

2017-18

मध्यप्रदेश शासन  
उच्च शिक्षा विभाग  
मंत्रालय

B. Se. Zoology  
B. Se. Biotechnology  
B. Se. Bioinformatics

Annual Patter

// आदेश //


भोपाल, दिनांक 12-7-17

क्रमांक 968/96/सी.सी./17/अडतीस- प्रदेश के महाविद्यालयों/  
विश्वविद्यालयों में लागू सेमेस्टर पद्धति के संबंध में सगन्वय समिति के निर्णय उपरान्त  
राज्य शासन द्वारा आदेश क्र 89/44/2007/03/38 दिनांक 17.01.2008 जारी कर  
सत्र 2008-09 से सेमेस्टर पद्धति लागू की गई थी।

मंत्रि परिषद के आदेश दिनांक 06.06.17 एवं माननीय कुलाधिपति जी द्वारा प्रदान  
किये गये अनुमोदन के आधार पर मध्यप्रदेश के महाविद्यालय/विश्वविद्यालयों में सत्र  
2008-09 से लागू सेमेस्टर प्रणाली में निम्नानुसार संशोधन आदेश जारी किया जाता है


1. महाविद्यालयों में संचालित हो रहे स्नातक स्तर के सामान्य पाठ्यक्रमों बी.ए./बी.  
एस.सी./बी.काम. हेतु सेमेस्टर प्रणाली को समाप्त करते हुए आगामी अकादमिक सत्र  
✓ 2017-18 से वार्षिक पद्धति अपनाई जाती है जिसमें वार्षिक तथा आंतरिक मूल्यांकन की  
व्यवस्थाएं क्रमशः 80 एवं 20 के अनुपात में होगी।
2. नियामक संस्थाओं यथा AICTE, NCTE, BCI आदि द्वारा स्नातक स्तर के निर्धारित  
पाठ्यक्रमों में, नियामक संस्थाओं के प्रावधानानुसार निर्धारित प्रणाली को अपनाया  
जायेगा।
3. स्नातकोत्तर पाठ्यक्रमों में सेमेस्टर पद्धति यथावत् रहेगी।

मध्यप्रदेश के राज्यपाल के नाम से  
तथा आदेशानुसार

  
(वीरन सिंह भलावी)

अवर सचिव,

म0प्र0शासन उच्च शिक्षा विभाग  
मंत्रालय,


  
15/7/17

Professor & Head

Department of Zoology

Govt. Madhav Vigyan Mahavidyalaya Ujjain

jan 2016

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

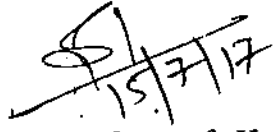


पृ.कमांक 969 / 96 / सी.सी. / 17 / अडतीस

भोपाल, दिनांक 12-7-17

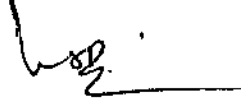
प्रतिलिपि:-

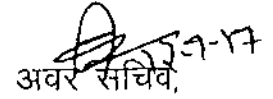
1. निज सहायक, प्रमुख सचिव, मा.मुख्यमंत्री, मध्यप्रदेश।
  2. निज सहायक, मा.मंत्री जी / राज्यमंत्री जी, उच्च शिक्षा, म.प्र.
  3. निज सहायक, प्रमुख सचिव, मध्यप्रदेश शासन, उच्च शिक्षा विभाग।
  4. आयुक्त, उच्च शिक्षा, सतपुड़ा भवन, भोपाल।
  5. समस्त क्षेत्रीय अतिरिक्त संचालक, उच्च शिक्षा, म.प्र.।
  6. कुलसचिव, समस्त विश्वविद्यालय, मध्यप्रदेश।
  7. प्राचार्य, समस्त अग्रणी महाविद्यालय, मध्यप्रदेश।
  8. आई टी. सेल-प्रभारी कार्यालय आयुक्त, उच्च शिक्षा सतपुड़ा भवन, भोपाल की ओर विभागीय वेबसाइट पर अपलोड करने हेतु अग्रेषित।
- की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु अग्रेषित।



**Professor & Head**  
Department of Zoology

Govt. Madhav Vigyan Mahavidyalaya, Jabalpur



  
अवर सचिव,

म0प्र0शासन उच्च शिक्षा विभाग  
मंत्रालय,



Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.Sc. (Bio) 3 Years  
As recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc. 1<sup>st</sup> year (Session-2017-18)  
Paper : 1<sup>st</sup>  
Subject/ विषय : Zoology  
Title of Paper : Invertebrate  
Max. Mark/ अधिकतम अंक : ~~50~~ 40

**Unit-I**

1. Elementary knowledge of Zoological Nomenclature and International Code.
2. Classification of Lower Invertebrates (According to Parker and Haswell 7<sup>th</sup> edition)  
(i. Protozoa ii. Porifera iii. Coelenterata iv. Helminthes)
3. Classification of Higher Invertebrates (According to Parker and Haswell 7<sup>th</sup> edition)  
(i. Annelida ii. Arthropoda iii. Mollusca iv. Echinodermata v. Hemichordata)

**Unit-II**

1. Protozoa- Type study of Plasmodium.
2. Protozoa and Diseases.
3. Porifera- Type study of Sycon
4. Coelenterata- Type study of Obelia.
5. Corals and Coral Reef formation.

**Unit-III**

1. Helminthes- Type study of Liver Fluke (Fasciola hepatica).
2. Nematodes and diseases.
3. Annelida- Type study of Earthworm (Pheretima)
4. Metamerism in Annelida
5. Structure and significance of Trochophore larva.

**Unit-IV**

1. Arthropoda- Type study of Prawn (Palaemon).
2. Larval forms of Crustacea.
3. Insect as Vectors of human diseases.
4. Mollusca- Type study of Pila (An Apple Snail).
5. Larval forms of Mollusca

**Unit-V**

1. Echinodermata- External features and water vascular system of Star fish.
2. Larval forms of Echinoderms.
3. Minor Phyla- Ectoprocta and Rotifera.
4. Hemichordata -Type study of Balanoglossus
5. Affinities of Balanoglossus.

w/od  
28/4/17  
(Anilika Yadav)  
at pathon  
28/4/17  
hsg

Dr. Shivsh Pratap Singh  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

Shagu  
15/4/17  
Shukla Shagu  
Professor & Head  
(Dr. Shobha Shouk) Govt. Veterinary College  
Department of Zoology, Rewa  
Dr. R. S. Mishra  
28/4/17  
Dr. C. Basu  
28/4/17  
Dr. Anand

Dr.



B.Sc. - I Year - Zoology

Books of MP Hindi Granth Academy

- Parker & Haswall : Text book of Invertebrate Zoology
- Kotpal, RL : Invertebrate
- Rastogi, VB : Developmental Biology
- Arora, MP : Embryology
- Verma, PS and Agrawal, VK : Chordate Embryology
- Karp : Cell and molecular Biology
- Sheelar & Bianchi : Cell and Molecular Biology
- Rastogi V.B. : Introduction to cytology
- De Robertis : Cell and Molecular Biology
- Powar, CB : Cell Biology
- Verma, PS and Agrawal, VK : Cell Biology, Genetics, Molecular Biology, Evolution

*Rathore*  
28.4.17  
(Prof. H.S. Rathore)

*H. M. S. Ekanbar*  
28/4/17  
(Dr. M.S. Ekanbar)

*Rousha Singh*  
28.4.17  
(Dr. Rousha Singh)

*Vinodini Nigam*  
28.4.17  
(Dr. Vinodini Nigam)

*N. Sahu*  
(Dr. N. Sahu)

*S. S. Shrivastava*  
28/4/17  
Dr. C.S. Shrivastava

*Rajiv Shrivastava*  
28/4/17  
(Dr. Rajiv Shrivastava)

