शासकीय कमला राजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर (मध्य प्रदेश)

आनो भद्राः क्रतवो यन्तु विश्वतः

प्राणीशास्त्र विषय के अध्ययनमंडल

द्वारा अनुमोदित प्राणिशास्त्र विषय के

स्नातक (2016–2019) एवं स्नातकोत्तर (2016–2018) पाठ्यक्रम

अनुमोदन अकादमिक सत्र

2016–2017

प्रस्तुतकर्ता

स्नातकोत्तर अध्ययन केन्द्र

प्राणीशास्त्र विभाग

प्राप्तकर्ता

अकादमिक प्रकोष्ठ

वेबसाइट : www.krgc.gwl.org ईमेल : krgc@rediffmail.com

दूरभाष : 0751 – 2625495, 0751 – 2438173, फैक्स : 0751 – 2625495

Govt. K.R.G.P.G. (Auto.) College, Gwalior (M.P.)

Panel of Examiners in Zoology (2016 – 18)

1	Dr. M.K.S. Kushwah	Govt. Nehru Degree College, Sabalgarh
2	Dr. R.L. Shrivastava	Rtd. AP Govt. Science College, Gwl.
3	Dr. R.B. Gupta	Govt. Model Science College, Gwl.
4	Dr. Sarita Shrivastava	Govt. P.G. College, Guna
5	Dr. Rajendra Dubey	Govt. K.R.G.P.G. College, Gwl.
6	Dr. Trapti Sharma	Govt. Science College, Gwl.
7	Dr. D.K. Sharma	Govt. Science College, Gwl.
8	Dr. Adarsh Dixit	Govt. Science College, Gwl.
9	Dr. Meenakshi Chaturvedi	Govt. Science College, Gwl.
10	Dr. S.K. Agrawal	Govt. College, Lahor, Bhind
11	Dr. Manisha Deshpandey	Govt. S.L.P. College, Morar, Gwl.
12	Dr. K.C. Gupta	Govt. V.R.G. College, Morar, Gwl.
13	Dr. Mukesh Dixit	Benzeer College, Bhopal
14	Dr. Deepali Das	Nutan Girls College
15	Dr. R.R. Kanhare	Controller P.S.C. Indore
16	Dr. D.K. Dewedi	Rtd. Principal Shivpuri College
17	Dr. Asha Mathur	Rtd. Principal
18	Dr. A.K. Jain	Rtd. Professor S.O.S.
19	Dr. O.P. Agrawal	Prof. S.O.S. in Zoology, J.U.G.
20	Dr. R.J. Rao	Prof. S.O.S. in Zoology, J.U.G.
21	Dr. I.K. Patro	Prof. S.O.S. in Zoology, J.U.G.
22	Dr. P.R. Chandelkar	Principal Chindwara –P.G. Girls College
23	Dr. B.K. Jain	SMS Govt. P.G. College, Shivpuri
24	Dr. R.N. Sharma	Rishi Galav College, Morena
25	Dr. Usha Singh	Govt. Brindasahay College, Dabra
26	Dr. Shakti Bhardwaj	Govt. Science College, Gwl.
27	Dr. Archana Dubey	Govt. K.R.G.P.G. College, Gwl.
28	Dr. R.K. Mahor	Govt. K.R.G.P.G. College, Gwl.
29	Dr. Preeti Morya	Govt. K.R.G.P.G. College, Gwl.
30	Dr. Ved Prakash	Govt. K.R.G.P.G. College, Gwl.
31	Dr. Mohit Arya	Govt. K.R.G.P.G. College, Gwl.
32	Dr. Santosh Yadav	Govt. K.R.G.P.G. College, Gwl.
33	Dr. Rachana Joshi	Govt. P.G. College, Guna
34	Dr. A. Rahul	Govt. P.G. College, Datia
35	Dr. Shiv Singh	Govt. P.G. College, Datia
36	Dr. Kusum Singh	Bundel Khand University Jhansi
37	Dr. Iqbal Khan	Bundel Khand University Jhansi
38	Dr. J.P. Yadav	Bundel Khand University Jhansi
39	Dr. Devendra Pandey	Bundel Khand University Jhansi
40	Dr. Sapna Ravi	Bundel Khand University Jhansi

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41	Dr. Manvendra Singh Sengar	Bundel Khand University Jhansi
42	Dr. Aditya Narayan	Bundel Khand University Jhansi
43	Dr. Romsha Singh	Nutan College, Bhopal
44	Dr. Vijay K. Shakya	Ganjbasoda - 9827559205
45	Dr. Abhishek Vashistha	Bekaner
46	Dr. Sujata Gupta	Dehradun
47	Dr. Vinod Thakur	Devi Ahilya University, Indore
48	Dr. Jaishree Sharam	Model Science College, Jabalpur
49	Dr. Sadhana Kesharwani	Home Science College, JBP
50	Dr. Sunita Shrivastav	Home Science College, JBP
51	Dr. Shashi Bala Shrivastav	Home Science College, JBP
52	Dr. Neerja Khare	Auto. P.G. Boys College, Satna
53	Dr. Pratima Khare	Nutan Girls College, Bhopal
54	Dr. Vijay Laxmi Sharma	Rtd. Pro. Faridabad
55	Dr. V.L. Sharma	Rtd. Pro. Of Zoology, Jhansi
56	Dr. D.N. Harit	Jharkhand University
57	Dr. M. More	Barwani
58	Dr. Dinesh Verma	Barwani
59	Dr. S.K. Pathak	Indore
60	Dr. Anil Upadhyay	Gorakhpur (U.P.)
61	Dr. R.K. Tiwari	Auto. College, Ambha
62	Dr. R.K. Saroniya	Govt. Degree College, Mathura
63	Dr. Shushant Punekar	Govt. P.G. College, Chindawara
64	Dr. Manoj Rohilla	Scientist Dep. Biotech C.G.O. Comp.
65	Dr. D.N. Harit	Govt. Champabi College, Mizoram
66	Dr. D.R. Khanna	Rtd. Prof. Gurukul Kangeli University, Haridwar (Uttrakhand)
67	Dr. S.B. Zade	RNT – University, Nagpur
68	Dr. Mukesh Kumar	Govt. P.G. College, Bharatpur
69	Dr. Ravi Yoddha	Govt. P.G. College, Barwah, Indore
70	Dr. S.K. Pathak	Govt. P.G. College, Indore
71	Dr. Sudhir Verma	A.P. Zoology Delhi University
72	Dr. K.K. Dubey	Rtd. Prof. Govt. Science College, Jabalpur
73	Dr. P.K. Gupta	Rtd. Prof. Govt. Science College, Gwl.
74	Dr. Rajesh Singh Tomar	Prof. & Dean Academics Amity University, Gwl.
75	Dr. Udita Tiwari	B.R. Ambedkar University, Agra
76	Dr. Anita Singh	Govt. Adarsh Motilal Vigyan Mahavidhyalay Bhopal
77	Mukesh Kumar	Govt. College, Bharatpur

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कार्यालय प्राचार्य, शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर

दिनांक 28 जून, 2016

प्राणिशास्त्र विभाग

अध्ययन मंडल की बैठक का कार्यवाही विवरण

नवीन सत्र 2016–17 हेतु ---------प्राणिशास्त्र---विषय से सम्बंधित अध्ययन मण्डल की बैठक आज दिनांक 28 जून, 2016 को प्रातः 11:00 बजे ----प्राणिशास्त्र विभाग में आयोजित की गई, जिसमें निम्नानुसार उपस्थिति रही –

1. डॉ. आर० के० दुबे (विभागाध्यक्ष) 28.6.16
2. डॉ. अर्चना दुबे 28/6/16
3. डॉ. आर० के० माहौर
4. डॉ. वेद प्रकाश प्रेमी
5. डॉ. मोहित आर्य 28/06/2016
6. डॉ. प्रीति मौर्य 28/6/16
7. डॉ. के० सी० गुप्ता
8. डॉ. शाकिर भारद्वाज 28/6/16
9. डॉ. आई० के० पात्रो 28/6/16
10. ~~डॉ.~~ कु० निखत कुरैशी अनुपस्थित
11. डॉ. संतोष यादव
12. डॉ. पी० के० गुप्ता

अध्ययनमंडल की बैठक की कार्यवाही निम्नानुसार रही —

1. ~~प्राणिशास्त्र~~ विषय के स्नातक स्तर के प्रथम, द्वितीय, तृतीय, चतुर्थ, पंचम एवं षष्ठ सेमेस्टर के पाठ्यक्रम अंक योजना सहित सत्र 2016–2017, 2017–2018 एवं 2018–2019 हेतु अध्ययनमंडल द्वारा मान्य किया जाता है।

2. ~~प्राणिशास्त्र~~ विषय की सत्र 2016–2017 में होने वाली परीक्षाओं हेतु संलग्न परीक्षकों की सूची को अध्ययनमंडल द्वारा मान्य किया जाता है।

3. विभाग में सत्र 2016–2017 में यदि कोई शोध संगोष्ठी / कार्यशाला / अधिवेशन / अध्ययन भ्रमण आदि के आयोजन का प्रस्ताव है तो उसका विवरण एवं अनुमोदन————

1. शैक्षणिक भ्रमण का आयोजन (1) द्वारा वर्ड सेन्चुरी जयपुर, राज० (अनुमानित राशि 60,000/- रु. (2) माधव नेशनल पार्क शिवपुरी, मध्य हेतु (अनुमानित राशि 40,000/- रु., (3) केवरी सम्बल वाइल्ड लाइफ सेन्टर हेतु (अनुमानित राशि 25,000/- रु.)

4. यदि अन्य कोई विषय हो तो उसका विवरण एवं अनुमोदन।

प्राणिशास्त्र विभाग द्वारा दो दिवसीय शोध संगोष्ठी के आयोजन हेतु प्रस्ताव अनुमोदनार्थ (अनुमानित राशि 1,50000/-)

हस्ताक्षर अध्ययन मंडल अध्यक्ष एवं समस्त सदस्य

28/6/16

28/6/16

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28/06/2016

5. यदि विभाग में स्ववित्तीय योजना के तहत् कोई पाठ्यक्रम/अतिरिक्त विषय/डिप्लोमा कोर्स/सर्टिफिकेट कोर्स प्रारंभ करने की योजना हो तो उसका विवरण एवं अनुशंसा।

निरंक

6. यदि अन्य कोई विषय हो तो उसका विवरण एवं अनुशंसा।

हस्ताक्षर अध्ययन मंडल अध्यक्ष एवं समस्त सदस्य

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Santosh

शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)
उच्च शिक्षा विभाग म.प्र. शासन
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केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के महामहिम राज्यपाल द्वारा अनुमोदित
सत्र 2014 – 15 से प्रभावशील

Department of Higher Education, Govt. of M.P.
Single Paper Pattern Syllabus for U.G. Classes Under Semester System
As recommended by Central Board of Studies and approved by the Governor of M.P.
Effective from Session 2014 -15
Session 2016-17

Class/कक्षा	: B.Sc.
Semester/सेमेस्टर	: I
Subject /विषय	: Zoology /प्राणीशास्त्र
Title of subject Group	:Invertebrate
Max. Marks : अधिकतम अंक	: 85

UNIT – 1

1. Elementary Knowledge of Zoological Nomenclature and International Code.
2. Classification of Lower invertebrates (According to Parker and Haswell 7th edition).
3. Classification of Higher invertebrates (According to Parker and Haswell 7th edition).
4. Protozoa – Type study of Plasmodium.
5. Protozoa and Diseases.

