigma$ Ci
Where, Si –is the SGPA of the $i^{th}$ semester and
Ci –is the Total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

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**Illustration of computation of SGPA and CGPA and format for Transcripts**

i. Computation of SGPA and CGPA

Illustration for **SGPA**

| Course | Credit | Grade Letter | Grade Point | Credit Point (Credit x Grade) |
|---|---|---|---|---|
| Course- 1 | 3 | A | 8 | 3 x 8 = 24 |
| Course- 2 | 4 | B+ | 7 | 4 x 7 = 28 |
| Course- 3 | 3 | B | 6 | 3 x 6 = 18 |
| Course- 4 | 3 | O | 10 | 3 x 10 = 30 |
| Course- 5 | 3 | C | 5 | 3 x 5 = 15 |
| Course- 6 | 4 | B | 6 | 4 x 6 = 24 |
| | 20 | | | 139 |

Thus, **SGPA** = 139/ 20 = **6.95**

Illustration for **CGPA**

| Points | Semester- 1 | Semester- 2 | Semester- 3 | Semester- 4 | Semester- 5 | Semester- 6 |
|---|---|---|---|---|---|---|
| Credits | 20 | 22 | 25 | 26 | 26 | 25 |
| SGPA | 6.9 | 7.8 | 5.6 | 6.0 | 6.3 | 8.0 |

Thus, **CGPA** = 20x6.9 + 22x7.8 + 25x5.6 + 26x6 + 26x6.3 + 25x8 / 144 = **6.73**

ii. **Transcript (Format)**: Based on the above, on Letter Grades, grade points and SGPA and CGPA, the Vikram University may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**
**M.Sc. Zoology**
**Semester I**
**Paper I**

**Core. ZOL PG 101 Biosystematics, Taxonomy and evolution**

**Unit- 1**

1. Definition and basic concepts of biosystematics.
2. History of classification.
3. Theories of biological classification:
4. Taxonomic categories and hierarchy categories.
5. International code of zoological nomenclature.
6. Formation of scientific names of various texa.

**Unit:- 2**

1. Taxonomic characters
2. Taxonomic collection of invertebrate
3. Taxonomic collection of vertebrate
4. Preservation and curetting.
5. Taxonomic Keys
6. Reproductive isolation

**Unit:- 3**

1. Concepts of evolution and theories of organic evolution.
2. Concepts of population genetics, Hardy- Weinberg law of genetic equilibrium.
3. Destabilizing forces: Natural selection, mutation, genetic drift and migration
4. Genetic polymorphism
5. Human Evolution
6. An overview of evolutionary biology

**Unit :- 4**

1. Modes of speciation.
2. Micro and Macro and mega Evolution.
3. Gene Evolution.
4. Origin of cells & first organism.
5. Taxonomic aids: museum, Herbarium, Taxidermy, Zoos.
6. Darwinism and neo Darwinism

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**Semester I Paper-I**

SUGGESTED READING MATERIAL


1. M. Koto-The. Biology of biodiversity-Springer
2. E.O. Wilson-Biodiversity-Academic Press Washington.
3. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication company.
4. E-Mayer-Elements of Taxonomy
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.
6. Skoal R.R. and F.J.Rohiff Biometry-Freeman, San-Francisco.
7. Snecdor, G.W. and W.G. Cocharan Statisical Methods of affiliated-East-West Press, New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester I**
**Paper II**

## Core. ZOL PG 102 STRUCTURE AND FUNCTION OF INVERTEBRATES

UNIT –I

1. Origin of metazoan.
2. Organization of Coelom: Acoclomates , Pseudocoelomates , Coelomates.
3. Locomotion in Protozoa( amoeboid flageller and cilliary movement )
4. Locomotion in Ecinodermata.
5. Hydrostatic movement in colentetra
6. Locomotion in Annelida

UNIT –II

1. Patterns of Feeding and digestion in lower metazoa,: Mollusca, & Annelida
2. Filter feeding in polychaeta.
3. Organs of respiration: gills, lungs and trachea.
4. Mechanism of respiration in insects.
5. Respiratory Pigments in invertebrates.
6. Coral reef & their formation.

UNIT – III

1. Excretion in lower invertebrates.
2. Excretion in higher invertebrates.
3. Mechanism of osmoregulation.
4. Metamorphosis in insects
5. Modification mouth parts in insects
6. Parasitic adaptation in Platyhelminthes and Aschelminthes.