*Shobha Shauky*  
28.4.17  
(Dr. Shobha Shauky)

*C. Basu*  
Dr. C. Basu

*Shiv Prasad Singh*  
**Professor & Head**  
Department of Zoology  
Govt. Madhav Vikram Mahavidyalaya Ujjain  
Dr. Shiv Prasad Singh  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

*Ullas Yadav*  
28/4/17  
(Dr. Ullas Yadav)

*Anita Salunkhi*  
28/04/17  
(Dr. Anita Salunkhi)

*[Signature]*

**Under Graduate Syllabus for B.Sc. (Bio) 3 Years**  
**As recommended by Central Board of Studies in Zoology**

उच्च शिक्षा विभाग, म.प्र. शासन  
 स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
 केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

**Class / कक्षा : B.Sc. I year (Session-2017-18)**  
**Subject/ विषय : Zoology Practical**  
**Max. Mark/ अधिकतम अंक : 50**

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

1. Study of Museum Specimens and slides relevant to Invertebrates Studied in theory. (any 8)
2. Mounting / squash preparation :- (any 1)
  - (a) Prawn statocyst
  - (b) Pila-Ctenidium/redula/osphridium
  - (c) Earthworm- Septal nephridia
  - (d) squash preparation onion root tip
3. Dissection – (any 1)
  - (a) Earthworm- Digestive System, Nervous System, Reproductive System
  - (b) Prawn- Nervous System, Appendages
  - (c) Pila- Nervous System
4. Exercise related to frog and Chick embryology. (any 2)
5. Exercise related to cell biology – (any 2)
  - (a) Stages of mitotic and meiotic cell division
  - (b) Special types of Chromosome

**Distribution of Marks**

1. Dissection	08
2. Spotting	16
3. Mounting/ Squash Preparation	06
4. Exercise related to Embryology	05
5. Exercise related to Cell Biology	05
6. Viva –voce	05
7. Practical Record and collection	05

**Total 50**

**Professor & Head**  
 Department of Zoology  
 Govt. Madhav Vignyan Mahavidyalaya Ujjain

*Dr. Shivesh Pratap Singh*  
 Prof. & Head, Dept. of Zoology  
 Govt. Autonomous P.G. College, Satna (M.P.)  
 Chairman, Board of Studies, A.P.S. University, Rewa

*Dr. Ramesh*

(Prof. H.S. RATHORE)

*Dr. Shobha Shrivastava*  
*Dr. Usha Yadav*  
*Dr. M.S. Chouhan*  
*Dr. Ramesh*  
*Dr. Shivobhan*  
*Dr. Vinodini Singh*

*Dr. Ramesh*

(5)

Department of higher Education, Govt. of M.P.  
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उच्च शिक्षा विभाग, म.प्र. शासन  
 स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
 केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc. II year (Session-2018-19)  
 Paper : I  
 Subject/ विषय : Zoology  
 Title of Paper : Vertebrates and Evolution  
 Max. Mark/ अधिकतम अंक : ~~40~~ 40

**UNIT I**

1. Origin of Chordates, Classification of Phylum Chordate upto orders according to Parker and Haswell (Latest edition).
2. Urochordata- Type study of Herdmania
3. Cephalochordata- Type study of Amphioxus, Affinities of Amphioxus
4. Comparison between Petromyzon and Myxine.

**UNIT II**

1. Comparative account of integuments
2. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).
3. Comparative account of digestive system (Amphibia, Reptiles, Birds and Mammals).
4. Comparative account of respiratory system (Amphibia, Reptiles, Birds and Mammals).

**UNIT III**

1. Comparative account of aortic arches and heart.
2. Comparative account of brain.
3. Comparative account of Urinogenital system.
4. Placentation in mammals.

**UNIT IV**

1. Origin of life- modern concepts only.
2. Lamarckism, Darwinism.
3. Modern synthetic theories: Variations, Mutation, Isolation & Speciation
4. Adaptation and Mimicry
5. Micro, macro evolution and mega evolution.

**UNIT V**

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.

**Professor & Head**  
 Department of Zoology  
 Govt. Madhav Vigyan Mahavidyalaya Ujjain

Dr. N. S. S. Sinha  
 Dr. Suresh Pratap Sino  
 Prof. & Head, Dept. of Zoology  
 Govt. Autonomous P.G. College, Satn  
 Chairman, Board of Studies, A.P.S. Univr  
 Dr. Anurastane

Dr. C. L. Yachar  
 Dr. M. S. Chauhan  
 Dr. S. Hobha Shukla  
 28/4/17  
 28/4/17  
 28/4/17

*[Handwritten signature]*

Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.Sc. (Bio) 3 Years  
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उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा	:	B.Sc. II year (Session-2018-19)
Paper	:	II
Subject/ विषय	:	Zoology
Title of Paper	:	Animal Physiology and Bio-Chemistry
Max. Mark/ अधिकतम अंक	:	<del>40</del> 40

**Unit I: Nutrition and 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 Physiology 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 lymphoid system, immune response: cellular and humoral immunity

**Unit III: Regulatory Mechanisms of Enzymes and role of Vitamins**

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

**Unit IV: Neuromuscular Co- ordination**

1. Types of neurons and glial cells
2. Physiology of nerve impulse conduction.
3. Types and structure of Muscles
4. Theory of muscle contraction and its biochemistry.

**Unit V: Endocrine 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 and female Sex hormones.

Dr. Shivesh Pratap Singh  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

Professor & Head  
Department of Zoology  
Govt. Mahatma Jyoti Bapu Mahavidyalaya Ujjain

VCh  
Dr. N. K. ...  
Dr. Suresh Ralho

Dr. Ramesh Singh  
28.3/17

(Dr. Vinodini Nigam) O'ade  
Dr. Ullas Yadav 28/4/15  
Dr. Shobha Shukla  
Dr. Shivastava 28/1/17  
Dr. Shobha Shukla  
Shobha

Dr. Shobha Shukla



B.Sc. - II Year - Zoology

Books of MP Hindi Granth Academy

- Parker & Haswall : Text book of Vertebrate Zoology
- Kotpal, RL : Vertebrate
- Jordan, EL and Verma, PS : Chordate Zoology
- Rastogi, VB : Organic Evolution
- Singh and Chaturvedi : Organic Evolution
- Ernst W. Mayr : Evolution and the Diversity of life
- Colbert : Evolution
- Verma, PS and Agrawal, VK : Cell Biology, Genetics, Molecular Biology, Evolution
- Verma PS : Animal Physiology
- Nigam, HL : Animal Physiology
- Wood, DW : Principle of Animal Physiology
- Berry, AK : Animal Physiology and Biochemistry
- Prosser, CL : Comparative Animal Physiology
- Goyal and Shastri : Animal Physiology
- Shrivastava, HS : Biochemistry
- Lehninger : Biochemistry

**Professor & Head**  
 Department of Zoology  
 Govt. Madhav Vigyan Mahavidyalaya, Rewa

*Dr. Shivesh Pratap Singh*  
 Prof. & Head, Dept. of Zoology  
 Govt. Autonomous P.G. College, Satna (M.P.)  
 Chairman, Board of Studies, A.P.S. University, Rewa

*Rathore*  
 28.6.17  
 (Dr. H.S. Rathore)

*Buys*  
 28.4.17  
 (Dr. Ramesh Singh)

*Jaisam*  
 28.4.17  
 (Dr. Vinodhini Nigam)

*N.S. Sahni*  
 (Dr. N. Sahni)

*PSB*  
 28/4/17  
 (Dr. C.S. Shrivastava)

*Shrivastava*  
 28/4/17  
 (Dr. Rajiv Shrivastava)

*Shrivastava*  
 28.4.17  
 (Dr. Shobha Shrivastava)

*C. Banerjee*  
 (Dr. C. Banerjee)