UNIT – 2

1. Porifera – Type study of sycon.
2. Types of canal system

3. Coelenterata – Type study of Obelia.

4. Corals and Coral reef formation.

UNIT – 3

1. Helminthes – Type study of Liver Fluke.

2. Nematodes and diseases.

3. Annelida – Type study of earthworm, metamerism

4. Type study of Hirudinaria.

5. Structure and significance of Trochophore larva.

UNIT – 4

1. Arthropoda - Type study of Prawn.

2. Type study of Periplanta.

3. Larval forms of Crustacea.

4. Insect as Vectors of human diseases.

UNIT – 5

1. Mollusca - Type study of Pila

2. Echinodermata – External features and water vascular system of Star fish.

3. Larval forms of Echinoderms

4. Minor Phyla – Ectoprocta & Rotifera.

शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)
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Session 2016-17

Class/कक्षा : B.Sc.

Semester/सेमेस्टर : Practical I

Subject /विषय : Zoology /प्राणीशास्त्र

Max. Marks : अधिकतम अंक : 50

PRACTICAL

The Practical's work will be based on theory syllabus and the candidates will be required to show Knowledge of the following :-

1. Study of Museum specimens , slides relevant to the type study in theory .

2. Mounting (Temporary)

a. Mouth parts of insects

b. Statocyst of Prawn

c. Ctenidium and Osphradium

d. Mounting Material

3. Major Dissection

a. Earthworm : Digestive system , Nervous system and reproductive system.

b. Cockroach : Digestive system , Nervous system

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c. Prawn : Nervous system , Appendages

d. Pila : Nervous system

4. Minor Dissection

a. Hastate Plate and appendages of prawn.

b. Salivary glands of cockroach

c. Radula of pila

d. Earthworm : Typholosole

Distribution of Marks

Time: 3 hours	**MM: 50**
1. Major Dissection	10 Marks
2. Minor Dissection	05 Marks
3. Temporary Mounting	04 Marks
4. Spotting (specimens + larva + Slides)Representative of Each Phylum	16 Marks
5. Collection	05 Marks
6. Viva-Voce	05 Marks
7. Practical Record	05 Marks
Total	**50 Marks**

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)
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सत्र 2014 – 15 से प्रभावशील

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Single Paper Pattern Syllabus for U.G. Classes Under Semester System
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Effective from Session 2014 -15
Session 2016-17

Class/कक्षा	: B.Sc.
Semester/सेमेस्टर	: II
Subject /विषय	: Zoology /प्राणीशास्त्र
Title of subject Group	:Vertebrates & Evolution
Max. Marks : अधिकतम अंक	: 85

UNIT – 1

1. Origin of chordates Classification of phylum Chordata upto orders according to Parker and Haswell (Latest edition)

2. Hemichordata – External features and affinities of Balanoglossus.

3. Urochordata – Type study of Herdmania

4. Cephalochordata – Type study of Amphioxus . Affinites of Amphioxus.

UNIT – 2

1. Comparison between Petromyzon and Myxine.

2. Comparative account of integuments

3. Comparative account of limb bones and girdles of vertebrates 9Amphibia, Reptiles , Birds and Mammals).

4. Comparative account of digestive system

5. Comparative account of respiratory system

UNIT – 3

1. Comparative account of aortic arches and heart

2. Comparative account of brain

3. Placentation in mammals.

UNIT – 4

1. Origan of life- modern concepts only

2. Lamarckism, Darwinism

3. Modern synthetic theories : Variations , Mutations , Isolation & Speciation.

4. Adaptation and mimicry

5. Micro, macro evolution and mega evolution.

UNIT – 5

1. Fossils, methods of fossilization , determination of age of fossils

2. Study of extinct forms : Dinosaurs and Archaeopteryx

3. Zoogeographical distribution

4. Evolution of man

5. Geological time scale and Insular fauna.

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सत्र 2014 – 15 से प्रभावशील

Department of Higher Education, Govt. of M.P.
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Effective from Session 2014 -15
Session 2016-17

Class/कक्षा	: B.Sc.
Semester/सेमेस्टर	: Practical II
Subject /विषय	: Zoology /प्राणीशास्त्र
Max. Marks : अधिकतम अंक	: 50

PRACTICALS

1. Major and minor dissection of commercially available species of local fishes / rat (Efforts may be done to use computer simulation technique).
2. Study of museum specimens (vertebrates).
3. Study of specimens of evolutionary importance viz living fossils, connecting links, extinct animals , fossils : Limulus, Latimeria, Dianosaurs , Asciatic chital , Archeopteryx , Periphatus etc.
4. Osteology : Limbbones and girdle bones.
5. Study of Geological time scale chart
6. Study of Histological slides (vertebrates).

Distribution of Marks

Time: 3 hours	**MM: 50**
1. Major Dissection	08 Marks
2. Minor Dissection	04 Marks
3. Spotting	16 Marks
4. Identification and comments upon bones (any two)	04 Marks
5. One spot showing evolution/ Exercise	04 Marks
6. Mounting	04 Marks
7. Viva-Voce	05 Marks
8. Practical Record	05 Marks
Total	**50 Marks**

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Dept. of Zoology.

2016-17

Department of Higher Education, Govt. of M.P.
Under Graduate Semester wise Syllabus
as recommended by Central Board of Studies in Zoology
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातक कक्षाओं के लिये समेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : **B.Sc.**
Semester / समेस्टर : **III**
Subject / विषय : **Zoology** (प्राणीशास्त्र)
Title of Paper : **Cell biology and Developmental Biology**

Max. Marks 85

Unit-I	1. History of Cell Biology. 2. Cell Theory , Prokaryotic and eukaryotic Cells. 3. Microscopy : Principle and application of Compound microscope & Electron microscope. 4. Structure and transport across the plasma membrane. 5. Extra nuclear organization of cell.
Unit-II	1. Nuclear organization of cell. 2. Nucleo cytoplasmic interactions. 3. Amitosis , mitosis and meosis. 4. Cell death : Necrosis and Apoptosis.
Unit-III	1. Spermatogenesis 2. Oogenesis 3. Fertilization 4. Parthenogenesis 5. Patterns of cleavage.
Unit-IV	1. Frog and Chick embryology upto the formation of three germinal layers. 2. Fate map construction in frog and chick. 3. Gastrulation in Frog and chick up to the formation of germinal layers.
Unit-V	1.Concept of competence 2. Determination and differentiation 3. Extra embryonic membranes in chick 4. Concept of regeneration 5. Stem cells..

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Under Graduate Semester wise Syllabus
as recommended by Central Board of Studies in Zoology
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातक कक्षाओं के लिये समेस्टर अनुसार पाठ्यक्रम
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा	:	**B.Sc.**
Semester / समेस्टर III	:	**Practical**
Subject / विषय	:	**Zoology** (प्राणीशास्त्र)

1. Study of type of cells through histological preparations
2. Study of embryological slides
3. Study of embryo, through window preparation in fertilized bird egg
4. Smear/ squash preparation techniques
5. Study of mitosis, meiosis, oogenesis, spermatogenesis

Distribution of Marks

Time 3 hours
Marks: 50

	Maximum Marks Allotted
1. Spotting (5 spots)	10
2. Squash preparation/ smear preparation	05
3. Identification of embryological stages (2 slides)/ window preparation	07
4. Identification of stage in cell division	05
5. Microtomy techniques/ double or single staining	08
6. Viva	10
7. Record	05
Total	50

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2018-19. New.

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Class / कक्षा	:	**B.Sc.**
Semester / समेस्टर	:	**IV**
Subject / विषय	:	**Zoology** (प्राणीशास्त्र)
Title of Paper	:	**Genetics**
Maximum Marks		**85**

Unit I: Heredity & Variation, Gene and Genetic Material

1. Chromosome: The Physical basis of heredity and transmitters of heredity.
2. Types of chromosomes: Lampbrush, salivary gland and Beta Chromosomes.
3. Nucleocytoplasmic interactions : Ultra structure of nucleus, nucleolus, Role of nucleus and nucleolus in nucleocytoplasmic interactions including Synthesis & Export of RNA, transport of proteins
4. Heredity and Variation : Sources of variation, Genotype, phenotype and environmental variations (elementary idea)
   - -Mendel's laws of heredity
   - -Kinds of variations
   - -Genetic basis of variation.
5. (a) Chemistry of Gene ; Nucleic Acids and their structure.
   (b).Concept of DNA replication.
   (c).Nucleosome (Solenoid model).
   (d) Split genes, overlapping genes and Pseudo genes..
   (e) Genetic Code.

Unit II: Linkage and Chromosomal Aberrations

1. Gene Linkage: Kinds and Theories of linkage, significance of linkage:
2. Crossing over: Types and mechanism.
3. Theories of sex determination.
4. Sex linked inheritance (Haemophilia, Colour blindness)

Unit III: Cytoplasmic Inheritance, Gene Expression and Regulation

1. Cytoplasmic inheritance: Maternal effect on limnea (Shell Coiling), Kappa particles in Paramecium.
2. Transcription in Prokaryotes and Eukaryotes
3. Translation in Eukaryotes
4. Gene Expression: Regulation of protein synthesis, transcription in Prokaryotes and Eukaryotes.
5. Gene Expression: Lac operon model

Unit IV: Mutation and Applied Genetics

1. Mutation

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2. Structural and numerical changes in chromosomes.
3. Causes of mutation.
4. Mutagens- classification, Types & effects.

Unit V: Human Genetics & Genetic Engineering

1. Human chromosomes, Elementary idea of Human Genome Project
2. Common genetic diseases in man (Autosomal syndromes, sex chromosome syndromes, diseases due to mutation-Sickle cell anaemia, Albinism & Alkaptonuria.
3. Multiple factors and blood groups.
5. Techniques used in recombinant DNA technology. Construction of Chimeric DNA, Elementary idea of plasmids & vectors.
6. Gene cloning and Polymerase Chain Reaction (PCR) ,Gel Electrophoresis,Northern & Southern Blotting.
7. Gene therapy.
8. DNA finger printing.