UNIT – IV

1. Primitive Nervous systems-Coelentetra and Echinodermata.
2. Structure, affinity and Life History of Phoronida and Ectoprocta
3. Larval forms in Mollusca.
4. Larvae forms in Echinodermata
5. Larval form Crustacea
6. Larval form echinodermata

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**Semester I Paper-II**

SUGGESTED READING MATERIAL


1. Hyman, L.H. The invertebrates, Nol. I. Protozoa through Ctenophora, McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
5. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
6. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
7. Russel-Hunter, W.D. A biology of higher invertebrates, the Macmillan Co. Ltd., London.
8. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V.Mc.Graw Hill Co., New York.
9. Read, C.P. Animal Parasitism. Parasitism. prentice Hall Inc., New Jersey.
10. Sedgwick, A.A. Student text book of Zoology. Vol. I,II and III. Central Book Depot, Allahabad.
11. Parker, T.J., Haswell W.A. Text book of Zoology, Macmillan Co., London.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-2020**

**M.Sc. Zoology**
**Semester I**
**Paper III**
**Core ZOL PG 103 Bio-statistics, Biodiversity and Wildlife**

Unit – I

1. Experimental designing and sampling theory
2. Mean, Median & Mode.
3. Student 't' test
4. Graphical representation of data (Column, Bar, Line, pie).
5. Standard deviation.
6. Standard Error.

Unit – II Biodiversity

1. Concept and principle of biodiversity
2. Causes for the loss of biodiversity
3. Biodiversity conservation methods
4. Medicinal uses of forest plants
5. Biodiversity hot spots
6. Biodiversity monitoring and documentation

Unit – IV

1. Values of wildlife: positive and negative
2. Wildlife protection Act
3. Conservation of wildlife in India
4. Endangered and threatened species
5. Red Data book
6. Crocodile breeding project in M.P.

Unit – IV

1. National Parks and Sanctuaries
2. Project Tiger
3. Wildlife in M.P. with references to reptiles, birds and mammals
4. Endangered birds and Their conservation
5. Biospheres reserve

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**Semester I Paper-III**

SUGGESTED READING MATERIAL


1. Jorgenserr, S.E. Fundamental of Ecological modeling Elsevier New York
2. Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
3. Sokal, R.R. and F. J. Rohit Biometry Freeman San Francisco
4. Snedecor, G.W. and W.G. cochran, statistical methods, Affiliated East, West Press New Delhi (Indian ed.)
5. Pelon, E.C. The interpretation of ecological data : A promer on classification and ordivation.
6. A. lewis – Biostatics
7. B.K. Mahajan Methods in Biostatics
8. V.B. Saharia wildlife in India
9. S.K. Tiwari wildlife in central India
10. Georgs & Wilians statistical method
11. R.K. Tondon Biodiversity Texonomy & Ecology
12. M.P. Arora An Introduction to prevantology
13. P.C. Kotwal Biodiversity and conservation
14. M. Koto : The Biology of Biodiversity. Springer.
15. E. O. Wildon : Biodiversity. Academic Press Washington.
16. G.G. Simpson : Principles of Animal Taxonomy. Oxford IBH Publication Company.
17. E. Mayer : Elements of Taxonomy.
18. Dobzansky : Biosystematics.
19. Dallela and Sharma : Animal Taxonomy and Museology.
20. Dodzhansky: The Genetics and origin of species. Columbia University Press.
21. Futuyama D.I. Evolutionary Biology. INC Publishers Dunderland.
22. Jha A.P. : Genes and Evolution – John Publication, New Delhi.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-2020**

**M.Sc. Zoology**
**Semester I**
**Paper IV**
**Core ZOL PG 104 Biomolecules and Metabolism**

Unit – I

1. Chromatographic methods of separation and purification of Proteins
2. Electrophoretic methods of separation and purification of Proteins.
3. Elucidation of primary structure of protein.
4. Elucidation of secondary structure of protein.
5. Elucidation of tertiary structure of protein.
6. Elucidation of quaternary structure of protein.

Unit- II

1. Molecular structure of A,B and Z forms of DNA
2. Different types of RNA and their role in Eukaryotic cells
3. Molecular structure of transfer RNA
4. Molecular Mechanism of DNA damage
5. Various modes of DNA repair
6. Molecular mechanism of DNA replication.

UNIT- III

1. Enzymes: Terminology and classification.
2. Mechanism of Enzyme Action.
3. Regulation of Enzyme action.
4. High Energy compounds.
5. Concept of laws of Thermodynamics.
6. Concept of Free energy.

Unit- IV

1. Pathways of gluconeogenesis.
2. Pathways of glycolysis.
3. Pathway of tricarboxylic cycle.
4. Pathways of Beta – oxidation of fatty acids.
5. Respiratory chain complexes and mechanism of electron Trans port system.
6. Mechanism of ATP synthesis and oxidative phosporylation.