*Gyada*  
 28/4/17  
 (Dr. Utkarsh Gyada)

*Anita Salunkhi*  
 28/04/17  
 (Dr. Anita Salunkhi)

*Dr. Anita Salunkhi*

Department of higher Education, Govt. of M.P.  
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उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc. II year (Session-2018-19)  
Subject/ विषय : Zoology Practical  
Max. Mark/ अधिकतम अंक : 50

1. Dissections of commercially available species of locally available Fishes (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, Asiatic chital, Archeopteryx, Peripatus, etc.
4. Osteology : Limb bones and girdle bones of Frog, Varanus, Pigeon and Rabbit.
5. Detection of Protein, Carbohydrate and Lipid / Study of Human salivary enzyme activity in relation to pH.
6. Hematological Experiment- RBC and WBC counting / Blood grouping in blood samples / Estimation of Hemoglobin 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 Digestive and Visceral organs - T.S of Stomach , T.S of Intestine, T.S of Pancreas T. S. of Liver, T.S of Lungs and L.S. of Kidney

**Distribution of Marks**

1. Dissection	08
2. Spot related to evolution	05
3. Spotting (4 spot, 2 Bones, 2 Slides)	16
4. Biochemical test / Enzyme activity	05
5. Hematological Experiment	06
4. Viva -voce	05
7. Record	05

Total 50 **Professor & Head**  
Department of Zoology

Govt. Madhav Vidyapeeth, Jabalpur

*Dr. Shivesh Pratap Singh*  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

*Dr. Shobha Shouche*

*(Dr. Vinodini Nigam)*

*Dr. S. Shrivastava*  
*(Dr. M. S. Chauhan)*

*Dr. Ramesh Singh*  
28/4/17

*(Dr. N. S. Rathi)*  
*(Dr. H. S. Rathore)*

*(Signature)*

Department of higher Education, Govt. of M.P.  
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उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc. III year (Session-2019-20)  
Paper : I  
Subject/ विषय : Zoology  
Title of Paper : Genetics  
Max. Mark/ अधिकतम अंक : 40

**UNIT I : Heredity and Genetic material**

1. Mendel's laws of heredity.
2. Variations- sources and types
3. Structure, molecular organization and function of DNA and RNA and types of RNA
4. DNA replication in Prokaryotes.
5. Nucleosome (Solenoid model)

**UNIT II Gene Expression**

1. Genetic Code
2. Transcription in Prokaryotes
3. Translation in Prokaryotes
4. Gene expression: Regulation of protein synthesis and Lac operon model.
5. Split gene, overlapping gene, pseudo gene

**UNIT III : Linkage and Chromosomal aberration**

1. Linkage and crossing over- Types and significance
2. Sex determination- Chromosomal and genetic balance theory.
3. Sex linked inheritance (Haemophilia, colour blindness)
4. Structural and numerical changes in chromosomes
5. Mutation-Types and Mutagens

**UNIT IV : Human Genetics**

1. Human Karyotype
2. Human Genome Project
3. Multiple allele and inheritance of blood group
3. Autosomal and Sex Chromosome Syndromes in human
4. Genetic diseases in human- Sickle cell anaemia, Albinism and Thalassemia

**UNIT V : Genetic Engineering**

1. Recombinant DNA technology and Gene Cloning
2. Polymerase chain reaction.
3. Blotting- Southern and Northern
4. DNA finger printing
5. Gene therapy

**Professor & Head**  
Department of Zoology  
Govt. Madhav Vigyan Mahavidyalaya Ujjain

*(Dr. Vinodini Nigam)*  
28.4.17  
*(Dr. Ramesh Singh)*  
*(Dr. Ujjwal Jaiswal)*  
*(Dr. Shobha Shrivastava)*

*(Dr. N. S. Jaiswal)*  
*(Dr. N. S. Jaiswal)*  
*(Dr. N. S. Jaiswal)*

*(Dr. Shivesh Pratap Singh)*  
-Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)

*(Signature)*

Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.sc (Bio) 3 Years  
As recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा	:	B.sc III year (Session-2019-20)
Paper	:	II
Subject/ विषय	:	Zoology
Title of Paper	:	Ecology and Applied Zoology
Max. Mark/ अधिकतम अंक	:	<del>40</del> 40

<b>Unit-I Concept of Ecology</b> 1. Abiotic and biotic factors, Component of ecosystem. 2. Energy flow in ecosystem : Food chain, Food web and Pyramids. 3. Biogeochemical cycle : Carbon, Oxygen, Nitrogen, Phosphorus 4. Population Concept – Characteristics of population. Factors affecting Population growth.
<b>Unit-II Habitat Ecology</b> 1. Fresh water , marine and terrestrial habitat 2. Ecological division of India. 3. Biodiversity : Natural resources and their conservation with special reference to forests.
<b>Unit-III Wild Life and Environment</b> 1. Wild life Protection Act ,National Parks and Sanctuaries of Madhya Pradesh. 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.
<b>Unit-IV Aquaculture</b> 1. Prawn culture: Culture of fresh water prawn , methods of prawn fishing , preservation and processing of prawns 2. Pearl culture and pearl industry. 3. Frog culture. 4. Major carp culture : Management of ponds , preservation and processing of fishes. 5. Maintenance of Aquarium.
<b>Unit-V Economic Entomology</b> 1. Sericulture: Species of silkworm, life history of <i>Bombyx mori</i> , Sericulture Industry in India. 2. Apiculture – Life cycle of the honey bee, methods of bee keeping, products of bees, enemies of bees. 3. Lac culture: Lifecycle of lac insect and host plant of lac insects. 4. Common pests: Stored grains: <i>Sitophilus oryzae</i> and <i>Tribolium castanae</i> Vegetable pest: <i>Piers brassicae</i> and <i>Dacus cucurbitae</i> . 5. Biological control of insect pests.

Professor & Head  
Department of Zoology  
Govt. Madhav Vigyan Mahavidyalaya Ujjain

Dr. Shivesh Pratap Singh  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

Dr. Vinod Chandra Nigam  
Dr. N. S. Singh  
Dr. S. S. Singh

Dr. Ujjwal Yadav  
28/4/17  
Dr. Ramesh Singh  
28/4/17

Signature

Signature

B.Sc. - III Year - Zoology

Books of MP Hindi Granth Academy

- Lewin : Genetics (Latest Edition Strickberger : Genetics)
- Gardner, MJ : Principles of Genetics
- Singh, BD : Genetics
- Singh, BD : Biotechnology
- Gupta, PK : Genetics
- Gupta, PK : Molecular Biology and Genetic Engineering
- Verma, PS and Agrawal, VK : Genetics
- Purohit : Biotechnology
- Kohli and Ansar : Economic Zoology
- Kohli : Ecology
- Odum, EP : Fundamental of Ecology
- Sharma PD : Environmental Biology and Toxicology
- Natrajan, SS : A Manual of Fresh Water Aquaculture
- Upadhaya : Economic Zoology

Pal Ajay : Cellular & Molecular Biology

Pragya Khanna

Cell & Molecular Biology

**Professor & Head**  
 Department of Zoology  
 Madhav Vigyan Mahavidyalaya Ujjain

Prathom  
 28.4.17  
 (Prof. H.S. Prathom)

Shrivastava  
 28/4/17  
 Dr. S.S. Shrivastava

Dr. Shivesh Pratap Singh  
 Prof. & Head, Dept. of Zoology  
 Govt. Autonomous P.G. College, Satna (M.P.)  
 Chairman, Board of Studies, A.P.S. University, Rewa

Dr. Roushdy Singh  
 28.4.17  
 (Dr. Roushdy Singh)

Rajiv Shrivastava  
 28/4/17  
 (Dr. Rajiv Shrivastava)

Dr. Celica Yadav  
 28/4/17  
 (Dr. Celica Yadav)