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Class / कक्षा : **B.Sc.**
Semester / सेमेस्टर प्ट : च्तंबजपबंस **IV**
Subject / विषय : **Zoology** (प्राणीशास्त्र)

Practical

1. Identification of spots related to theory.
2. Squash preparation of onion root tip /Chironomous larva salivary gland/grass hopper testis.
3. Study of instruments techniques related to applied genetics.– PCR, Gel electrophoresis, DNA fingerprinting etc.
4. Problems based on genetics.
5. Study of chromosomal DNA (Isolation and demonstration)

Distribution of Marks

Time 3 hours **Maximum Marks: 50**

	Marks Allotted
1. Spotting (5 Spots)	10 Marks
2. Squash preparation	05 Marks
3. Study of instruments / techniques related to applied genetics.	05 Marks
4. Problems on Genetics	10 Marks
5. Viva-Voce	05 Marks
6. Extraction of chromosomal DNA	05 Marks
7. Practical Record and Collection	10 Marks
Total	**50 Marks**

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Class / कक्षा	:	**B.Sc.**
Semester / समेस्टर	:	**V**
Subject / विषय	:	**Zoology** (प्राणीशास्त्र)
Title of Paper	:	**Animal Physiology and Biochemistry**
Max. Marks		85

Unit I: Nutrition, Metabolism

1. Physiology of digestion in mammals
2. Protein Metabolism: Deamination, Decarboxylation. Transamination of amino acids, and Ornithine cycle.
3. Carbohydrate metabolism- Glycogenesis, Glycogenolysis, glycolysis, The Citric acid cycle, Gluconeogenesis.
4. Lipid Metabolism-Beta oxidation of fatty acids.

Unit II: Respiration Excretion and Immune System

1. Mechanism and of respiration in mammals(transport of gases, chloride shift)..
2. Physiology of Excretion- urea and urine formation in mammals
3. Innate and acquired immunity, immune cells and lymphyed system, immune response: cellular and humoral

Unit III: Regulatory Mechanisms and Enzymes

1. Thermoregulation.
2. Definition and nomenclature of enzymes, classification of enzymes.
3. Mechanism of enzyme action.
4. Vitamins and Co-enzymes

Unit IV: Neuromuscular Co- ordination

1. Introduction to functional anatomy of human brain
2. Types of neurons and glial cells
3. Theory of muscle contraction and its biochemistry.
4. Physiology of nerve impulse conduction.

Unit V: Endocrine system and Reproductive system

1. Structure and functions of Pituitary Gland.
2. Structure and functions of Thyroid Gland.
3. Structure and functions of Adrenal Gland.
4. Structure and functions of Parathyroid, Thymus and Islets of langerhan's.
5. Physiology of Male reproductive organ and female reproductive organ.

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Class / कक्षा	:	**B.Sc.**
Semester / समेस्टर V	:	**Practical**
Subject / विषय	:	**Zoology** (प्राणीशास्त्र)

1. Detection of protein, carbohydrate and lipid.
2. Study of Human salivary enzyme activity in relation to pH.
3. Detection of nitrogenous waste products – Ammonia & Urea
4. Blood pressure measurements
5. Exercise on Haematology – Counting of RBC /WBC and Blood grouping in blood samples.
6. Estimation of Haemoglobin and sugar in blood samples.
7. Histological study of various endocrine glands –T. S. of Thyroid, T. S. of Pituitary gland , T. S. of Adrenal gland , T. S. of Testis, T. S. of Ovary.
8. Histological study of Alimentary canal & various digestive organs – T.S of Stomach , T.S of Intestine ,T.S of Pancreas, and T. S. of liver. ,
9. Histological study of Visceral organs - T.S of Lungs, L.S. of Kidney
10. Histological study of Muscles – Striated, Unstriated & Cardiac muscle.

Distribution of Marks

Time 3 hours **Maximum Marks: 50**

	Marks Allotted
1. Spotting (10 Spots).	20Marks
2. Biochemical tests	05 Marks
3. Physiological Experiment (RBC/WBC Count/ Blood Group / Hb)	10 Marks
4. Exercise on enzyme activity	05 Marks
4. Viva-Voce.	05 Marks
5. Practical Record and Collection.	05Marks
Total	**50Marks**

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Class / कक्षा : **B.Sc.**
Semester / समेस्टर : **VI**
Subject / विषय : **Zoology** (प्राणीशास्त्र)
Title of Paper : **Ecology and Applied Zoology**
Max. Marks: **85**

Unit-I **Concept of Ecology :** 1. Abiotic and biotic factors 2. Energy flow in ecosystem : Food chain and Food web 3. Biogeochemical cycle : Co_2 N and P 4. Population Concept – Characteristics of population. Factors affecting Population growth, Pollution indicators.
Unit-II **Habitat Ecology** 1. Fresh water , marine and terrestrial habitat 2. Ecological division of India. 3. Biodiversity : Natural resources and their conservation with special reference to forests.
Unit-III **Man and Environment** 1. Wild life conservation(Laws , National Parks and Sanctuaries of MP) 2. Endangered species of India. 3. Types of pollution : Air, water, soil, thermal and noise pollution. 4. Urbanisation and effect of human population on environment.
Unit-IV **Aquaculture** 1. Prawn culture: Culture of fresh water prawn , methods of prawn fishing , preservation and processing of prawns 2. Pearl culture and pear industry. 3. Frog culture: Breeding and selection. 4. Major carp culture : Management of ponds , preservation and processing of fishes. 5. Maintenance of Aquarium.
Unit-V **Economic Entomology** 1. Sericulture: Species of silkworm, life history of *Bombyx mori*, Sericulture Industry in India. 2. Apiculture – Life cycle of the species methods of bee keeping, products of bees, enemies of bees. 3. Lac culture: Lifecycle, and association with the host plant. 4.Common pests: Stored grains: *Sitophilus oryzae and Tribolium Castanaeum,* Vegetable pest: *Piers brassicae and Dacus cucurbitae..* 5.Biological control of insect pests.

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केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : **B.Sc.**
Semester / समेस्टर VI : **Practical**
Subject / विषय : **Zoology** (प्राणीशास्त्र)

1. Study of fresh water, marine and terrestrial fauna
2. Water analysis- Dissolved Oxygen, Chloride, pH, hardness, turbidity, temperature
3. Pond ecosystem
4. Wild life: Endangered and threatened species
5. Study of specimen related to micro and mega evolution: Commensalism, symbiosis, mimicry, parasitism, colouration, etc.
6. Study of various fossils: Limulus, Latimera, Dinosaurs, Archaeopterux
7. Models of ecosystem
8. Study of life cycles of animals of economic importance
9. Study of planktons
10. Study of pests

Distribution of Marks

Time 3 hours **Maximum Marks: 50**

	Marks Allotted
1. Physicochemical analysis of water bodies	10
2. Excercise based on applied zoology (life cycles)	05
3. Excercise based on museum keeping techniques	05
4. Spotting	16
5. Models of ecosystem	04
6. Viva	05
7. Recrd	05
Total	50

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DETAILED SYLLABUS

FIRST SEMESTER

ZOOL. 101: STRUCTURE AND FUNCTION OF INVERTEURATES

UNIT – 1

1. Organization of coelom: Acoeloamtes, pseudocoelomates and coelomates
2. Protostomia and dueterostomla
3. Locomotion: Flagellar and cilliary movement in protozoa
4. Hydrostatic movement in Colenterata, Annelida and Eohlnodermata

UNIT – 2

5. Patterns of feeding and digeston in lower Metazoa
6. Filter feeding in polychaeta, Mollusca and Echinodermata
7. Orgens of respiration : Gills Lungs and trachea
8. Respiratory pigments and their functions
9. Mechanism of respiration and transport of gases

UNIT – 3

10. Organs of excrection: Coelom, coolomoduots and Malphigian tubules
11. Mechanlsm of excretion in invertebrates
12. Primitive Nervous system of Coolonterates and Echinoderms
13. Advanced Nervous system of Annellda, Arthropoda (Crustacen and Insecta) and Mollusca (Cephalopoda)

UNIT – 4

14. Trends in neural evolution
15. Larval forms of crustacean, mollusca and echlnodermata
16. Larval forms of invertebrate parasites
17. Strategies and evolutionary significance of larval forms

UNIT – 5

18. Organization and general character of Rotifera
19. Organization and general characters of Acanthocephala
20. Organization and general characters of Ectoprocta
21. Organization and general characters of Endoprocta
22. Organization and general characters of Phoronida

Suggested Readings:

Hyman, L.H. the Invertebrates, Vol – 1 Protozoa through Ctenophora. Mc Graw Hill Co. New York.
Hyman, L.H. The Invertebrates, Vol – 2nd McGraw Hill Co. New York and London.
Bames, R.D. Invertebrate Zoology, 3rd edition W.B. Baunders Co. Phlladelphia.
Barringion B.J.W. Invertebrate structure and function, Thomas Neison and Sons Ltd. London.
Sedgwlok A.A. student Text Book of Zoology Vol. 1st 2nd and 3rd Central Book Depot, Allahabad.
Parker T.J., Haswell, W.A. Text Book of Zoology, Macmillan Co. London.

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ZOOL, 102: QUALTITATIVE BIOLOGY AND BIOINPORMATICS

UNIT – 1

1. DISTRIBUTION: Normal , Biomial and Poisseon
2. Hypothesis testing
3. Student's t test
4. Chi Square test
5. The mean, mode, median, standard deviation and Standrd error of classified Data

UNIT – 2

6. Analysis of variance (one way and two way ANOVA)
7. Correlation
8. Regression
9. Graphic representation of data

UNIT – 3

10. Computers and their application in biology
11. Operation system: DOS WINDOWS
12. Application software: MS Word, MS Access
13. MS Excel, MS Power Point
14. Internet and its uses

UNIT – 4

15. Bioinformatics: Definition, history and scope
16. Analysis of DNA and protein sequences: molecular and genomic database (e.g., GENEBANK, SWISS – PROT and other databases)
17. Introductory ideas on use of database for sequence retrieval, similarity search and sequence alignment; post transcriptional modiflcation prediction
18. Bioinformatics in drug discovery

UNIT – 5

19. Types of models: Deterministic and statistical, mechanistic, simulation of biological problems.
20. Formation and properties of models – generality, precision, realism and validation
21. Building population models for biological species of different categories, wild life population models
22. Eutrophication models cycling of nutrients in an ecosystem,

Suggested Readings:

Batschelet, E, Introduction to Mathematics for Life Scientists. Springer – Veriag, Berlin.

Jorgenson, S.E. undamentals of Ecological Modelling. Eisevler, New York.