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**Semester I Paper-IV**

SUGGESTED READING MATERIAL


1. Voet, D. and J.G. Voet. Biochemistry John Wiley & Sons.
2. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
3. Segal, I.H. Biochemical calculations John Wiley and Sons
4. Creighton, T.E. Protein Structure and Molecular Properties W.H. Freeman & Co.
5. Freifelder, D. Essentials of Molecular Biology
6. Wilson, K. and K.H. Goulding A Biologists Guide to Principals and Techniques of Practical Biochemistry
7. Cooper, T.G. Tools of Biochemistry
8. Hawk, Practical Physiological Chemistry
9. Garret, R.H. and C.M. Grisham. Biochemistry. Saunders college Publishers

10 Fundamentals of Biochemistry 3rd edition by D. Voet, JG Voet, CW. Pratt, John Wiley & Sons
11 Principles of Biochemistry 5th edition by Nelson, Cox and Lehinger, WH Freeman & Company
12 Molecular Cell Biology by Lodish, Berk, Kaiser, Kreiger, Scott, Zipursky, Darnell
13 Biochemistry with clinical correlations by TJ Devlin, Wiley Leiss
14 Biochemistry by Zubey, Macmilan Publishing Company, New York
15 Biochemistry by CK Mathews, KE Van Holde, The Benjamin Cummings Publishing Company, Melano Park.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology Semester I**
Practical based on paper 101-104

Total marks 16+24 = 40

**(A) INTERNAL EXAMINATION** **16 Marks**

Exercise:

1. Practical Record
2. *Viva-voce*/ Oral test
3. Exercise on Mean, Median, Mode, Standard deviation, Standard error and Student "t" test
4. 9. Cell division preparation of slide on Meiosis &Mitosis
5. ~~Total Marks 100~~

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**(B) UNIVERSITY EXIMINATION** **24 Marks**

Exercise:

1. Spotting – Classification and identification of various phylum. 06
2. One major dissection of various systems of invertebrates – Squilla, Prawn, Sepia, Loligo. 02
3. One minor dissection- Grosshopper, Honeybee, Echinus, Starfish, Aplysia. 02
4. Mounting material - permanent mount 02
5. Spotting related with Adaptation. homologies, analogies and modification of mouth parts. 02
6. Problem based on Biodiversity and wild life. Mammals and Fishes group 06
7. Museum keeping, Preservation, Categorization , Naming and Preparation Of Museum Specimens. 04

**Total Marks 40 (16+24)**

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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester II**
**Paper I**
**Core ZOL PG 201 Immunology and Animal Physiology**

Unit – I

1. Component of innate and acquired immunity.
2. Cells of the immune system.
3. Organs of immune system.
4. T cell lineage, receptor and activation.
5. B cell lineage, receptor and activation.
6. Immunoglobin structure and class.

Unit – II

1. Structure and function of major histo-compatibility/ (MHC) complex
2. Antigen processing and presentation.
3. Types of hypersensitivity.
4. Auto immunity and autoimmune diseases.
5. Types and applications of ELISA.
6. Compliment pathway.

Unit – III

1. Patterns of nitrogen excretion in different animal groups.
2. Comparative physiology of digestion.
3. Osmoregulation in different animal groups.
4. Thermoregulation in homeotherms, poikilotherms and hibernation.
5. Comparative study of mechanoreception.
6. Comparative study of photoreception.

Unit – IV

1. Comparative study of phonoreception.
2. Comparative study of chemoreception.
3. Bioluminescence as means of communication among animals.
4. Pheromones as means of communication among animals.
5. Chromatophores and regulation of their function among animals.
6. Hormones, their classification and chemical nature.

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**Semester II Paper-I**

SUGGESTED READING MATERIAL


1. EJW Barrington-General & comparative Endocrinology-Oxford, Claredon Press
2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
3. C.R. Martin- Endocrine Physiology-Oxford University Press.
4. Molecular Cell Biology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
5. Molecular Biology of the cell-B. Alberts, D-Bray, J.Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Pub. New York.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-2020**

**M.Sc. Zoology**
**Semester II**
**Paper II**
**Core ZOL PG 202 Population Ecology and Environmental Physiology**

Unit I

1. Populations and their characters.
2. Conservation management of natural resources.
3. Environmental impact assessment.
4. Population regulation: Extrinsic and intrinsic mechanisms.
5. Population growth curves.
6. Habitat and niche.

Unit II

1. Adaptations: Levels of adaptations.
2. Significance of body size and adaptation.
3. Fresh water environment.
4. Eco-physiological adaptations to fresh water environments.
5. Eco-physiological adaptations to terrestrial environments.
6. Physiological adaptation to parasitic habitats.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationships.
3. Sustainable development.
4. Mutualism, evolution of plant pollinator interaction.
5. Community structure.
6. Ecological succession.

Unit IV

1. Concept of homeostasis.
2. Endothermic and physiological mechanism of regulation of the body temperature.
3. Physiological response to oxygen deficient stress.
4. Physiological response to body exercise.
5. Meditation and their effects.
6. Yoga and their effects.