Dr. N. Sakai  
 (Dr. N. Sakai)

Dr. Vinodini Nigam  
 28.4.17  
 (Dr. Vinodini Nigam)

Dr. Shobha Shouche  
 28.4.17  
 (Dr. Shobha Shouche)

Dr. Anita Solanki  
 28/04/17  
 (Dr. Anita Solanki)

Dr. C. B. Singh  
 (Dr. C. B. Singh)

[Signature]

Under Graduate Syllabus for B.Sc. (Bio) 3 Years  
As recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc. III year (Session-2019-20)  
Subject/ विषय : Zoology Practical  
Max. Mark/ अधिकतम अंक : 50

The practical's work will be as per theory syllabus and the candidates will be required to the show the knowledge of the following :-

1. Study of fresh water, marine and terrestrial fauna, Major carps, Common stored grain pest and vegetable pest
2. Water analysis – Dissolve Oxygen, pH, Hardness, Turbidity.
3. Study of Ecosystems and maintenance of Aquarium
4. Study of instrument related to Genetics- Centrifuge, PCR, Gel electrophoresis, DNA finger printing.
5. Wild life - Endangered species.
6. Life cycle of silkworm, Honey Bee, Lac insect

Distribution of Marks

1. Spotting	
2. Analysis of water	12
3. Exercise based on wildlife	04
4. Ecosystem	05
5. Study of Instruments	04
6. Problem on Genetics	05
7. Life Cycle	05
8. Viva -voce	05
9. Practical Record and collection	05

Total	50	<i>Professor Head</i>
Department of Zoology		
Govt. Madhav Vigyan Mahavidyalaya Ujjain		

*Dr. Shivesh Pratap Singh*  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Setna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

*Dr. Shobha Shauchi*  
*Dr. Ulke Yadav*  
28/4/17

*Prof. H.S. Rathore*  
(Prof. H.S. Rathore)

*Dr. C.S. Shivastava*  
(Dr. M.S. Choudhary) (Dr. Rousha Saha)

*Dr. Rajiv Shevaram*  
(Dr. Vinodini Nigam)

*MSB*

*28/4/17*

*MSB*

⑬

Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.Sc (Bio) 3 YearS  
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उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc I year (Session-2017-18)  
Paper : I  
Subject/ विषय : प्राणीशास्त्र  
Title of Paper : अकशेरुकी  
Max. Mark/ अधिकतम अंक : ~~40~~ 40

**इकाई I**

1. प्रणिकीय नामकरण एवं अंतर्राष्ट्रीय कोड का सामान्य अध्ययन
2. निम्नतर अकशेरुकी प्रणियों का वर्गीकरण (पारकर एवं हेजवेल का 7वाँ संस्करण अनुसार)  
(i) प्रोटोजोआ (ii) पोरीफेरा (iii) सीलेंट्रेटा (iv) हेल्मिंथस
3. उच्चतर अकशेरुकी प्रणियों का वर्गीकरण (पारकर एवं हेजवेल का 7वाँ संस्करण अनुसार)  
(i) ऐनेलिडा (ii) आर्थोपोडा (iii) मोलस्का (iv) इकाइनोडर्मेटा (v) हेमीकार्डेटा

**इकाई II**

1. प्रोटोजोआ- प्लाजमोडियम का प्रारूप अध्ययन
2. प्रोटोजोआ एवं रोग
3. पोरीफेरा- साइकोन का प्रारूप अध्ययन
4. सीलेंट्रेटा- ओबेलिया का प्रारूप अध्ययन
5. प्रवाल एवं प्रवाल-भित्ति का निर्माण

**इकाई III**

1. हेल्मिंथस- फेसिओला का प्रारूप अध्ययन
2. नेमटोडा एवं रोग
3. ऐनेलिडा- केंचुए का प्रारूप अध्ययन (फेरीटिमा)
4. ऐनेलिडा में मेटामेरीज्म
5. ट्रोकोफोर लार्वा की संरचना एवं महत्व

**इकाई IV**

1. आर्थोपोडा - डीप्टेरा का प्रारूप अध्ययन (पेलीमोन)
2. क्रस्टेशिया के लार्वा
3. मानव रोगों के वाहक कीट
4. मोलस्का - पाइला का प्रारूप अध्ययन (एपल घोंघा)
5. मोलस्का के लार्वा

**इकाई V**

1. इकाइनोडर्मेटा - तारा गछली की वाह्य संरचना एवं जल संवहन तंत्र
2. इकाइनोडर्मेटा के लार्वा
3. माइनर फाइला- एक्टोप्रोक्टा एवं रोटीफेरा
4. हेमीकार्डेटा - वैलेनोग्लारसस का प्रारूप अध्ययन
5. वैलेनोग्लारसस की बंधुता

**Professor & Head**  
Department of Zoology  
Govt. Madhav Vigyan Mahavidyalaya Ujjain

28/4/17

28/4/17

28/4/17

28/4/17

(Dr. M. S. Choudhary)

(Dr. Rajwinderpal Singh)

(Dr. Ramsha Singh)

(Dr. Shobha Shauki)

28/4/17

28/4/17

28/4/17

28/4/17

28/4/17

(12)

Under Graduate Syllabus for B.Sc (Bio) 3 Years  
AS recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc I year (Session-2017-18)  
Paper : II  
Subject/ विषय : प्राणीशास्त्र  
Title of Paper : कोशिका विज्ञान एवं भ्रौणिकी विकास  
Max. Mark/ अधिकतम अंक : ~~40~~ 40

**इकाई I**

1. कोशिका विज्ञान का इतिहास, कोशिका सिद्धांत
2. प्रोकैरियोटिक एवं यूकैरियोटिक कोशिका
3. गोल्जी बॉडी, एन्डोप्लाज्मिक रेटिकुलम, लाइसोसोम की संरचना एवं कार्य
4. माइटोकॉन्ड्रियाँ, राइबोसोम, सेंट्रिओल, माइक्रोसोम की संरचना एवं कार्य

**इकाई II**

1. केंद्रक एवं केंद्रिका की संरचना एवं कार्य
2. प्रारूपिक गुणसूत्र की संरचना एवं कार्य
3. विशेष प्रकार के गुणसूत्र - लेम्बोब्रुश एवं पॉलीटीन
4. केंद्रक-कोशिकाद्रवीय पारस्परिक क्रिया
5. कोशिका चक्र, समसूत्री एवं अर्ध सूत्री कोशिका विभाजन

**इकाई III**

1. शुक्राणुजनन
2. अंडाणुजनन
3. निषेचन
4. अनिषेकजनन
5. पुनरुद्भवन

**इकाई IV : मेढक का विकास**

1. विदलन
2. क्ल्यास्टुलेशन
3. फेटमेप का निर्माण
4. गेस्टूलेशन एवं तीन जनन स्तरों का निर्माण
5. टैंडपोल लार्वा की संरचना

**इकाई V : चूजे का विकास**

1. विदलन
2. क्ल्यास्टुलेशन
3. फेटमेप का निर्माण
4. गेस्टूलेशन
5. प्रिमिटिव र्टीक बनने तक चूजे के भ्रूण का विकास
6. चूजे में बाह्य भ्रूण झिल्लियाँ

**Professor & Head**  
Department of Zoology

Govt. Madhav Vigyan Mahavidyalaya Ujjain

(Prof. H.S. Kathiwar) 28.1.17

Dr. C.S. Shivabhan (28/1/17)

Dr. Utkarsh Yadav (28/1/17)

Dr. Shivesh Pratap Singh (28/1/17)  
Prof. & Head, Dept. of Zoology  
Gallane Satna (M.P.)