Swartzman, G. Land S.P.O. Kaluzny: Ecological Simulation Primer, Macmillan, New York.

Lendren D. Modelling in Behavioral Ecology. Chapman and Hall, London, UK.

Sokal, R.R. and F.J. Rohif. Biometry. Freeman, San Franslsco.

Snedecor, G.W. and W.G. Cochran. Statistical Methods Affiated East – West Press, New Delhi (Indian Ed.)

Green R.H. Sampling, Design and stastical Methods for Environmental Bbiologists.

John wiley & Sons, New York.

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Murray, J.D. Mathematical Biology Springer Verlag Berlin.

Pielou, e.C. The Interpretation of Ecological Data: A Primer on Clasification and ordination.

De saplo, Calculus for Biologists.

Rubinov, S.I. Introduction to Mathematical Biology.

Saxena, V.P. 'Jalv Ganit EK Parichaya' (M.P. Hindi Granth Academy).

Brown, S.M. Blonfomatics – A Biologists Guide to Biocomputing and Internet, Eaton Publishing, New York, 2000.

Lesk, A.M. Introduction to Bioinformatics. Oxford, 2002.

Bioinformations Methods and Protocols, In: Methods in Molecular Biology. Vol. 132.

Human press, 2001.

Higging & Taylor. Bioinformatics – Sequence, Structure and Databanks Oxford, 2000.

Baxevanls and Ouellette Bioinformatics john wiley & Sons, 1998.

Swindell Internat for the Molecualr Biologists 3. Horizon Scientific, 1996.

Peruski & Peruski. The internet & new Biology, ASM, 1997.

Gibson, G. & S.V. Muse. A Primer of Genome Science. Sinauer. Associates Inc. Publishers, 2002.

Krane and Raymer Fundamental Concept of Bioinformatics. Person Education, 2003.

Awesthead, Parish and Twyman. Instant Notes: Bioinformatics, Viva Book Pvt. Ltd., 2003.

Attwood and Parry – smith. Introduction to Bioinformatics, Pearson Education, 2003.

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ZOOL, 103 CELLULAR AND MOLECULAR BIOLOGY

UNIT – 1

1. Biomembrances: Structure of Membrance (Fluid mosaic model) , Molecular composition of the membrance, functional significance
2. Transport across cell membrances: Simple diffusion and osmosis, facilitated diffusion (Transporters, unlports and antiports carries, symports, Ion channels), Active transport, Membrance pumps, bulk transport (Endocytosis and Exocytosis)
3. Cytoskeleton: Microfilaments: structure dynamics and functions, Microtubules: structure dynamics and functions.
4. Intracellular transport: Axonal transport, Transport of pigment is melanophores: role of kinesin and dyneun.

UNIT – 2

5. Cell – cell adhesion and cell junctions : collagen and Non – collagen components of extracellular matrix of animal cells, Fibronentins and Integrins, cell adhesion proteins, their types cell junctions (occluding, Anchoring & Gap Junctions)
6. Signal transduction mechamlsms: Intracullarand cell surface receptors, signal amplification, secondary messengers, signaling through G Protien cupled receptors (PKA, PKC), Enzyme linked receptor signaling (Growth factor receptor signaling, jack state pathway, Network and Crosstalk between different signaling mechanism, role of NO and CO in cell signallng.

UNIT – 3

7. Neurons: General organization of neurons classification of neurons
8. Glia: Structure & Types of Glia, Functin of glia
9. Synapses: Ultra structure of a synapse , Types fo Synapses, Synaptic transmission: Elecrical & chemical, Functions of nerveb fibers
10. Muscle contraction: Excitation – contraction coupling and Sarcoplasmic reticulum.

UNIT – 4

11. Genome organization: Molecular organization of Gene Chromosomal organization of Gene
12. Organelle genome: Mitochondrial genome: Structure and function
13. Gene mutation: induced mutations spontaneous mutations
14. DNA damage and repair: Types of DNA damage basic pathway of DNA repair , DNA methylation
15. Gene regulation in prokaryotes: DNA BINDING MOTIFS, Lac operon, Tryptophan operon

UNIT – 5

16. Sex determination in Drosophila: Chromosomal basis, Molecular basis
17. Sex determination in mammals: Hormonal basis, Molecular basis
18. Dosage compensation, Basic Concepts in Drosophila, Basic concepts in mammals

Suggested Readings:

Albert et. Al. Essential Cell Biology, Garind Publishing Inc., New York, 1998.
Albert, D. Bray J. Lewis, M. Raff, K . Roberts and J.D. Waston. Molecular Biology of the cell, B. Garland Publishing Inc. New York, 2001.
Boney. Cel Biology Level 2nd. Macdonald & Evans, 1982.
Darnell, J.H. Lodish and D. Baltimore. Molecular cell biology. Scientific American Book, Inc., USA
De Robertis & De Robertis. Cel and Molecular Biology. Lea & febiger
Gilbert Devleopment Biology, sinauer, 2000,
Karp. Cell and Molecular Biology john Willey & sons, New York, 1996.
Lodish et al. Molecular Cell Biology. Freeman & Co., 2000.
Tob. . and Morcel Asking about Cells Saunders, 1997.

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ZOOL. 104: TOOLS AND TECHNIQUES FOR BIOLOGY

Unit – 1

1. Microscopy, principle & application of : Light microscope, phase contrast microscope and fluorescence microscope
2. General principal and application of Electron microscope (TEM & SEM)
3. Principal and Apllication of Control microscopy
4. Cryotechniques: Cryopreservation of cells, tissues, organs and organism Freeze fracture & freeze drying

UNIT – 2

5. Principles and applications of photometry: Beer & Lambert's law, Absorption spectrum & absorption maxima
6. Colormeter & spectrophotometer
7. Flame photometer
8. Atomic absorption spectrophotometer

UNIT – 3

9. Separation techniques: Chromatography, principle, types and applications
10. Electrophoresis, principle, types & applications, PAGE and agarose gel electrophoresis
11. Radioisotopes in biology: units of radioactivity, Radioactive counters
12. Autoradiography

UNIT – 4

13. Techniques in immunodetection: Immunocyto-/ histochemistry „ Immunoblotting, immunodetection and immunofluorscene
14. Surgical techniques: organ ablation (E.G. overiactomy adrenalectomy etc.) perfusion techniques and stereotaxy
15. Histological techniques: principles of tissue fixation, Microtomy, cryotomy, and Histochemical staining
16. Immunological techniques : Immunodiffiusion and Imunoelectrophoresis

UNIT – 5

17. Cell culture techniques:
    Design and functioning of tissue culture laboratory
    Culture media, essential companies and preparation
    Cell viability testing
18. Cytological techniques:
    Mitotic & Melotic chromosome preparations from insects and vertebrates
    Chromosome banding techniques (G- C-, O-, R- banding etc.)
19. Molecular cytological techniques:
    In situ hybridization (radiolabelled & non – radiolabelled methods).
    FISH and Restriction banding
20. Molecular biology techniques:
    Southern hybridization and Northern hybridization
    DNA sequencing
    Polymerase chain reaction (PCR)

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Suggested Readings:

Clark & Switzer. Experimental Biochemistry. Freeman, 2000.

Locquin and Langeron. Handbook of Microscopy, Butterwaths, 1983.

Boyer, Modern Experimental Biochemistry, Benjamin, 1993.

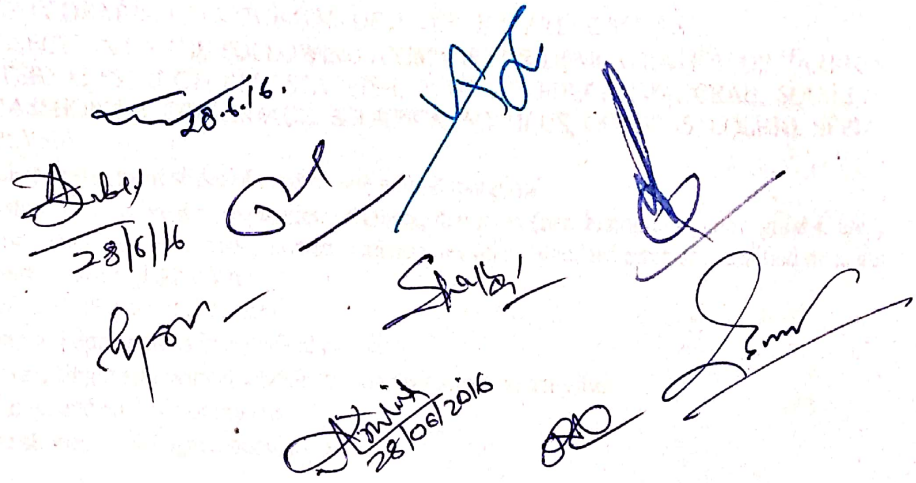
Frelfelder, physical Biochemistry, Freeman, 1982.

Wilson and Walker, Practical Biochemistry, Cambridge, 2000.

Cooper, The Cell A Molecular Approach ASM, 1997.

John R.W. Masters. Animal Cell culture A practical approach, IRL Press.

Rubert Braun, Introduction to instrumental analysis MeGraw Hill Int. Ed. K. Willson & K. H. Goulding. A Biologist's Guide to principles & Techniques of practical Biochemistry. ELBS Ed.



LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL. 105: INVERTEBRATES, QUATITATIVE BIOLOGY & BIOINFORMATICS

- STUDY OF PROTOZOA IN LIVING STATE AND PERMANENT MOUNTING
- COLLECTION, PRESERVATION, STAINING, MOUNTING AND IDENTEFICATION OF DIFFERENT LARVAE, PROTOZOANS, SPONGES,COELENTERATES HELMINTHS, PARTICULARLY THE FOLLOWING:

BALANTIDIUM,OPALINA, NYCTOTHERUS, MONOCYSTIS,EUGLENA, PARAMAECACIUM, PLASMODIUM, VORTICELLA, HYDRA, SPONGES ROTIFEERS, ASCARSIS, LIVERFLUKE ETC.