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**Semester II Paper-II**

SUGGESTED READING MATERIAL


1. Cherrett, J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth, B.D. and K.M. Baumgartner, population Biology, Van Nostrand Co., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, New York.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs,C.J. Ecological Methodology. Harper and Row , New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H. Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation. Priceton, New Jersey.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester II**
**Paper III**
**Core ZOL PG 203 Molecular Cell Biology and Genetics**

Unit – I

1. Molecular organization of Plasma Membrane
2. Transport across cell membrane
3. Microfilaments- structure and Function
4. Microtubes - structure and Function
5. Modes of cell signaling
6. Signaling from plasma membrane to nucleus

Unit – II

1. Gap junctions (connexins)
2. Integrins
3. Ultra structure of nuclear Envelop(NE) and transport of RNA & import of Proteins
4. Genome organization- Hierarchy in organization
5. Chromosomal organization of genes and non-coding DNA
6. Genetic code -universal and exceptional

Unit – III

1. Basic concept of dosage compensation in mammals
2. Cytogenetics of human chromosomes
3. Prenatal diagnosis & genetic screening
4. Genetic counseling
5. Human gene therapy
6. Transgenic animals & their applications

Unit- IV

1. The normal human karyotype
2. Elementary idea of gene mapping in human
3. Molecular basis of mutations
4. Concept of Genomics
5. Functional genomics: Proteomics
6. The Human Genome Project: overview & ELSI program

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**Semester II Paper-~~IV~~ III**

SUGGESTED READING MATERIAL


1. J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
2. B. Alberts D. Bray, J. Lewis, M. raff, K. roberts and J.D. Wattson. molecular biology of the cell. Garland Publishing Inc. New York.
3. John R. W. animal cell culture A practical approach masters. Irl. Press
4. Alberts et. al Essentials cell biology garland publishing Inc. New York 1998
5. J.M. Barry molecular biology
6. Philip E. Hartman Gene Action
7. L.C. Dunn, principals of Genetics
8. A.M. Winchester genetics
9. Edgar Alterbrg Genetics
10. L.C. Dunn genetics and the origin of species
11. Bengt A. Kihlman actions of chemicals of dividing cells


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**Vikram University, Ujjain**
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**M.Sc. Zoology**
**Semester II**
**Paper ~~III~~ IV**
**Core ZOL PG ~~203~~ 204 Tools and Techniques in Biology**

**Unit :- 1**

1. Principle and Applications of Light Microscope
2. Principle and Applications of Phase Contrast microscope.
3. Principle and Applications of Confocal microscope
4. Principle and Applications of Electron microscope
5. Spectrophotometer.
6. Types and application of Centrifuge .

**Unit:- 2**

1. Cryopreservation and Freeze drying techniques.
2. Column chromatography.
3. Thin Layer Chromatography.
4. Gel Electrophoresis.
5. HPLC.
6. Radioisotopes techniques in biology.

**Unit:- 3**

1. Types and application of Microtome.
2. Tissue fixation and complete procedure for staining.
3. Biosensor and its application.
4. Essential component and preparation of culture media.
5. Sterilization, Inoculation & Microbial identification (bacteria, fungi).
6. Organ ablation (ovariectomy, and adrenalectomy)

**Unit:- 4**

1. Chromosome banding techniques
2. Human Karyotype preparation and its significance.
3. Southern Blotting, Northern Blotting and Western Blotting.
4. Polymerase Chain Reaction.
5. DNA sequaneing.
6. Tissue culture techniques .

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**Semester II Paper-~~III~~ IV**

SUGGESTED READING MATERIAL


1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson and K.H. Goulding ElBS Edn.
3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
10. Robert Braun. Introduction to instrumental analysis. McGraw Hill


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Session

**M.Sc. Zoology Semester II**
Practical based on paper 201-204

Total marks 16+24 = 40

(A) **INTERNAL EXAMINATION** **16 Marks**

Exercise:

1. Practical Record
2. *Viva-voce*/ Oral test
3. Experiment on Hematology: Blood group, Total and differential counts.
4. Demonstration of Enzyme Action, and pH.
5. Detection of Nitrogenous products in samples.
6. Lagging chromosome, Chromosome bridge, Micronuclei study in permanent slides.

(B) **UNIVERSITY EXIMINATION** 24 Marks

1. Comments upon the structure and application of analytical instruments 10
   - i) Colorimeter
   - ii) Spectrophotometer
   - iii) Ultracentrifuge
   - iv) ESR and NMR Spectrometer
   - v) Microtome
   - vi) HPLC
2. Problem based on human genetic diseases 04
3. Exercise based on immunology. 04
4. Problem based on Hardy Weinberg law 03
5. Demonstration of chromosome polymorphism in any insect population 03

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**Total Marks 40 (16+24)**

~~Total Marks 100~~

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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

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# Revised Syllabus ONLY for SS in Zoology for 2018-20 Session

**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester III**
**Paper I**
**Core ZOL PG 301Comparative Anatomy of Vertebrates**

Unit – I

1. Origin of Chordata.
2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs)
3. Respiratory system comparative account of respiratory organs.
4. Comparative account of Digestive System.
5. Comparative anatomy of heart.