Dr. Rajwadevarstand (28/1/17)

Dr. Vinodini Nigam (28/1/17)

Dr. Shobha Shauki (28/1/17)

Dr. C. Basu



13

Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.Sc (Bio) 3 Years  
AS recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा : B.Sc II year (Session-2018-19)  
Paper : 1  
Subject/ विषय : प्राणीशास्त्र  
Title of Paper : कशेरुकी ओर उद्विकास  
Max. Mark/ अधिकतम अंक : ~~40~~ 40

**इकाई I :**

1. रज्जुकियों की उत्पत्ति, रज्जुकियों का गण स्तर तक वर्गीकरण (पारकर एवं हेसवेल के नवीन संस्करण अनुसार)
2. यूरोकार्डेटा - हर्डमानिया का अध्ययन
3. सिफैलोकॉर्डेटा- एम्फीऑक्सस का अध्ययन, एम्फीऑक्सस की सजातियता
4. ट्रैटोमाइजॉन एवं मिक्सीन की तुलना

**इकाई II :**

1. अध्यावरण का तुलनात्मक विवरण
2. कशेरुकी में पादस्थियाँ तथा मेखला का तुलनात्मक विवरण (उभयचर, सरीसृप, पक्षी एवं स्तनीयों में)
3. पाचन तंत्र का तुलनात्मक विवरण (उभयचर, सरीसृप, पक्षी एवं स्तनीयों में)
4. श्वसन तंत्र का तुलनात्मक विवरण (उभयचर, सरीसृप, पक्षी एवं स्तनीयों में)

**इकाई III :**

1. हृदय एवं एऑटिक आर्सेस का तुलनात्मक विवरण
2. मरिषक का तुलनात्मक विवरण
3. मूत्रजनन तंत्र का तुलनात्मक विवरण
4. स्तनी में जरायु विन्यास

**इकाई IV :**

1. जीवन की उत्पत्ति- आधुनिक संकल्पना
2. लेमार्कवाद, डार्विनवाद
3. आधुनिक संश्लेषण सिद्धांत - विभिन्नताएँ, उत्परिवर्तन, पृथक्करण एवं जातीय उद्भव
4. अनुकूलन एवं अनुहरण
5. गाइक्रो, मेक्रो एवं मेगा उद्विकास

**इकाई V :**

1. जीवाश्म, जीवाश्म बनने की विधियाँ, जीवाश्मों की आयु का निर्धारण
2. विलुप्त प्राणियों का अध्ययन- डाइनोसॉर्स एवं आर्किओप्टेरिक्स
3. जंतु भौगोलिक वितरण
4. मानव का उद्विकास
5. भूगर्भीय समय-तालिका और इन्सूलर जंतु-जगत

**Professor & Head**  
Department of Zoology

Govt. Mahav. Vidyapeeth, Mahavidyalaya Ujjain

L. S. Rathore (28/4/17)  
 Prof. H. J. Rathore (28/4/17)  
 Dr. Rajiv Shrivastava (28/4/17)  
 Dr. S. Shrivastava (28/4/17)  
 Dr. Shobha Shrivastava (28/4/17)  
 Dr. M. S. Chouhan (28/4/17)  
 Dr. Ram Singh (28/4/17)  
 Dr. Usha Yadav (28/4/17)  
 Dr. Anita Salunkhi (28/4/17)  
 Dr. Anil (28/4/17)

AMN

Department of higher Education, Govt. of M.P.  
 Under Graduate Syllabus for B.Sc (Bio) 3 Year  
 AS recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
 स्नातक कक्षाओं के लिये त्रिवर्षीय पाठ्यक्रम  
 केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशंसित

Class / कक्षा	:	B.Sc II year (Session-2018-19)
Paper	:	II
Subject/ विषय	:	प्राणीशास्त्र
Title of Paper	:	जन्तु कार्यिकी एवं जैव-रसायनिकी
Max. Mark/ अधिकतम अंक	:	<del>40</del> 40

**इकाई I : पाचन एवं कार्यिकी**

1. स्तनधारियों में पाचन की कार्यिकी
2. प्रोटीन उपापचय -- निअमोनीकरण, विकारबोवसीलेशन अमीनो अम्ल का अमाइनी अनुअंतरण एवं ऑर्निथिन चक्र
3. कार्बोहाइड्रेट उपापचय -- ग्लाइकोजेनेसिस, ग्लाइकोजिनोलाइसिस, ग्लाइकोलाइसिस, साइट्रिक अम्ल चक्र
4. वसा उपापचय -- वसीय अम्ल का दीटा ऑक्सीकरण

**इकाई II : श्वसन, उत्सर्जन एवं प्रतिरक्षा तंत्र**

1. स्तनधारियों में श्वसन तंत्र की कार्यिकी एवं क्रियाविधि (वायवीय परिवहन एवं क्लोराइड शिफ्ट)
2. उत्सर्जन की कार्यिकी -- स्तनधारियों में यूरिया तथा यूरिन की निर्माण विधि
3. सहज एवं अर्जित प्रतिरक्षा प्रणाली, प्रतिरक्षा कोशाएं तथा लिम्फोइड तंत्र, प्रतिरक्षा प्रतिक्रिया, कोशिकीय तथा ह्यूमोरल प्रतिरक्षा

**इकाई III : एन्जाइम्स की नियमन क्रियाविधि तथा एवं विटामिन्स के कार्य**

1. तापनियमन
2. एन्जाइम की परिभाषा, नामकरण एवं वर्गीकरण
3. एन्जाइम की क्रियाविधि
4. सह-एन्जाइम
5. विटामिन्स

**इकाई IV : तंत्रिका-पेशीय समन्वय**

1. न्यूरोन्स के प्रकार तथा ग्लिअल कोशिकाएं
2. तंत्रिक आवेग संचरण की कार्यिकी
3. पेशीय संरचना एवं पेशियों के प्रकार
4. पेशीय संकुचन का सिद्धांत तथा उसकी जैवरसायनिकी

**इकाई V : अन्तस्त्रावी तंत्र**

1. पियूष ग्रंथी की रचना एवं कार्य
2. थायरॉइड ग्रंथी की रचना एवं कार्य
3. अधिवृक्क ग्रंथी की रचना एवं कार्य
4. पैराथायराइड थायमस, आइलेट्स ऑफ लैंगरहेन्स की रचना एवं कार्य
5. नर एवं मादा के जनन हार्मोंस की कार्यिकी

*Professor & Head*  
**Department of Zoology**  
 Govt. Madhav Vigyan Mahavidyalaya Ujjain

*(Dr. S. Smirnov)*  
*(Dr. Anuradha Solanki)*  
*(Dr. Shiv Prasad)*  
*(Dr. Rajiv Shrivastava)*  
*(Dr. Shobha Shouche)*  
*(Dr. Ramesh Singh)*  
*(Dr. C. Basu)*  
*(Dr. Shivesh Pratap Singh)*  
 Prof. & Head, Dept. of Zoology  
 Govt. Autonomous P.G. College, Satna (M.P.)  
 Chairman, Board of Studies, A.P.S. University, Rewa  
*(Dr. Utkarsh Padav)*

Under Graduate Syllabus for B.Sc (Bio) 3 Years  
AS recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुशासित

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Class / कक्षा : B.Sc III year (Session-2019-20)  
Paper : I  
Subject/ विषय : प्राणीशास्त्र  
Title of Paper : अनुवांशिकी  
Max. Mark/ अधिकतम अंक : 40

इकाई I : अनुवांशिकता तथा अनुवांशिक पदार्थ

1. मेंडल के अनुवांशिकता के नियम
2. विभिन्नताये :- स्रोत तथा प्रकार
3. डी.एन.ए. एवं आर.एन.ए. की संरचना, आणविक संगठन एवं कार्य तथा आर.एन.ए. के प्रकार
4. प्रोकेरियोट्स में डी.एन.ए का द्विगुणन
5. न्यूक्लियोसोम (सोलीनाइड मॉडल)