- MOUNTING AND IDENTIFICATION OF WHOLE MOUNTS OF INVERTEBRATES THEIR STRUCTURAL PARTS LIKE GILLS, RADUALA, STATOCYST, TENTORIUM, TYMPANUM SPIRACLES MALPHIGIAN TUBULTES SALIVARY, GLANDS OF INSECTS,STING APPARATUS OF HONEY BEE, NEPHRIDIA AND OVARY OF EARTHWORM, ETC .
- STUDY OF MUSEUM SPECIMENS OF INVERTEBRATE ANIMALS
- DISSECTION OF THE FOLLOWING ANIMALS FOR DEMOSTRATION OF VARIOUS INTERNALSSTRUCTURES :STARFISH, ECHINUS, PHERETIMA, CRAB, SQUILLA, GRASSHOPPER, COCKROACH, SCORPION, MYTILUS, OCTOPUS, LOLIGO, SEPIA, APLYSIA.
- study of permanent slides of invertebrate animal materials
- biostatistical problems: preparation of charts, diagrams (bar, histograms, pie , graphs, etc.), computation of mean, mode, median, standard deviation, standard error of ckassified data, chi square , t-test and ANOVA
- statistical analysis of field data
- computer applications in statistical problems
- constructing mathematical models for simple zoological activities
- solution and analysis of models
- case studies of biological populations

SCHEME OF PRACTICAL EXAMINATION

1. Major dissection of organ system of invertebrate with bisplay and diagram
2. Biostatical problem
3. Exercise of computer application and bioinformatics
4. Preparation of stained permanent mount of nonchordate material with diagram and identification
5. Spotting (museum specimens -03,slide -03,mathematic models -02.computer applications -02)
6. Collection and preservation of specimen
7. Viva voce
8. Practical record

TOTAL MARKS

DURATION (HOURS)

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LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL, 106: MOLECULAR CELL BIOLOGY GENETICS AND TOOLS & TECHNIQUES

1. Microtomy of invertebrate or vertebrate materials
2. Preparation of buffer solutions of defined ionic concentration and determination of poll
3. Absorption spectrum of colourd and colourless sofituns using speckophot and colorimeter
4. Seperation and detection of dyes/amino acids/sugars usig paper sschrorrasfgaraphy TLC
5. Study of permanent slides of cytology
6. Study of mitosis from onion root tips by making stained termporary squash operation
7. Study of meisois from testicular tissue of grasshopper
8. Salivary gland squash preparation for the study of polytene chrosueurfescwe of gloacsifes/Drosophila
9. Mammalian blood smear preparation for the study of drum stick sesa crhnosiation rat/ human
10. Study of Mendelian ratios from the seed coat colour pattern of seeds (mafioqdihybrid ratio)
11. Collection of Drosophilla for the study of morphological characters of mades and fesmilies
12. Study of cellular ultrastructure by means of electron micrographics
13. Working and applications of tools: B- Counter , ELISA reader and association/spectophtometer and image analyzer

SCHEME OF PRACTICAL EXAMINATION

1. Cytological/ molecular biological/ cytogenetic exercises
2. Microbiological/ genetics exercise
3. Determination of pH, preparation of buffer, colorimetric or spectro photometric exercises
4. Chromatographic separation (paper/thin layer) of biomolecules
5. Spotting (cytological slides-3, immursological tools-2, microbiological preparations-1, electron micrographs-2)
6. Microtomy: (a) Sectioning & stretching (b) staining & mounting
7. Viva voce
8. Practical record

TOTAL MARKS

DURATION (HOURS)

28/6/16

28.6.16.

28/06/2016

SECOND SEMESTER:

ZOOL.201: GENERAL AND COMOPARATIVE ANIMAL PHYSIOLOGY

UNIT -I

1. Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, hemoglobin, immunity haemostasis.
2. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination.
3. Respiratory pigments through different phylogenic groups.
4. Neutral and chemical regulation of respiration.

UNIT-II

5. Excretory system: Comparative physiology of excretion, kidney, urine, formation, urine concentration, waste elimination & micturition.
6. Regulation of water, balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
7. Digestive system: Digestion, absorption, energy balance, BMR.
8. Thermoregulation: Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.

UNIT-III

9. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissues.
10. ECG- its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.
11. Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.
12. Physiology of impulse transmission through nerves and synapse.

UNIT-IV

13. Comparative study of mechanoreception
14. Comparative study of photoreception
15. Comparative study of phonoreception
16. Comparative study of chemoreception

UNIT-V

17. Sense organs: Vision, hearing and tactile response.
18. Stress and adaptation.
19. Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases: reproductive processes.
20. Neuroendocrine regulation of Hormones, their classification and chemical nature.

Suggested Readings:

Prosser, C.L. **Comparative animal physiology**. W.B. Saunders and Co.

Eckert, R. **Animal physiology– Mechanisms and adaptation**. W.H. Freeman and Co.

Hoar, W.S. **General and Comparative Animal physiology.**

Schemdt-Neilsen. **Animal Physiology: Adaptation and Environment**. Cambridge

Prosser, C.L. **Environmental and Metabolic Physiology**. Wiley-Liss, New York

28.6.16.

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ZOOL. 202: BIOMOLECULES, STRUCTURE & FUNCTIONS

1. Primary, secondary, tertiary and quaternary structures of proteins
2. Protein folding and denaturation
3. DNA: Double helical structure of DNA: Replication & Recombination
4. RNA: Phosphate Pathway and Glyconeogenesis.

UNIT-II

5. Basic concept of metabolism: Coupled and interconnecting reactions of metabolism, cellular energy resources and ATP synthesis
6. Glycolysis and glyconeogenesis
7. Citric acid cycle: Oxide phosphorylation
8. Pentose Phosphate Pathway and Glyconeogenesis.

UNIT-III

9. Functional importance of lipid storage & membrane lipids; lipid storage diseases
10. Fatty acid metabolism: Synthesis and degradation of fatty acids
11. Protein Synthesis
12. Bile Composition and functions: bile dysfunction associated diseases

UNIT-IV

13. RNA synthesis and splicing
14. Biosynthesis of amino acids
15. Biosynthesis of nucleotides
16. Biosynthesis of membrane lipids and steroids.

UNIT-V

17. Enzymes: Basic concepts and kinetics
18. Mechanism and Regulation of enzyme catalysis
19. Concept of free energy and thermodynamic principles in biology
20. Energy rich bonds, compounds and biological energy transducers

Suggested Readings:

Voet, D. and J.G. Voet. Biochemistry. John Wiley & sons

Freifelder, D. Physical Biochemistry. W.H. Freeman & Co.

Segal, I.H. Biochemical Calculations. John Wiley and Sons

Creighton, T.E. Protein Structure and Molecular Properties. W.H. Freeman & Co.

Freifelder, D. Essentials of Molecular Biology.

Cooper, T.G. Tools of Biochemistry.

Hawk. Practical Physiological Chemistry.

Garret, R.H. and C.M. Grisham: Biochemistry. Saunders College Publishers.

28.6.16.

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ZOOL. 203: POPULATION ECOLOGY AND ENVIRONMENTAL BIOLOGY

UNIT-I

1. Biodiversity Conservation
2. Biodiversity laws, significance and management approaches.
3. Population ecology: Characteristics of a population: population growth curves: population regulation: life history strategies (r and k selection)
4. Concept of metapopulation- demes and disposal, interdemic extinctions, age structured Populations.

UNIT-II

5. Case studies in population dynamics with two examples from areas such as fisheries and wildlife
6. Adaptation: Levels of adaptation, mechanisms and significance of body size
7. Biogeography: Major terrestrial biomes: bio geographical zones of India
8. Aquatic environments: Freshwater, marine and estuarine environments

UNIT-III

9. Eco-physiological adaptations to terrestrial fresh water and marine water environments
10. Ecological succession: Types: mechanisms: changes involved in succession: concept of elimax
11. Environmental limiting factors
12. Concepts of homeostasis

UNIT-IV

13. Inter and intra specific relationship competition
14. Predatory- prey relationship, predator dynamicm optimal foraging theory
15. Mutualism, evolution of plant- pollinator interaction
16. Environmental pollution: global environmental change: Environmental impact assessment

UNIT-V

17. Biodiversity-status, monitoring and documentation: major drivers of biodiversity change
18. Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves)
19. Sustainable development
20. Ecological modeling: Fundamentals of constructing models

Suggested Readings:

Cherrett, J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.

Elseth, B.D. and K.M. Baummagartner. Population Biology. Van Nostrand Co. New York

Jorgensen, S.E. Fundametals of Ecological Modeling. Elsevier, New York

Krebs. C.J. Ecology, Harper & Row. New York

Krebs. C.J. Ecological Methodology. Harper & Row, New York

Eckert, R. Animal Physiology: Mechanisms and Adaptation. W.H. Freeman and Co. New York

Hochachka P.W. and G.N. Somero, Biochemical Adaptation. Priceton, New Jersey

Schiemdt Nielsen. Animal Physiology: Adaptaion and Environment. Cambridge

Willmer, P.G. Stone and Johnston. Environmental Physiology. Blackwell Science Publication, Oxford, U.K.

Louw, G.N. Physiological Animal Ecology. Longman Harlosss, U.K.

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ZOOL. 204: BIOSYSTEMATICS, TAXANOMY AND EVOLUTION

UNIT-I

1. Definition and basic concepts of biosystematics and taxonomy
2. Trends in biosystematics: Chemotaxonomy, cytotaxonomy and molecular taxonomy
3. Dimensions of speciation and taxonomic characters
4. Species concept: Different species concepts

UNIT-II

5. Species category, sub- species and other infra- specific categories
6. Theories of biological classification
7. Taxonomic categories & Hierarchy of categories
8. Taxonomic characters: Different kinds, origin of reproductive isolation, biological mechanism of genetic incompatibility

UNIT-III

9. Taxonomic procedures: Taxonomic collections, preservation, curetting, process of identification
10. Taxonomic keys: Different kinds of keys, their merits and demerits
11. International code of Zoological nomenclature (ICZN): Operative principles interpretation & application of important rules formation of scientific names of taxa
12. Concepts of evolution and theories of organic evolution

UNIT-IV

13. Neo-Darwinism and population genetics:
    Hardy- Weinberg Law of genetic equilibrium: Gene frequency and the destabilizing forces (natural selection, mutation, genetic drift, migration & meiotic drive)
14. Molecular population genetics, Pattern of changes in nucleotide and amino acid sequences Ecological significance of molecular variations (genetic polymorphism)
15. Specification: Patterns and mechanisms of reproductive isolation: Modes of speciation: Allopatry & Sympatry
16. Zoo-geological time scale

UNIT-V

17. Trends in evolution
18. Molecular evolution: Gene evolution of gene families
19. Molecular phylogenietics: Construction of phylogenetic tree, Amino acid sequences and phylogeny
20. Nucleic acid phylogeny: DNA-DNA hybridization, restriction enzyme sites, nucleotide sequence comparison and homologies

Suggested Readings:

Kato, M. The Biology of Biodiversity, Springer

Avise, J.C. Molecular Markers, Natural History and Evolution. Chapman & Hall, New York

Wilson, E.O. Biodiversity, Academic Press, Washington

Simpson, G.G. Principle of Animal Taxonomy, Oxford IBH Publishing Company

Mayor, E. Elements of Taxonomy

Wilson, E.O. The Diversity of Life (College Edition) W.W. Northerm & Co.