Unit – II

1. Blood circulation in various vertebrate groups.
2. Comparative anatomy of urinogenital system in vertebrate.
3. Comparative account of organs of olfaction and taste
4. Comparative anatomy of brain and spinal cord (CNS)
5. Comparative account of peripheral and autonomic nervous system

Unit – III

1. Comparative account of lateral line system.
2. Comparative account of electroreception.
3. Flight adaptations in vertebrates.
4. Aquatic adaptations in birds.
5. Aquatic adaptations in mammals.

Unit –I V

1. Origin, evolution general organization of Ostracoderms.
2. General organization, characters of cyclostomes.
3. Origin, evolution general organization of early Gnathostomes.
4. General account of Elasmobranchi, Holocephali.
5. General account of Dipnoi.

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**Semester III Paper-I**

SUGGESTED READING MATERIAL


1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Autonomy 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, 4th Ed. McGraw Hall Book Co., New York.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-2020**

**M.Sc. Zoology**
**Semester III**
**Paper II**
**Core ZOL PG 302 Developmental Biology**

Unit I

1. Comparative account of gonads in mammals and invertebrate.
2. Spermatogenesis:
3. Biochemistry of Semen: Semen composition and formation, assessment of sperm function.
4. Fertilization: Prefertilization events, Post fertilization events.
5. Biochemistry of fertilization.
6. Hormones and their role in reproduction.

Unit- II

1. Ovarian follicular growth and differentiation
2. Oogenesis and vitellogenesis and ovulation and ovum transport in mammals.
3. Biology of sex determination and sex differentiation a comparative account.
4. Multiple ovulation and embryo transfer technology.
5. Invitro oocytes maturation.
6. Super ovulation

Unit – III

1. Cell commitment and differentiation.
2. Cell fate and cell lineages.
3. Germ cell determinants and germ cell migration.
4. Development of gonands.
5. Malanogenesis.

Unit –IV

1. Cell diversification in early Amphibian embryo,.
2. Stem cell : Types (totipotency and pleuripotency) and Application.
3. Embryonic stem cells and significance.
4. Connective tissue cell family
5. Hemopoietic stem cells : Blood cells formation.
6. Stem cell disorders, Stem cell therapy.

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**Semester III Paper-II**

SUGGESTED READING MATERIAL


1. Long J.A. Evan H.M. 1922 : the Oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou. A.C. – Reproductive physiology
3. Prakash A.S. 1965-66 Marshall's, Physiology Reproduction (3 Vol.)
4. Gilbert, S.F. Developmenal Biology , Sinauer Associated Inc. Massachulsetts.
5. Ethan Bier, The cold spring Harbor laboratory Press, New York.
6. Balinsky B.I. Introduction to Embryology sanders, Philadelphia.
7. Berril N.J. and Karp. G. Development Biology. McGraw Hill New York.
8. Davidson, E.H. Gene Activity During Early Development. Academic Press, New York.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
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**M.Sc. Zoology**
**Semester III**
**Paper III**
**Core ZOL PG 303 Animal Behavior**

UNIT I-

1. Scope, Significance and aim of Ethology.
2. Animal psychology, classification of behavioral patterns, analysis of behavior (ethogram)
3. Reflexes and complex behavior
4. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual.
5. Evolution and ultimate causation: Inheritance behavior and relationships.

UNIT II-

1. Natural and hormonal control of behavior.
2. Genetic and environmental components in the development of behavior.
3. Motivation: Drive, timing, and interaction of drives, physiological basis of motivation.
4. Communication: chemical, Visual, light and audio.
5. Brood care in invertebrates.

UNIT III –

1. Ecological aspects of behavior: Habitate selection, food selection, optimal foraging theory, anti-predator defenses.
2. Homing territoriality, dispersal, host parasite relations.
3. Biological rhythms: Circadian and circannual rhythms,
4. Orientation and navigation.
5. Migration in turtles and birds.
6. Learning and memory: Conditioning, habituation, insight learning, association learning, reasoning.

UNIT IV-

1. Reproductive behavior. strategies, mating systems, courtship,
2. Sexual selection, Parental care.
3. Social behavior. aggregations, schooling in fishes, flocking in birds,
4. Herding in mammals, group selection, kin selection,
5. Altruism, reciprocal altruism, inclusive fitness
6. Social organization in insects and primates.

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**Semester III Paper-III**

SUGGESTED READING MATERIAL


1. Eibl-Eibesfeldt, I. Ethlogy. The biology of Behaviour. Holt, Rineheart & Winston, New York.
2. Gould, J.L. The mechanism and Evolution of Behaviour.
3. Kerbs, J.R. and N.B. davies : Behaviourable Ecology. Blackwell, Oxford, U.K.
4. Hinde, R.A. Animnal Behaviour : A Synthesis of Ethology and Comparative Psychology. McGraw Hill, New York.
5. Alcock, J. Animal Behaviour : An Evolutionary approach. Sinauer Assoc. Sunderland, Massachsets, USA.
6. Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication. Sinauer Assoc. Sunderland, Massachsets, USA.