इकाई II :- जीन अभिव्यक्ति

1. अनुवांशिक कूट
2. प्रोकेरियोट्स में अनुलेखन
3. प्रोकेरियोट्स में अनुवाद
4. जीन अभिव्यक्ति : प्रोटीन संश्लेषण का नियम तथा ओपेरॉन मॉडल
5. स्प्लिट जीन, ओवरलैपिंग जीन, स्फूडोजीन

इकाई III :- सहलग्नता तथा गुणसूत्रीय विपथन

1. सहलग्नता तथा क्रॉसिंग ओवर :- प्रकार तथा महत्व
2. लिंग निर्धारण - गुणसूत्रीय तथा अनुवांशिक संतुलन सिद्धांत
3. लिंग सहलग्न अनुवांशिकता - हीमोफिलिया, वर्णान्धता
4. गुणसूत्रों में संरचनात्मक तथा संख्यात्मक परिवर्तन
5. उत्परिवर्तन - प्रकार तथा म्यूटोजेन

इकाई IV :- मानव अनुवांशिकता

1. मानव केरियोटाइप
2. मानव जीनोम प्रोजेक्ट
3. बहुविकल्पी तथा रक्त समूह की अनुवांशिकता
4. मानव में ऑटोसोमल तथा लिंग गुणसूत्रीय सिन्ड्रोम्स
5. मानव में अनुवांशिकीय विमारियाँ - सिकल सेल एनीमिया, एल्डिनिज्म, थैलेसीमिया

इकाई V :- अनुवांशिकी अभियांत्रिकी

1. रिक्त स्थानों में डी.एन.ए. तकनीक तथा जीन क्लोनिंग
2. पॉलीमरेज अभिक्रिया श्रृंखला
3. ब्लॉटिंग - सदर्न तथा नार्दन
4. डी.एन.ए अंगुली छापन
5. जीन थेरेपी

Professor & Head  
Department of Zoology

Govt. Madhav Vigyan Mahavidyalaya, Itanagar

Dr. C.S. Shivastava  
28/4/17

Dr. M.S. Ghoshal  
28/4/17

Dr. Shivesh Pratap Singh  
Prof. & Head, Dept. of Zoology  
Govt. Autonomous P.G. College, Satna (M.P.)  
Chairman, Board of Studies, A.P.S. University, Rewa

Dr. Rajni Shivastava  
28/4/17

Dr. Vinod Mishra  
28/4/17

Dr. Usha Yadav  
28/4/17

Dr. Shobha Shouk

(18)

Department of higher Education, Govt. of M.P.  
Under Graduate Syllabus for B.Sc (Bio) 3 Year  
AS recommended by Central Board of Studies in Zoology

उच्च शिक्षा विभाग, म.प्र. शासन  
स्नातक कक्षाओं के लिए त्रिवर्षीय पाठ्यक्रम  
केन्द्रीय अध्ययन मण्डल प्राणीशास्त्र द्वारा अनुसंसित

Class / कक्षा	:	B.Sc III year (Session-2019-20)
Paper	:	II
Subject/ विषय	:	प्राणीशास्त्र
Title of Paper	:	पारिस्थितिकी एवं व्यवहारिक प्राणी शास्त्र
Max. Mark/ अधिकतम अंक	:	42 <sup>1/2</sup>

**इकाई-I पारिस्थितिकी की अवधारणा :-**

1. अजैविक एवं जैविक घटक, पारिस्थितिकी तंत्र के घटक
2. पारिस्थितिकी तंत्र में उर्जा प्रवाह श्रृंखला, खाद्य जाल तथा पिरामिड
3. जैवभूरासायनिक चक्र- कार्बन, ऑक्सीजन, नाइट्रोजन तथा फॉस्फोरस
4. जनसंख्या अवधारणा: जनसंख्या की विशेषताएँ, जनसंख्या वृद्धि को प्रभावित करने वाले कारक

**इकाई-II आवासीय पारिस्थितिकी :-**

1. स्वच्छ जलीय, समुद्रीय तथा स्थलीय आवास
2. भारत का पारिस्थितिकीय विभाजन
3. जैवविविधता, प्राकृतिक संसाधन तथा उसका संरक्षण (विशेष रूप से वनों के संदर्भ में)

**इकाई-III वन्य जीव एवं पर्यावरण :-**

1. वन्यजीव संरक्षण अधिनियम, मध्य प्रदेश के राष्ट्रीय उद्यान तथा अभ्यारण्य
2. भारत की संकटापन्न प्रजातियाँ
3. प्रदूषण के प्रकार: वायु, जल, भूमि, तापीय तथा ध्वनि प्रदूषण
4. नगरीयकरण तथा पर्यावरण पर मानव जनसंख्या का प्रभाव

**इकाई-IV जलसंवर्धन :-**

1. झींगा संवर्धन :- स्वच्छ जलीय झींगा संवर्धन, झींगा मत्स्यन, संरक्षण एवं प्रक्रमण ।
2. गोती संवर्धन तथा मोती उद्योग ।
3. मेढक संवर्धन
4. मेजर कार्प संवर्धन:- तालाब प्रबंधन, मत्स्य परिरक्षण एवं प्रक्रमण
5. जलशाला एवं उसका प्रबंधन

**इकाई-V व्यावसायिक कीट विज्ञान :-**

1. रेशमकीट संवर्धन:- रेशमकीट प्रजातियाँ, बॉम्बेक्स मोरी का जीवन चक्र, भारत में रेशम उद्योग
2. मधुमक्खी पालन :- मधुमक्खी का जीवन चक्र, संवर्धन, मधुमक्खी के उत्पाद, मधुमक्खी के शत्रु
3. लाख कीट संवर्धन :- लाख कीट का जीवन चक्र तथा लाख कीट के पोषक पादप
4. सामान्य पीड़क:- संडारित अनाजों के पीड़क - 1. साइटोफिलस ओराइजी तथा ट्राइबोलियम कैस्टेनियम। 2. सब्जियों के पीड़क:- पायरस ब्रैसिका तथा डैक्स कुकराबिटी
5. कीट पीड़कों का जैविक नियंत्रण

Dr. C. S. Shivabharan (Dr. Vinodini Nigam) (Dr. Shobha Shouche) (Dr. Rajni Bhuyastana) (Dr. Anil Solanki) (Dr. Shivesh Pratap Singh)

Dr. Usha Yadav

*(Signature)*

PROPOSED SYLLABUS FOR B.Sc. BIOTECHNOLOGY

CENTRAL BOARD OF STUDIES

(Held On 27-28 April 2017)

B.Sc I Year	Title of the Paper	Theory	Internals	Total
BT-101	Cell Structure & Biology	25 40	25 10	50
BT-102	Microbiology	25 40	25 10	50
BT-103	Laboratory			50
				150

B.Sc II Year	Title of the Paper	Theory	Internals	Total
BT-201	Biophysics & Biochemistry	25 40	25 10	50
BT-202	Bioinstrumentation, Biostatistics & Bioinformatics	25 40	25 10	50
BT-203	Laboratory			50
				150

B.Sc III Year	Title of the Paper	Theory	Internals	Total
BT-301	Molecular Biology & Genetic Engineering	25 40	25 10	50
BT-302	Applied Biotechnology	25 40	25 10	50
BT-303	Laboratory			50
				150

GRAND TOTAL- 450

*Sishaque*  
15/7/17  
Prof. *Sishaque*  
Professor & Head  
Department of Zoology  
Vikram University, Ujjain

*[Signature]*  
1. *[Signature]*

*[Signature]*  
Dr. Anil Kumar

*[Signature]*  
B. D. S. Rathore  
*[Signature]*  
Deepa Rathore

*[Signature]*  
P. K. Singh

*[Signature]*  
22/7/17  
Prof. Dr. H.S. RATHORE  
DEAN  
Faculty of Life Sciences  
Vikram University,  
UJJAIN, 456 010, India

*[Signature]*

Paper I : Cell Structure and Biology

Unit-I:

Cell Structure & Theory. Structure of prokaryotic cell, Eubacteria and Archaeobacteria. Size, shape and arrangement of bacterial cells. Gram's positive and Gram's negative cells.