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Tikadar, B.K. Threatened Animals of India, ZSI Publication, Calcutta

Dobzhansky, Th. Genetics and Origin of Species. Columbia University, Press

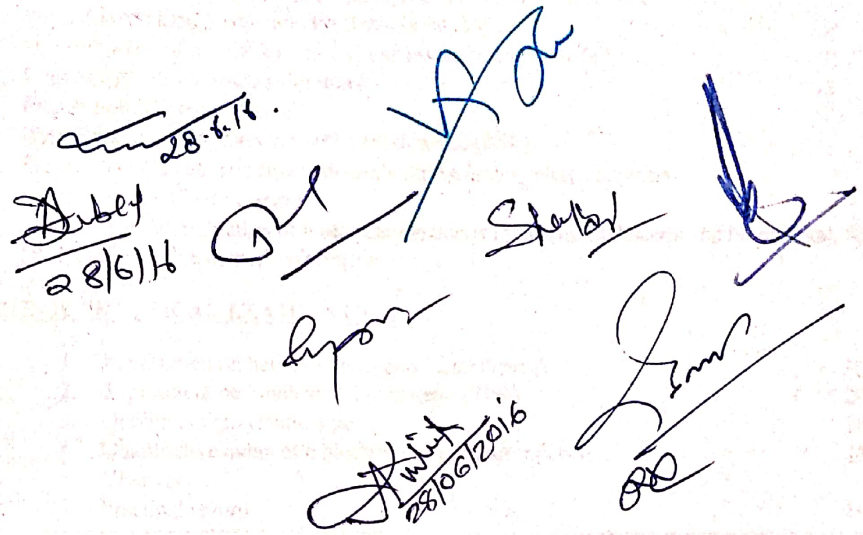
Dobzhansky, Th. F.J. Ayala G.L. Stebbines and J.M. Valentine Evolution. Surjeet Publication Delhi

Futuryama, D.J. Evolutionary Biology. Suinuaer Associates. INC Publishers. Dunderland

Jha, A.P. Genes and Evolution, John Publication, New Delhi

Merrel, D.J. Evolution and Genetics. Holt, Rinchart and Winston, Inc

Strikberger, M.W. Jones and Bartett Publisher, Boston London



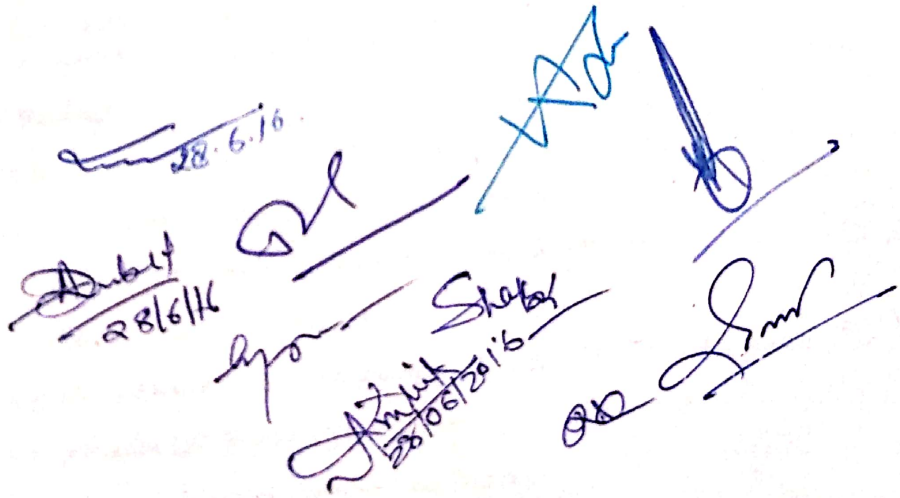
LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL- 205: PHYSIOLOGY AND BIOCHEMISTRY

- Detection of carbohydrates, proteins and lipids in the given sample
- Demonstration of salivary digestion
- Demonstration of gastric pancreatic digestion
- Demonstration of pancreatic digestion
- Detection of urea, uric acid, ammonia in the given sample
- Counting of red blood corpuscles in the blood of rat or man
- Counting of white blood corpuscles in the blood of rat or man
- Determination of haemoglobin percentage in the blood of rat or man
- Detection of blood groups and Rh factor in rat or man
- Determination of rate of respiration in an insect, mammal or fish
- Determination of blood clotting time
- Preparation of haemin crystals
- Determination of Erythrocyte sedimentation rate (ESR)
- Separation of Serum and tissue protein with the help of electrophoresis
- Demonstration of reflex action
- Quantitative determination of biological parameters (protein, cholesterol and blood sugar, RNA and DNA etc.) with the help of colorimeter

SCHEME OF PRACTICAL EXAMINATION

1.	Experiment on hematological parameter (Three)	30
2.	Experiment on biochemical parameter (Two)	20
3.	Qualitative enzymatic assay	10
4.	Quantitative assay of a biochemical parameter (Two)	20
5.	Viva voce	10
6.	Practical record	10
	TOTAL MARKS	100
	DURATION (HOURS)	06



THIRD SEMESTER:

ZOOL/ 301: COMPARATIVE ANATOMY OF VERTEBRATES

UNIT-I

1. Origin of chordata: Concept of Protochordata
2. Origin and classification of vertebrates
3. Vertebrate morphology: Definition, scope and importance
4. Development, structure and functions of vertebrate integrument and its derivatives (glands, scales, features and hairs)

UNIT-II

5. Respiratory system: Characters of respiratory tissue, external and internal respiration, comparative account of respiratory organs
6. Evolution of heart
7. Evolution of aortic arches and portal systems
8. Blood circulation in various vertebrate groups

UNIT-III

9. Form, function, body size and skeletal elements of the body
10. Comparative account of law suspensorium and vertebral column
11. Comparative account of limbs and girdles
12. Evolution of urinogenital system in vertbrates

UNIT-IV

13. Comparative account of organs of olfaction and taste
14. Comparative anatomy of brain and spinal cord (CNS)
15. Comparative account of peripheral and autonomic nervous system
16. Comparative account of lateral line system

UNIT-V

17. Comparative account of electroreception
18. Comparative account of simple receptors
19. Flight adaptation in vertebrates
20. Aquatic adaptations in birds and mammals

Suggested Readings:

Young, J.Z. life of vertebrates, oxford University Press, London

Young, J.Z. Life of mammals. Oxford University Press, London

Colbert, E.H. Evolution of the vertebrates. John Wiley and Sons Inc. New York.

Kent, C.J. Comparative Anatomy of Vertebrates.

Wostenholng, E.W. and knight, J. (ED.) Taste and Smell in Vertebrates. J& A Churehill, London

Walters, H.A. and Sayles. L.D. Biology of Vertebrates,Macmillon & Co, New York.

Montagna, W. Comparative Anatomy, Clarenden Press, Oxford.

Welchert, C.K. and Presch, W. Elements of Chordate Anatomy. 4th edn. MeGraw Hill Book Co., New York.

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ZOOL/ 302: DEVELOPMENT AND DIFFENTIATION

UNIT-I

1. Basis concepts of Development: Cell division and the cell cycle, Chromosomal puffs and gene activation, cell commitment and differentiation (Specification, determination, induction competence, differentiation), Morphogen gradients, cell fate, celln potency and morphogenesis
2. Gametogenesis: Origin and migration of primordial germ cells, 2.2 Production of male gamates (Spermatogenesis), 2.3 Gene expression during spermatogenesis and sperm maturation, Production of female gametes (oogenesis) (Previtellogenesis, vitellogenesis and maturation phase in development of amphibian egg), Gene expression during amphibian oogenesis, Ovulation and ovum transport in mammals

UNIT-II

3. Fertilization and early development: Pre fertilization events (sperm penetration of egg and acrosomal reaction, binding of sperm to the egg, Blocks to polyspermy), Biochemistry of fertilization (metabolic activation of egg, penetration of spermatozoa into the egg, union of gametes), Post- fertilization events
4. Establishment of polarity in amphibians and birds
5. Gastrulation and formation of germ layers in animals\
6. Multiple ovulation and embryo transfer technology: In vitro oocyte maturation and super ovulation

UNIT-III

7. Hormonal regulation of ovulation, pregnancy and partuition
8. Hormonal regulation of development of mammary glands and lactation
9. Endocrinology and physiology of placenta
10. Collection and cryo preservation of gametes and embryos

UNIT-IV

11. Teratological effects of xenobiotics on gametes
12. Wolfian lens regeneration
13. Melanogenesis
14. Differentiation and development of gonads

UNIT-V

15. Cell diversification in early embryos, xenopus blastomeres, totipiotency & pleuipotncy
16. Embryonic stem cells, chord-blood cells & their significance
17. Hemopoetic stem cells, formation of blood cells
18. Connective tissue cell family

Suggested Readings:

Gilbert, S.F. Developmental Biology, Sinauer Associated Inc, Massachusetts.

Ethan Bier. The Cold Spring. The cold Spring Harbor Laboratory Press, New York

Balinsky, B.J. Introduction to Embryology. Saunders, Philedelphia.

Berril, N.J. and karp, G. Development Biology. McGraw Hill, New York

Davidson, E.H. Gene Activity During Early Development. Academic press, New York.

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COURSES FOR SPECIAL (ELECTIVE) GROUPS:

A. AQUATIC BIOLOGY AND AQUACULTURE

ZOOL. 303 (A) AQUATIC ECOLOGY & RESOURCES

UNIT-I

1. Aquatic ecology: Science and its development
2. Origin and classification of wetlands including lakes
3. Morphology of lakes, reservoirs and ponds
4. Physical chemical and biological characteristics of marine environment

UNIT-II

5. Estuaries and other brackish water environments in India and their faunal importance
6. Physical and chemical characteristics of lakes, ponds and rivers
7. Freshwater biota: Plankton, benthos and macrophytes
8. Food chain, food web, tropic levels and energy flow

UNIT-III

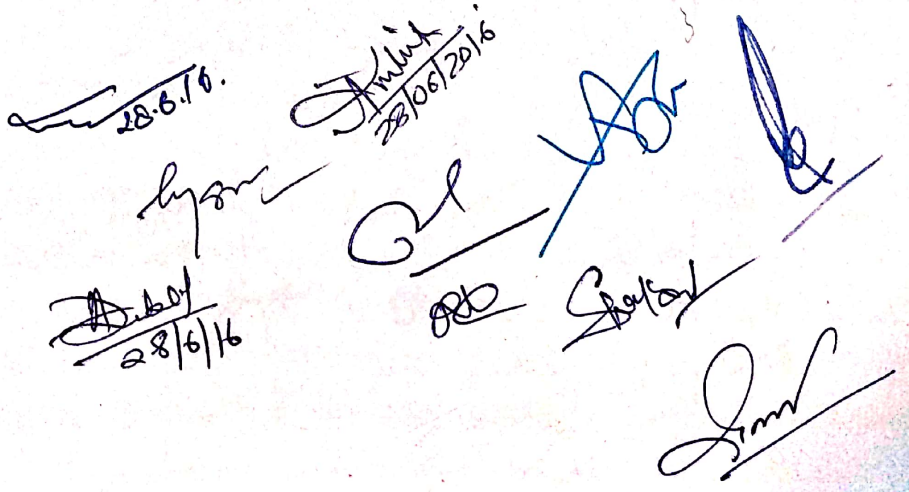
9. Primary productivity in Inland water and method of its determination
10. Degradation of wetland in India and control measures
11. Aquatic resources: Invertebrates and vertebrates
12. Importance and management of aquatic resources in India