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
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**M.Sc. Zoology**
**Semester III**
**Paper IV**
**Core ZOL PG 304 Aquaculture**

Unit-1

1. Aquaculture: history, definition, scope & importance.
2. Abiotic & biotic factors of water necessary for fish life.
3. Inland cultivable fishes and their crop potential.
4. General ecological characteristics of reservoirs of India
5. Ecology of fish culture pord .

Unit-2

1. Fish culture: composite fish culture techniques
2. Fresh water Prawn culture.
3. Sewage fed fish culture.
4. Paddy cum fish culture
5. Frog culture.
6. Larvivorous fish and their significance

Unit-3

1. Fish breeding in natural conditions and bundh breeding.
2. Stripping and hypophysation breeding technique
3. Transport of live fish & seed.
4. Plankton and its role in fisheries.
5. Common weeds of fish ponds and methods of their eradication.
6. Culture of Air Breathing fishes

Unit-4

1. Water pollution, its effects on fisheries and methods of its abetment.
2. Common fish diseases & their control
3. Preservation & processing of fish.
4. By products of Fish Industry & Their utility.
5. Economic importance of fishes.

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**Semester III Paper-IV**

SUGGESTED READING MATERIAL


1. C.B.L. Shrivastava: Fishes of India
2. Jhingran: Fish and fisheries of India
3. S.S. Khana: An Introduction to Fish
4. R.S. Rath: Fresh Water Aquaculture
5. Gopal Ji Shrivastava: Fishes of UP & Bihar
6. H.D. Kumar: Sustainability & 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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**Vikram University, Ujjain**
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**M.Sc. Zoology Semester III**
Practical based on paper 301-304

Total marks 16+24 = 40

**(A) INTERNAL EXAMINATION** **16 Marks**

Exercise:

1. Practical Record
2. *Viva-voce*/ Oral test
3. Exercise based on comparative anatomy
4. Study of Museum Specimen of Vertebrates

8. ~~Viva- voce~~ ~~10~~

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~~Total 25~~

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**(B) UNIVERSITY EXIMINATION** **24 Marks**

Exercise:

| | |
|---|---|
| 1. Exercise based on Developmental biology | 04 |
| 2. Spotting on Vertebrates. | 02 |
| 3. Major Exercise (estimation of DO, pH, Alkalinity, Hardness of Water) | 06 |
| 4. Exercise on embryology and animal behavior | 06 |
| 5. Spotting on fishes | 06 |

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**Total Marks 40 (16+24)**

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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
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**M.Sc. Zoology**
**Semester IV**
**Paper I**

**Core ZOL PG 401 Neurophysiology and Ecotoxicology**

UNIT I –

1. Introduction to neurophysiology.
2. Neuron morphology
3. Syneptic physiology.
4. Animal psychology.
5. Reflexes and complex behaviour.
6. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual.

UNIT II –

1. Neural and hormonal control of behaviour.
2. Genetic and environmental components in the development of behaviour.
3. Motivation: Drive, timing and interaction of drives, physiological basis of motivation.
4. Neurotransmitters and receptors.
5. Action potential propagation.
6. Neurodegenerative diseases.

UNIT III –

1. General principles of Environmental Biology with emphasis on ecosystems.
2. Abiotic and biotic factors of ecosystems.
3. Communities of the environment, their structure & significance.
4. Energy flow in environment: Ecological energetic.
5. Recycling and reuse technologies for solid and liquid waste in environment Conservation.

UNIT IV –

1. Kinds of environmental pollution and their control methods.
2. Radioactive compounds and their impact on the environment.
3. Pesticides, types, nature and their effects on environment.
4. Important heavy metals and their role in environment.
5. Environmental indicator organisms.

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**Semester IV Paper-I**

SUGGESTED READING MATERIAL


1. **G. W. Jenkins and G.J. Tortora : Anatomy and Physiology, III Edition, John Weley and sons.**
2. **R.H.S. Carpenter: Neurophysiology, IV ed.**
3. **A. R. Crossman and D. Neary: Neuroanatomy, III ed. Elesevier Publication.**
4. "Psychoneuroendocrinology: Brain, Behavior, and Hormonal Interactions" by Clarissa S Holmes.
5. Clark: Elements of ecology
6. Odum: Fundamentals of Ecology
7. South Woods: Ecological methods.
8. Trivedi and Goel: Chemical and biological methods for water pollution studies

**School of Studies in Zoology & Biotechnology,**
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**M.Sc. Zoology**
**Semester IV**
**Paper II**
**Elective ZOL 402 Ichthyology (Fish)**

Unit-1

1. Classification of fishes as proposed by Berg
2. Fish integument
3. Locomotion
4. Fish growth and Age determination
5. Biology of some food fishes
6. Culturable fishes

Unit-2

1. Food and feeding habits of fish
2. Accessory respiratory organs
3. Air bladder and its functions
4. Weberian ossicles their homologies and functions.
5. Fish Behaviour

Unit-3

1. Sound producing organs
2. Deep sea adaptations
3. Hill stream adaptions
4. Migration in fishes
5. Viviparity in fishes
6. Poisonous and venomous fishes.