Structure of Eukaryotic cell, plant cells, animal cells. Difference between prokaryotic and eukaryotic cells.

Unit-II:

Structure and function of bacterial cell - flagella, pili. Cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic granules, spores and cysts.

Structure and function of eukaryotic cell - Cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, Centriole, Lysosome.

Unit-III:


Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, Cell-cell interactions, Cell locomotion, Cell differentiation.

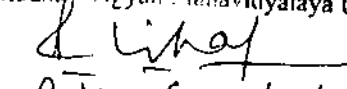
Unit-IV:

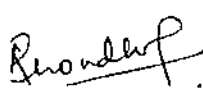
Transport Process: Cell Membrane: Models of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their roles. Transport across membranes - active and passive diffusion, mechanisms.


Unit-V:

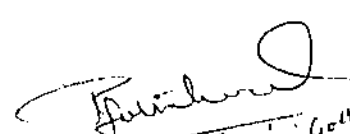
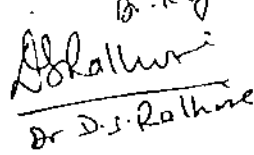

Introduction to Necrosis, Senescence, Apoptosis - Programmed cell death. Mechanism of Apoptosis. Intrinsic & Extrinsic pathways of cell death. Apoptosis in relation to Cancer. Oncogenes - Types of cancer.

  
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Govt. Madhav Vigyan Mahavidyalaya Ujjain

  
P.K. Singh



  
Dr Anil Kumar

  
Dr. D.S. Rathore  
  
Dr D.S. Rathore  
  
Dr D.S. Rathore

## Paper-II: Microbiology

## Unit-I:

Introduction of Microbiology - History, Applications & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification, Microbial Taxonomy. Classification and identification of Bacteria, Bergey's manual.

## Unit-II:

Structure and Diversity of Bacteria & Virus, Microbes in extreme environment, Nutritional requirement of microbes.

Bacteriology: Morphology and ultra structure of bacteriomorphological types, Archaeobacteria, Structure and function of cell organelles.

## Unit-III:

Structure and Diversity of Algae, Fungi, Protozoans, Mycoplasmas and Extremophiles. General characteristics, Various methods of staining - simple, Gram, endospore, capsule, flagella and negative staining, Fungal stains, Algal stains.

## Unit-IV: Microbial Growth

Microbial growth - mathematical expression of growth, growth curve, factors affecting growth, Batch, continuous, synchronous and diauxic growth, Quantification of microbial growth.

Control of micro organisms - physical & chemical, Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol-coefficient.

## Unit-V:

Microbial Nutrition and metabolism - Microbial Metabolism - Concept of Anabolism & catabolism processes, Nitrogen Fixation - Types and mechanisms, Microbial disease in plants & Animals (Only General concept).

Fermentation Process - Fermenter & its microbes of industrial importance.

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 Professor & Head  
 Department of Zoology  
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3

*Dr. Anil Kumar*  
 Dr. D. S. Rathore

*Dr. Pooja Kulkarni*  
 Dr. Pooja Kulkarni  
 Dr. Pooja Kulkarni  
 Dr. Pooja Kulkarni

*Dr. Anjali Choudhary*  
 Dr. Anjali Choudhary

BT-103 Laboratory

List of Practicals

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells, Muscles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization of flagellin.
8. Viable cell counting using haematocytometer.
9. Measurement of cell by light microscope:-  
Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, Cleaning of glassware, Preparation of cotton plugging and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by Pour plate, Spread Plate Methods.
16. Staining Method—Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining, shape and size.
18. Antibiotic Sensitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterisation of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note: 70% of the above list should be compulsorily performed.

*P.K. Singh*  
P.K. Singh

Professor & Head  
Department of Zoology  
Govt. Madhav Vignyan Mahavidyalaya Ujjain

*Dr. Anil Kumar*  
Dr. Anil Kumar

*Dr. D. S. Rath*  
Dr. D. S. Rath

*Dr. Anjali Choudhary*  
Dr. Anjali Choudhary

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Dr. Anjali Choudhary

*Dr. D. S. Rath*  
Dr. D. S. Rath

*Dr. Anjali Choudhary*  
Dr. Anjali Choudhary



Scheme of Practical Examination

MM: 50

Duration: 3 Hrs

1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)

Suggested Reading

1. Cell and molecular. Biology: P.K.Gupta
2. Cell & Molecular biology: S.C.Rastogi
3. Molecular Biology of Cells, (2002), Alberts's et. al.
4. Cell Biology, P.S. Verma & Agarwal.
5. Text book of Microbiology by R.C.Dubey
6. A Text book of Microbiology -Dubey and Maheshwari
7. Essentials of Microbiology -K.S.Bilgrami /R.K.Sinha
8. Microbiology P.D.Sharma
9. General Microbiology Vol.I & II Pawar & Dagniwala.
10. Applied Microbiology P.D.Sharma
11. Microbiology Fundamentals & Applications -S.S.Purohit
12. Experiments in Microbiology ,Plant Pathology & Biotechnology -K.R.Aneja
13. Fundamentals of Microbiology & Immunology By A.K.Banerjee.Nimalaya Banerjee
14. Modern Concept of Microbiology H.D.Kumar&Swati Kumar

*P.K. Singh*  
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*Dr. Anil Kumar*

*D.S. Rathore*  
Dr. D.S. Rathore

*Deepa Rathore*  
Deepa Rathore

*Dr. Anjali Choudhary*  
Dr. Anjali Choudhary

*Dr. Pooja Choudhary*  
Dr. Pooja Choudhary

*Dr. Pooja Choudhary*  
Dr. Pooja Choudhary

Paper-I: Biophysics and Biochemistry

Unit-I:

Thermodynamics: Thermodynamic System, Equilibrium, Thermodynamic laws and their applications. Different types of processes. Thermodynamic variables and Entropy. Thermodynamic potentials and relations, Maxwell's Equations. Fundamental equation of heat flow.

Unit-II:

General Biophysical methods: Measurement of pH. Radioactive labeling & counting. Autoradiography. Diffusion. Sedimentation. Osmosis. Viscosity- definitions. factors influencing them and their applications in biology.

Bragg's equation. Reciprocal lattice. Miller indices & Unit cell. Concept of different crystal structure. determination of crystal structure.

Unit-III:

Fundamentals of Biochemistry: Biochemistry as molecular logic of living beings. Axioms of living matter. Major organic compounds of animate objects a general view. Chemical elements. structure of atoms, molecules and chemical bonds. Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water. Water as universal solvent. Acids, bases and salts, pH and buffers.

Unit-IV:

Biomolecules: Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.

Unit-V:

Enzymes: Structure, classification and function -Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km- Michaelis Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot. Introduction to Allosteric Enzymes. Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples. Concept of ribozyme, multiple forms, isozymes and abzymes.

P.K. Singh

D. Anil Kumar  
Department of Zoology  
Madhav Vigyan Mahavidyalaya Ujjain

Dr. D.S. Rathi

Choudhary  
Choudhary  
hs

Prakash Choudhary

Deeps Rathan

Dr. D.S. Rathi

**Paper-II: Bioinstrumentation, Biostatistics and Bioinformatics.****Unit-I:**

Microscopy – Light, Phase contrast, fluorescence and Electron microscopy

Centrifugation technique. Principles types & separation of biological molecules.

**Unit-II:**

Chromatography and Electrophoresis

Chromatography: Principles and applications, Principle and application of electrophoresis.

Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.