UNIT-IV

13. Migration pattern of aquatic animals including aquatic birds
14. Threatened wetlands and endangered aquatic species
15. Aquatic wild life: Habitat and its importance, composition and conservation strategies
16. Aquatic pollution, its causes and control measures

UNIT-V

17. Major sources of pollution in rivers and remedies
18. Biological indicators of water pollution
19. Eutrophication, its impact on water bodies and control measures
20. Aquatic toxicology: Aquatic toxicity, long-term toxicity and chronic toxicity



ZOOL. 304 (A): FISH BIOLOGY & PHYSIOLOGY

UNIT-I

1. Structure and functions of skin and scales, significance of scales in taxonomy
2. Chromatophores: Classification, ultrastructure and functional significance
3. Origin of paired fins and modification of caudal fin
4. Respiratory organs including accessory respiratory organs and respiration in fish

UNIT-II

5. Swim bladder and its functional significance
6. Food, feeding habits and nutrition in fish
7. Digestive system and physiology of digestion in fish
8. Osmoregulatory organs and osmoregulatory mechanisms in fish

UNIT-III

9. Brain of fishes and its functional organization in relation to ecological conditions
10. Lateral line system: Structure, modifications and functional significance
11. Electric organs and their significance
12. Bioluminiscence in fish and its significance
13. Chemical communication in fish

UNIT-IV

14. Neuro-endocrine integration and hypothalamo-hypophysical system in fish
15. Anatomy and physiology of pituitary gland
16. Anatomy and physiology of thyroid gland
17. Pineal organ, internal gland and caudal neurosecretory system

UNIT-V

18. Seasonal cycles of gonads in Indian fish
19. Hormonal and endocrine control of reproduction in fish
20. Development of teleost fish
21. Parental care in fish

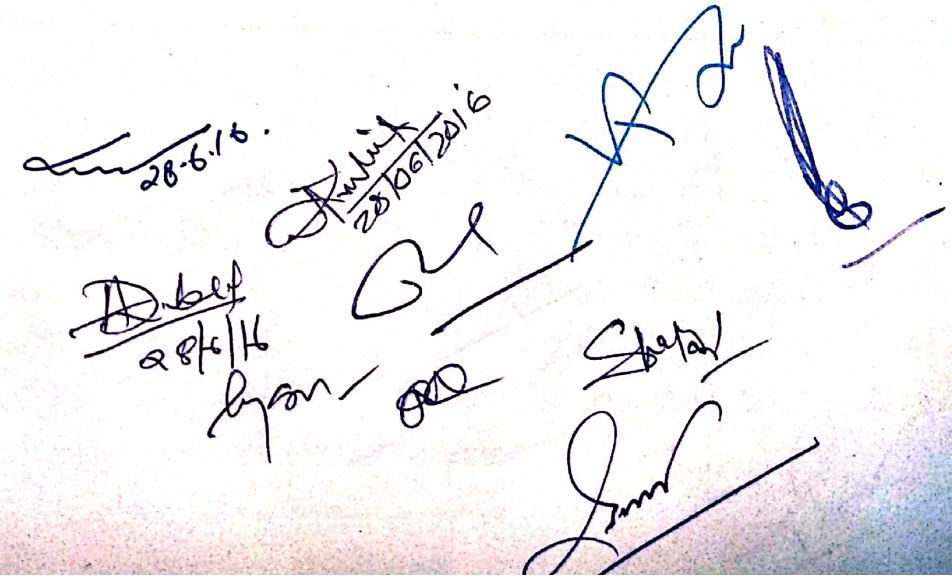
Suggested Readings:

Brown, M.E. The Physiology of Fishes, Vol. I & II. Academic Press, New York

Lager, K.F. Bardach, J.E. Miller, R.R. and Passino, D.R.m. Ichthyology, John Wiley & Sons, New York

Hoar and Randall. Fish Physiology Vo.1- 16. Academic Press, New York

Nikolsky, G.V. The Ecology of Fishes. Academic Press, New York.



ZOOL. 304 (A): FISH BIOLOGY & PHYSIOLOGY

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Lager, K.F. Bardach, J.E. Miller, R.R. and Passino, D.R.m. Ichthyology, John Wiley & Sons, New York

Hoar and Randall. Fish Physiology Vo.1- 16. Academic Press, New York

Nikolsky, G.V. The Ecology of Fishes. Academic Press, New York.

28-6-16.

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LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL. 305: VERTEBRATES AND GENES, DEVELOPMENT & DIFFERENTIATION

- Classification of lower chordates and study of representatives of various groups
- Dissection of different organ systems of the following animals: Hardmania, Amphioxus, Bony fish and frog or toad
- Minor dissection and stained preparations from lower chordate animals
- Study of disarticulated skeleton of dog fish, bony fish and amphibians
- Study of permanent slides of Urochordata, Cephalochordata elasmobranchs and amphibians
- Classification of Chordata and study of representatives of various groups
- Dissection of different organ system of the following animals: snake, Hemidactylus, Calotes, pigeon, rat etc.
- Minor dissection and stained preparation from above mentioned animals
- Study of disarticulated skeleton of various vertebrates
- Study of permanent slides of chordate materials
- Study of important characters of poisonous & non-poisonous snakes and their biting apparatus
- Study of migratory and resident birds
- Study of animals of zoo including mammals
- Study of development of eggs of fish, frog, hen and invertebrates
- Study of distribution of RNA in developing eggs
- Study of effects of chemicals and temperature on developing eggs, polyploidy,aneulpoidy
- Determination of respiratory rates of eggs
- Study of electron micrographs of spermatogenesis and oogenesis
- Study of permanent slides of chick and frog gonds and embryology

SCHEME OF PRACTICAL EXAMINATION

1.	Dissection of organ-systems and display with diagram of cartilogenous fish, bony fish,house lizard, garden lizard, pigeon or rat	12+3
2.	Mounting of chordate material/ Minor dissection with diagram (hardmania, Amphioxus and the chordate material)	08+2
3.	Preparation and mounting of developmental stages of frog, chick or any other suitable animal Spotting (bones-2, slides-2, museum specimens-2, embryological slides-2, electron micrographs-2)	15
4.	Viva voce	10
5.	Practical record	10
	TOTAL MARKS	85+15=100
	DURATION (HOURS)	06

28.6.16.

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LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL. 306 (A) AQUATIC BIOLOGY & AQUACULTURE

- Analysis of water samples for physic-chemical and biological characteristics, including water depth, transparency turbidity, temperature, nutrients (Phosphates, silicates), BOD, and COD and plankton
- Estimation of primary productivity by light and dark bottle experiment
- Macrobenthic fauna and its estimation
- Preparation of permanent mounts of planktonic organisms
- Physico-chemical analysis of soil of fish pond
- Field studies or river, stream and reservoir ecosystem, wetland sanctuaries and proofs
- Microtony of fish and shell fish material: block making, sectioning and training
- Histology and histopathology of fish tissues
- Anatomy of fish, sexual dimorphism in carp and other fish
- Dissection of cranial nerves of catfishes and carps
- Gills and accessory respiratory organs of fishes
- Alimentary canals of carps, catfishes and murrels
- Biochemical estimation of fish constituents
- Acute toxicity determination for freshwater fish
- Experiments on fish behavior
- Age determination with the help of scales and other materials

SCHEME OF PRACTICAL EXAMINATION

1. Dissection of cranial nerves of Wallago/ mysus / Labeo/Torpedo
2. Minor dissection of fish anatomy/ alimentary canal/ accessory respiratory organs/ age determination/ maturity stages/pigeatary behavior
3. Estimation of physic-chemical characteristics of water/ soil nutrient
4. Analysis/ Primary productivity/ identification of benthic/ planttonic organisms/ toxicity test
5. Spotting (histological/ histopathological slides-3, specimen-3, bones-2
6. Viva voce
7. Practical record / submission of charts / models / collection etc.

TOTAL MARKS

DURATION (HOURS)

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FOURTH SEMESTER
ZOOL, 401: ANIMAL BEHAVIOUR

UNIT-I

1. Introduction: Ethology as a branch of biology and animal psychology.
2. Classification of behavioral patterns, analysis of behavior (ethgoram)
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

6. Motivation: Drive, timing and Interaction of drivers, physiological basis of motivation, hormones and motivation, aggregation
7. Communication: Chemical, visual, light and audio, evolution of language
8. Ecological aspects of behavior: Habitat selection, food selection, optimal foraging theory, anti-predator defenses, aggression
9. Homing, Behaviour , dispersal, host-parasite relations
10. Biological rhythms: Cireadian rythms

UNIT-III

11. Orientation and navigation, migration of fishes, turtles and birds.
12. Learning and memory: Conditioning, habituation, insight learning, association learning, reasoning
13. Reproductive behavior, Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection, panchtal care

UNIT-IV

14. Social behavior, aggregation, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness
15. Social organization in insects
16. Social Organization in primates.

UNIT-V

17. Neural and bonnonal of behavior
18. Genetic and environmental components
19. Biolumine scence
20. Electric organs and behavior

Suggested Readings:

Esbt.Libesteldt, L. Ethelogy The biology of Behaviour Holt, Rincheart & Winston, New York
Gould, J.L. The mechanism and Evoluating of Behaviour
Kerbs, J.R. and N.B. davis : Behaviourable Ecology Blackwell, Oxford, U.K.
Hinde, R.A. Animal Behaviour: A synthesis of Ethology and Comparative Psychology McGraw Hill, New York
Alcock, J. I. Animal Behaviour An Evolutionary approach, Sinauer Assoc. Sunderland, Massachsets U.S.A
Bradbury, J.W. and S.I. Vehneneatp, Principles of Animal Communication, Sinauer Assoc. Sunderland, Massachsots, U.S.A
Kandel. ER, Schwantz,J.H. and Jessell, T.M.: Principles of Neural Science McGraw Hill, New York
Brown A.G. Nerve cells and Nervous systems Narosa Publisging house, Delhi.
Mishra: Clinical Neuro- physiology, Clurebell I. livingstone

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20-6-16.