Unit-4

1. Coloration in fish
2. Parental care in fishes
3. Sexual cycle and fecundity
4. Early development and hatching
5. Luminous organs in fishes
6. Ecology of fishes

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**Semester IV Paper-II**

SUGGESTED READING MATERIAL


1. Leo.S.Berg Classification of fishes (fossiliged & Recent).
2. Francis day Vol I & II Fishes of India.
3. C.B.LShrivastava, Fish Biology.
4. K.S.Mishra: An aid to classification of Fishes.
5. Gopalji Shrivastava: Indian of fishes of U.P.& Bihar.
6. B.Qurashi: Identification of fishes.
7. W.D.Rusell: Aquatic Productivity.
8. A.J.K.Mainan: Identification of fishes.
9. K.F.Lagler: Icthyology.
10. N.R.Rao: An Introduction of fishes.
11. J.F.Norman: An History of fishes.
12. S.S.Khanna: An Introduction of fishes.
13. R.L.Rath: Fresh water Aquaculture.
14. H.R.Singh: Advance in fish Biodiversity.
15. H.D.Kumar: Sustanibility & Management of Aquaculture & Fisheries.
16. Arugun & Natarajan: Fresh water Aquaculture.
17. Arugun & Natarajan: Santanu-Costal Aquaculture.
18. R.Sanatham: A manual of fresh water Aquaculture.


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**Vikram University, Ujjain**
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**M.Sc. Zoology**
**Semester IV**
**Paper IV (E-2)**
**Elective ZOL PG 403 Molecular Endocrinology and Reproductive Technology**

Unit-1

1. Definition and scope of molecular endocrinology.
2. Chemical nature of hormones
3. Purification and characterization of hormones
4. Production of hormone by r DNA technology.
5. Methods for production of hormone
6. Neurohormone and neural messengers

Unit-2

1. Posta glandin and its biosynthesis.
2. Eicosanoids and hormone action.
3. Concentration and transport of hormones in the blood.
4. Genetic analysis of hormonal disorders.
5. Hormone and aging
6. Hormone and antagonism

Unit-3

1. Extraction and estimation of pregnanediol from urine.
2. Extraction of Gonadotrophin.
3. Extraction and purification of estrogen from urine
4. Diagnosis of pregnancy by the urine
5. Bioassay of Androgen.
6. Bioassay of progesterone.

Unit-4

1. Contraception.
2. Multiple ovulation and embryo transfer technology.
3. Study of estrous cycle by vaginal smear technology.
4. Surgical techniques- castration, overiectomy, vasectomy, tubectomy and laprotomy.
5. Hormonal regulation of continues breeders
6. Hormonal regulation of seasonal breeders

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**Semester IV Paper-IV**

SUGGESTED READING MATERIAL


1. Benjimine Lewin – Genes VII/ VIII, oxford University press.
2. Lodies etal – Molecular Cell Biology
3. Zarrow, M.X., Yochin J.M. and Machrthy, J.L.- Experimental Endocrinology.
4. Chatterji C.C.- Human Physiology(vol-II)
5. Bentley,P.J. – Comparative Vertebrate Endocrinology
6. Chinoy, NJ Rao, M.V., Deshraj, K.J. and High land , H.N. – Essential techniques in reproductively physiology and Endocrinology.
7. Norris, D.O.- Vertebrate Endocrinology.


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**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester IV**
**Paper IV (E-1)**
**Elective ZOL PG 404 Limnology & Fish Productivity**

Unit- 1

1. Basic principle and development of science of limnology.
2. Origin of Lake.
3. Classification of Lake system of the world
4. Saprobien System indicator organisms and water quality monitoring
5. Aquatic macrophytes and their control
6. Morphometry of Lake- use of various morphometric Parameter

Unit- 2

1. Light and its relation in fresh water
2. Heat and its relation in fresh water
3. Role of oxygen in fresh water.
4. Role of carbon – dioxide in fresh water
5. Role of organic and inorganic carbon in fresh water.
6. Reverine fisheries

Unit- 3

1. Freshwater ecosystem and communities- Lentic and lotic environment
2. Aspects of primary productivity in fresh water.
3. Role of physic-chemical characteristics in fresh water.
4. Plankton its role in fresh water.
5. Characteristics of Bethic Biota and their significance

Unit- 4

1. Fresh water resources in India and their quality.
2. Wetland and its management.
3. Fishery and management of reservoir.
4. Inland fish breeding.
5. Fish production in pond and its management
6. Recycling of organic wastes with reference to fish culture.

