

Official Copy Acad Section V.U

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

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Semester wise Syllabus

For

Postgraduates

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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

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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

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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	Paper 1: 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	ZOL 104	Paper 4: Biomolecules and Metabolism OR Microbiology	*Generic elective	40	60	100	5
05	ZOL 105						
06	ED 106	Entrepreneurship Devpt.	**Skill Devpt.	30	50	80	4
07	ZOL 107	Practical based on theory Papers	Core	15	25	40	2
08	ZOL 108	Comprehensive <u>Viva-voce</u> (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

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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	ZOL 204	Paper 4: Tools and Techniques in Biology OR Enzyme Technology/ MOOC/ Skill Development	*Discipline specific Elective	40	60	100	5
05	ZOL 205						
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

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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	ZOL 304	Paper:4 Aquaculture OR Genomics and Proteomics	*Discipline specific Elective	40	60	100	5
05	ZOL 305						
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 <u>Viva-voce</u> (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

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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
04	ZOL 404	OR 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 <i>Viva-voce</i> (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)

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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
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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
- 2 Dynamics of Entrepreneurial Development and Management
- 3 Innovation and Entrepreneurship
- 4 Entrepreneurship Development
- 5 Entrepreneurship-Need of the Hour
- 6 Entrepreneurship Development

Dr.C.B.Gupta
Vasant Desai

Peter F.Drucker
G.A.Kaulgud
Dr.Vidya Hattangadi
Dipesh D. Uike

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COMMUNICATION SKILLS

Marks: 100

Credit for each course

Credit: 04

30 hours/semester

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

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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
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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
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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.

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

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 = $(20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6 + 26 \times 6.3 + 25 \times 8) / 144 = 6.73$

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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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 taxa.

Unit:- 2

1. Taxonomic characters
2. Taxonomic collection of invertebrate
3. Taxonomic collection of vertebrate
4. Preservation and curation.
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 Stastical Methods of affiliated-East-West Press, New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

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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: Acoelomates , Pseudocoelomates , Coelomates.
3. Locomotion in Protozoa(amoeboid flageller and cilliary movement)
4. Locomotion in Echinodermata.
5. Hydrostatic movement in coelenterata
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-Coelenterata 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, Vol. 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. McGraw 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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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 primer on classification and ordination.
6. A. Lewis – Biostatistics
7. B.K. Mahajan Methods in Biostatistics
8. V.B. Saharia wildlife in India
9. S.K. Tiwari wildlife in central India
10. Georgrs & Wilians statistical method
11. R.K. Tondon Biodiversity Taxonomy & 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 phosphorylation.

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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

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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. Immunoglobulin 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, Clarendon 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. Princeton, 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. Microtubules - 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

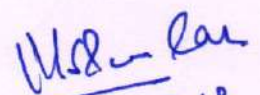
1. The normal human karyotype
2. Elementary idea of gene mapping in human
3. Molecular basis of mutations
4. Concept of Genomics
5. Functional genomics: Proteomics
6. The Human Genome Project: overview & ELSI program


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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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Session 2018-20

M.Sc. Zoology
Semester II
Paper III ~~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 sequencing.
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 EIBS 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

Total Marks 40 (16+24)

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School of Studies in Zoology & Biotechnology,
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Revised Syllabus ONLY for SS in Zoology for 2018-20 Session

Vikram University, Ujjain
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Session 2018-20

M.Sc. Zoology
Semester III
Paper I
Core ZOL PG 301 Comparative 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 – IV

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 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, 4th Ed. McGraw Hall Book Co., New York.

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Vikram University, Ujjain
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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 gonads.
5. Malanogenesis.

Unit -IV

1. Cell diversification in early Amphibian embryo.,
2. Stem cell : Types (totipotency and pluripotency) 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. Developmental Biology , Sinauer Associated Inc. Massachussets.
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,
Session 2018-2020

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. Ethology. 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. Aninnal 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,
Session 2018-20

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 pond .

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

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

o. *Viva-voce*

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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 |

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 IV
Paper I

Core ZOL PG 401 Neurophysiology and Ecotoxicology

UNIT I –

1. Introduction to neurophysiology.
2. Neuron morphology
3. Synaptic 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. Elsevier 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

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

**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 adaptations
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 (fossilized & 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: Ichthyology.
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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M.Sc. Zoology
Semester IV
Paper IV (E-2)

403
Elective ZOL PG 404 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. Post 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, ovariectomy, 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,
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✓ 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. Schwocrbble- 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~~ Economic Zoology

405

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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Dr.

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Dr. S.

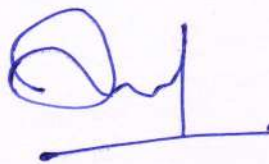
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SUGGESTED READING MATERIAL

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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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. <i>Viva- Voce/Oral test</i>	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. <i>Viva- Voce/oral test</i>	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. <i>Viva- Voce/Oral test</i>	02

Total 24

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