ZOOL, 402: MOLOGY OF PARASITISM AND VERTEBRATE IMMUNE SYSTEM

UNIT-I

1. Parasitism: Concept, origin, evolution, advantages and disadvantages in the parasitic life
2. Classification of parasites according to habitat, microenvironment and host specificity
3. Modes of parasitic invasion: Passive, mechanical, active, contact, transovarial pathways of entry and sites of habitation
4. Host specificity: Definition, origin, types, structural, physiological & pathological response, tissue, ecological and phylogenetic response
5. Host-parasite system: Effects of pansites no hosts (mechanical, nutritional, destructive, toxic etc.)

UNIT-II

6. Host reactions to parasites: Resistance, compatibility and immunity
7. Innate and acquired immunity
8. Cells of immune system and their differentiation
9. Nature of immune response: Antigenicity and immunogenicity, factors influencing immunogenicity, epitopes and haptens
10. Structure and functions of antibodies: Classes and subelasses, gross and fine structure, antibody mediate effcter functions

UNIT-III

11. Antigen –antibody Interactions: Antibody affinity and avidlity, gross reactivity, agghuination
12. Major histo-compatibility complex in mouse and HLA system in human: MHC hapalotypes, class –I and class-II molecules, cellular distribution, pepride binding, expression and diversity, disease susceptibility and MHC/HIA
13. T- cell receptors: Isolation, molecular components and structure, T-cell maturation and thymus, T-cell activation mechanism, T- cell differentiation, cell death and T-cell population

UNIT-IV

14. B-cell generation, activation and differentiation: B-cell receptors, selection of immature and self reactives B-cells, B-cell activation and proliferation, T-B- cell interactions, humoral immune response and kinetics
15. Cytokiness: Structures and functions, cytokine receptor, cytokines and immune response
16. Complement system: Component activation & biological consequences
17. Cell-mediated effecter functions: Cell adhesion molecules, effecter cells and molecules,CTL and NK cells- mechanisms of action, delayed type hypersensitivity

UNIT-V

18. Immune response to infectious diseases: Immune response to viral, bacterial, protozoan and other parasitic worms
19. Vaccines: Types of vaccines, active and passive immunization
20. Immunodeficiency disorders: Primary immunodeficiences, secondary of acquired immunodeficiences (AIDS)
21. Transplantation: Immunological basis of graft rejection, general and specific Immunosuppressive therapy

Suggested Readings:

Chandler, A.C. and C.P. Ruad Introduction to Parasitology. Wiley Eastern, New Delhi
Croll, N.A. Ecology of Parasites. Heinmann ,London]
Dogied, V.A. General Parasitulogy, Oliver and Hoyd, Edenburh, Lodon
Jones, A.W. Introduction to Parasitology. Addition- Welsey Reading. Mass
Kuley, Immunology. W.H. Freeman, U.S.A
Paul, W, Fundamentals of Immunlogy
Rott, L.M. Essensial Immunology, ELHS edition

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LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

ZOOL, 405: ANIMAL BEHAVIOUR, BIOLOGY OF PARASITISM & VERTERBRATE IMMUNE SYSTEM

- Experiments on animals behavior:
  Exploratory behavior in rats/ mice
  Parental care in rats / mice
  Burrowing behavior of blowfly larvae
  Phototactic behavior of blowfly larvae
  Burrowing & geoncgative behavior of earthworms
  Borrowing behavior of turtles
  Cireadian rhythmicity in foraging behavior of honeybees
  T. .Mare, Y. Mare
- Blood film preparation and identification of cells
- Study of Protozoan and helminth parasites,parasitic adaptation in animals, Parasitic invasions, host-parastic interactions
- Lymphoid organs & their microscope organization
- Study of antigen-antibody interaction
- Immunodiffusion
- Immunoehectrophoresis
- ELISA
- Immunocytochemistry
- Immunodiagniosis (demonstration using commercial kits)

SCHEME OF PRACTICAL EXAMINATION

1.	Immunological experiments (immunodiffusion / immunelectrophoresis)	10
2.	Immuneytochemistry/ CLISA	10
3.	Experiments on animal behavior (02)	14
4.	Identification & comments upon & spots (parasitic adaptation in protozoans) Heliminthes & other animals, parasitcs invasion, host-parasite interaction & animal behavior)	24
5.	Blood film preparation and identification of cells	07
6.	Viva voce	10
7.	Practical record	10
	TOTAL MARKS	85+15=100

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COURSES FOR SPECIAL. (ELECTIVE) GROUPS:
A. AQUATIC BIOLOGY AND AQUACULTURE
ZOOL, 403 (A) FISHERIES AND PISCICULTURE

UNIT-I

1. Classification of commercially important fish fishes and shell fishes and their significance
2. Fishes and shell fishes of Madhya Pradesh
3. Reservoir and lake fisheries (with emphasis on Tighra reservoir)
4. Reverine fisheries
5. Estuarine and brackets water fisheries

UNIT-II

6. Marine fisheries of India
7. Environmental factors (a biotic and biotic) in relation to life of fishes
8. Exotic fishes larvicidal fishes and their signigicance
9. Common parasites of fishes, fish diseases, their control and treatment
10. Economical importance of fishes and their by-products

UNIT-III

11. Cultivable species of inland fishes and principle of their selection
12. Predatory fishes and their importance in fish culture
13. Plankton and their importance in fish culture
14. Fish ponds and their hydrobiological requirements
15. Principles of genetics, hybridization and sex determination in fish

UNIT-IV

16. Transgenic, fish, formation and importance
17. Traditional verses modern fish culture practices
18. Paddy corn fish culture and its significance
19. Sewage fish culture and its importance
20. Fish net, gears and method of fishing

UNIT-V

21. Fish preservation technology and packing
22. Marketing of fishes and role of co-operative societies
23. Fisheries and rural development
24. Fisheries leglstation
25. Fisheries development in Madhya Pradesh

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ZOOL, 404 (A): AQUACULTURE

UNIT-I

1. Identification of stages of life histories of important cultivable fishes and prawn
2. Natural breeding, bundh breeding and Induced breeding of carps though hypophysotion and drugs
3. Planning and designing of freshwater fish firms
4. Management of rearing, nursry and stocking ponds

UNIT-II

5. Transport of live fish and fish seed
6. Planning and management of brackish-water fish farms
7. Nutritional requirements of fish and artificial diet
8. Freshwater aquaculture, Prospectus and management
9. Methods of aquaculture: Pen culture ,bottom and off bottom culture

UNIT-III

10. Integrated fish farming in India: Agriculture corn fishery, trapa-cum-fishery, poultry,cum-fishery, puffery cum fishery, pultry-piggery-fishes
11. Economical aspect of fish culture management
12. Freshwater prawn culture practice in India
13. Brackish water prawn culture development in India

UNIT-IV

14. Prospects and development of mariculture: Pearl culture mussel culture and oystser culture
15. Frog culture: Species Breeding, Culture, and polyculture with fish
16. Culture of freshwater macrophytes (Azolla) and algae (Spiruling)
17. Prospectus and development of turtle fishery

UNIT-V

18. Breeding and rearing of crocodiles, crocodile industry: Indian and International
19. Perspective
20. Production of Jayanti culture of fresh water oyater for pearls, and sea weed culture
21. Whaling industry: Substainable utilization
22. Major aquatic resources: Export and economice status in India

Suggested Readings:

Brown, m.e. the physiology of fishes Vol. I & II. Academic Press.

Lagier, K.F. J.F. Rardach, R.R, Miller and D.R.M. Pasino. Ichthylogy, John Wiley & Sons. New York

hoar and Radndall Fish Physiology Vol-16. Academic Press

Nikosky, G.V. The Ecology of fishes, Academic Press

Day , I. The Fishes of India . Vol. I & II , William Dawson & Sons Ltd. London

Khanna,S.S. and singh H.R. Fish biology and fisheries Narendra Pub. House Delhi

Udwas S.P. Fundamental of technology, Narendra Pub. House, Delhi

Srivastva, C.B.I Fishery science and fisheries kitah Mahai.

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Clary, M.R. and Sara, R.P. Fundamental of Aquatic Texcology. Hemisphere Pub. Corp.

Shanna, B.K. and kaur, H. Water Pollution cluel Pub. House

Sasnthanam, R. Ramanathan, N. and legatheman G.Coastal Aquaculture in India CBS Pub.

Hynes , H.B.N. The Ecology of hunning water Liverpool Uni Press

Chokrahorty, C. and Sadhu, A.K. Biology Hatchery and Culture Technology of Tiger prawn and gial freshwater

Prawn Daya Pub. House,Delhi

Saxena, A. Text book of Crustacca Discovery Pub. House.

Wetzel, R.G. Limnology Lake and Resevoire ecosystem Academe Press

LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

- Identification of freshwater fishes, amphibions, reptiles and mammals
- Identification of Common weeds, predator fishes and harmful insects
- Maintenance of fish and other aquatic animals in the laboratory
- Biometric observation of prawns, fishes, frogs, turtles and crocodile
- Estimation of length-weight relationship and condition factor of fish
- Determination of fecundity, ova diameter and maturity stages of fishes, prawns, frogs
- Methods of included breeding of fish through hypohysation, collection, preparation and preservation of pituitary extract, close determination and techniques of administration
- Crafts and gears used in inland capture fisheries
- Experimental culture of phyto – and zooplanktons
- Sampling equipments of water planktd and bethic oraganisms
- Statistical procdures in fishery sclene
- Survey of local fish farm, visit to fish seed production and fish culture UNIT in Gwalior, Datia, Dabra, morena and shivpuri
- Visit to fish landing centre, fish markets and study of fishing operations, preservation, packing and transport
- Visit to national institutes /centers for fishery/ survey/ education/ extension trips to Goa, Bhmbneshwar, Bombay Cochin, Barnaekpore, Luknow, Hidwani etc.
- Visit to brackish water aquaculture / prawn culture farms/ centers in A.P.,Kerala, CMFRI,
- Pawardhera etc.
- Practical consideration to peal culture/ oyster culture
- Preparation and submission of visit/ survey/project report and charts, models and specimens

SCHEME OF PRACTICAL EXAMINATION

1.	Identification of freshwater prawns, fishes, frogs, turtles & crocodiles up to species with biometric data	15
2.	Experiments cut carp breeding through hypophysation /cultures of plankton/identification fish frys, fingerlings, post-larve of prawns	08
3.	Identification & comment upon common weeds predator fishes, insects, other aquatic organisms harmful to fishes, nets, gears, crafts, sampling tools and apparatuses	24
4.	Statistical procedures in fishery science / length-weight relationship/ condition factor / estimation of fecundity	08
5.	Viva voce	10
6.	Practical record , visit / survey report/ materials, charts, models, specimens	10
7.	Seminar	10
	TOTAL MARKS	85+15=100

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