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**Semester IV Paper-III**

SUGGESTED READING MATERIAL


1. E.P. Odum- Fundamental of Ecology
2. R.G. Wetzel- Limnology
3. P.S. Welsch- Limnology
4. R.G. Wetzel- Laboratory guide of Limnology
5. J. Schwocrble- Principlr of Limnology
6. K.A. Ruttner- Fundamentals of Limnology
7. Hutchinson- A Treatise on Limnology Vol .1-2
8. V.G. Cole- Limnology
9. G.A. Cole – Limnology
10. W.T. Edmondson- fresh water Biology
11. R.W. Pennak- Fresh Water invertebrates on N. America
12. J.G. Needham and P.R. Neendam – A guide to fresh water invertebrate
13. G.T. Tonpi- Fresh water animals of India
14. S. Krishan Swamy- A guide to the study of fresh water organism
15. G.W. Prescott- Fresh Water Algae.
16. Deshikachary – A guide for identification of Algae.
17. Published by International Biological program - I.B.P. Hand Books Nos. 1&2
18. H.L. Goltermann- Chemical analysis of fresh waters.


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**School of Studies in Zoology & Biotechnology,**
**Session 2018-20**

**M.Sc. Zoology**
**Semester IV**
**Paper ~~III~~ (E-1) IV**
**Elective ZOL PG ~~404~~ 405 Economic Zoology**

Unit- 1

1. Sericulture
2. Apiculture
3. Lac culture
4. Common pest of vegetables
5. Common pest of stored grains
6. Integrated pest management

Unit- 2

1. Economic importance of protozoans
2. Economic importance of snakes
3. Vermi culture
4. Shark liver oil
5. Economic importance and by product of fish
6. Identification of common aquarium fishes

Unit- 3

1. Poultry farming
2. Piggery farming
3. Goat farming
4. Duck farming
5. Dairy farming

Unit – 4

1. Economic importance of molluscs
2. Economic importance of Porifera
3. Pisci culture
4. Pearl culture
5. Aqua culture
6. Algae culture

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SUGGESTED READING MATERIAL


1. **Chakraborty, C. & Sadhu, A. K.** 2000. Biology Hatchery and Culture Technology of Tiger Prawn and Giant Freshwater Prawn. Daya Publishing House. x+102pages, figs., plates.

2. **Dash M.C.** 1994. Brackish Water Prawn Culture. Palani Paramount Publications. 232 pages.

3. **Dholakia, A. D.** 2004. Fisheries and Aquatic Resources of India. Daya Publishing House. xxx + 413pages, figs., tables, index.

4. **Harvey, B. & Carolsfeld, J.** 1993. Induced breeding in tropical fish culture. Ottawa, Ont., IDRC, x + 144 pages.

5. **Horvath, L., Tamas, G., Seagrave, C.** Carp and Pond Fish Culture. Wiley-Blackwell. 188 pages.

6. **Jangi, B. S.** 1991. Economic Zoology. CRC, first edition (June 1, 1991), 200 pages.

7. **Jawaid Ahsan, Sinha, S. P.** 2008. A Handbook of Economic Zoology. S. Chand Group Publ. 272 pages.

8. Jawaid Ahsan and Subhas Prasad Sinha: A Hand Book on Economic Zoology: S. Chand Publ.
9. G.S. Shukla: Economic Zoology.
10. A. Rathore Applied and Economic Zoology, Publisher: Daya Publishing House


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**Vikram University, Ujjain**
**School of Studies in Zoology & Biotechnology,**
**Session 2018-20, M.Sc. Zoology**
**Semester IV**
**Practical – Based on paper 403 and 404**

(A) **INTERNAL EXAMINATION**

**Limnology (Elective)**

Exercises:- **MM Marks 16**

| | |
|---|---|
| 1. Major Limnological Exercise | 04 |
| 2. Minor Limnological Exercise | 02 |
| 3. Spotting | 04 |
| 4. Estimation (Two) | 02 |
| 5. Practical Record | 02 |
| 6. *Viva- Voce/Oral test* | 02 |
| Total | 16 |

**OR**

**Endocrinology (Elective)**

Exercises:- **M M Marks 16**

| | |
|---|---|
| 1. Experiments on molecular endocrinology/ Reproductive technology | 04 |
| 2. Surgical/ Experimental Techniques | 02 |
| 3. Histochemical/ Histological techniques | 04 |
| 4. Study of specimens (Spotting) | 02 |
| 5. Practical Record | 02 |
| 6. *Viva- Voce*/oral test | 02 |
| Total | 16 |

(B) **UNIVERSITY EXIMINATION**
**Based On Theory Paper :401, 402 and 405**

Exercises:- **M M Marks 24**

| | |
|---|---|
| 1. Exercise based on Neurophysiology and Eco-toxicology | 05 |
| 2. Exercise based on Economic Zoology | 05 |
| 3. Minor dissection of fish | 05 |
| 4. Study of museum specimen | 05 |
| 5. Practical Record | 02 |
| 6. *Viva- Voce/Oral test* | 02 |
| Total | 24 |

M Sundar

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