**Unit-III:**

Spectrophotometry.

Colorimetry (UV and Visible), Radio and Non radio labelling, Autoradiography

**Unit-IV:**

Biostatistics- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation.

Probability, definition, Random variable and its distribution, Binomial probability distribution.

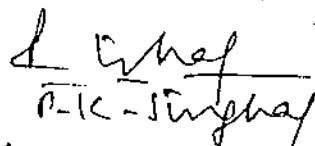
**Unit-V:**

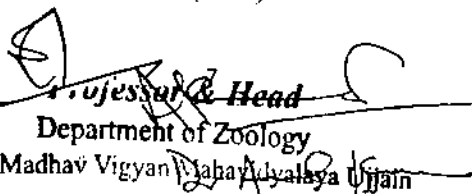
Computers: General introduction (characteristics, capabilities, generations), hardware: organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices); software : (System software; application software, languages -low level, high level), internet application.

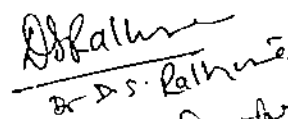
Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

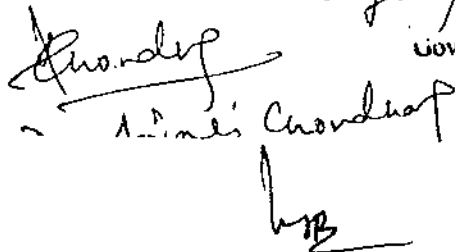
Biological Databases: Sequence databases (EMBL, GenBank, DDBJ, UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc).

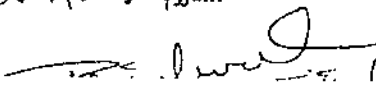
Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

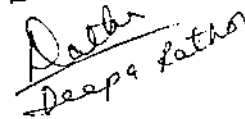
  
P. K. Singh

  
Head  
Department of Zoology  
Govt. Madhav Vigyan Mahavidyalaya Ujjain

  
D. S. Rathore

  
A. P. Singh



  
Deepa Rathore



BT-203 Laboratory

List of Practicals

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Quantitative estimation of Protein by Folin-Lowry method.
4. Quantitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of pH on enzyme activity.
7. Study the effect of temperature on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and Output devices
20. Prepare a Marksheet of your class Subjects
21. Design your class timetable.
22. Prepare a bar chart ,pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures , word art & clip art
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability.
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.

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*Anand Choudhary*  
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*Dr. Anil Kumar*

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*Dr. S. S. Rathore*

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*Rathore*

31. Introduction to NCBI.
32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
33. Analyzing Protein Sequences.
34. Analyzing DNA sequence.

Scheme of Practical Examination

MM: 50

Duration: 3 Hrs

1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)

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Dr. D. S. Rathore

Dr. Anjali Choudhary  
Dr. Anjali Choudhary

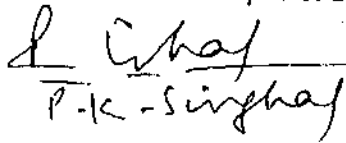
Dr. Rajini Gokulchand  
Dr. Rajini Gokulchand

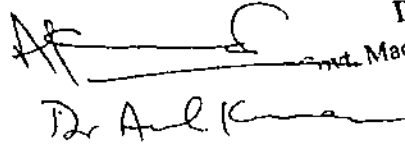
Dr. P. Rathore  
Dr. P. Rathore

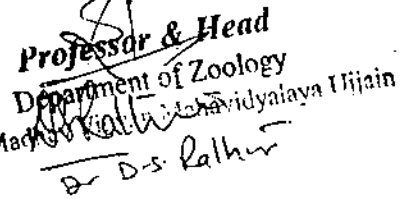
Dr. P. Rathore

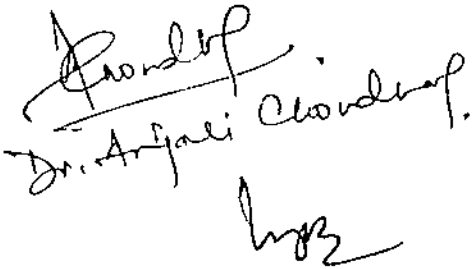
## Suggested Reading

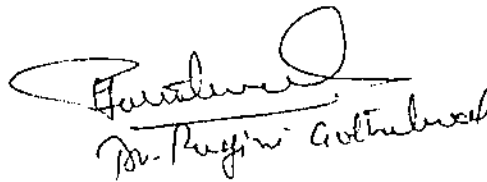
1. A text book of Bioinformatics by Sharma & Munjal & Shankar.
2. Bioinformatics by CSV Murthy
3. Basic Bioinformatics by S. Ignacimuthu. S.J
4. Bioinformatics: Concepts, Skills and Application By S.C. Rastogi. N. Mendiratta & Parag Rastogi
5. Practical Guide for basic Bioinformatics & Biostatistics By P. Tiwari & P. Pandey
6. Biostatistics by B. Prasad
7. Statistical Methods By S.P. Gupta
8. Fundamentals of Statistics By S.C. Gupta
9. Biostatistics by P.N. Arora
10. Principles of Biochemistry, Lehninger
11. Fundamentals of Biochemistry, J.L. Jain
12. Biochemistry, Voet and Voet.
13. Textbook of Biochemistry - S.P. Singh.
14. Biophysics : Mohan P. Arora
15. Biophysics : Pattabh & Gautham
16. Biochemistry: A.C. Deb
17. Biomolecule: Mohan P. Arora
18. Principles of Biochemistry (2005), Nelson & Cox

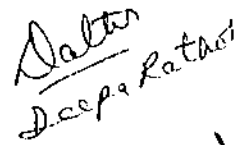
  
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hps

  
Dr. Pooja Gautham

  
Dr. Deepa Rathi



B.Sc III Year

Paper-I: Molecular Biology and Genetic Engineering

Unit-I:

DNA and RNA. Chemical Structure. Types and Properties. Experimental Proof of DNA as genetic material, Genome- Concept, Plant, Animal. Bacterial and Viral Genome. DNA Replication. Types, Experimental proof of semi conservative replication. Replication- Concept. proteins and enzymes involved in replication in prokaryotes and eukaryotes. Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication. Y shaped,  $\theta$  mode, rolling circle mechanism.

Unit-II:

Eukaryotic chromosomal organization, Euchromatin, Heterochromatin, chromatin structure, nucleosomes, histone and non histone proteins, Histone modifications, Introduction to epigenetics.

Unit-III:

Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules. Evolution of early forms, Mendelian genetics: Mendel's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.

Unit-IV:

Introduction to Recombinant DNA technology. Scope & importance. Gene Cloning. PCR. Introduction to Restriction endonuclease, Vectors for DNA transfer and their types: Plasmids, Phagemids, Cosmids, BAC. Gene amplification.

Unit-V:

Plasmids Types Properties and cloning vectors. Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA.

Mutation. Types of mutations: Point mutation (Base pair change, frame shift, deletion).

Transcription, translation and gene expression in eukaryotes (yeast). Alternate splicing.

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Anjali Choudhary

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Department of Zoology  
Maharaja Pratap Singh  
Mahavidyalaya Ujjain  
Dr. S. K. Patil  
Deputy  
Patil

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**Unit-I: Microbial Biotechnology**

Food Microbiology-Microbial contamination & Spoilage, Food preservation, Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.

**Unit-II: Plant Biotechnology-**

Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis, Protoplast culture, Somatic hybridization, Genetic manipulation of plants using *Agrobacterium tumefaciens*.

**Unit-III: Immunology and Animal Biotechnology**

Immunity- Innate and Acquired, Host defense mechanism- Infection and its types, Organs and Cells of Immune system, Vaccines and its types, Antigens- Properties and types, Adjuvants, Immunoglobulins- Structure, types and functions, Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions.

History, Equipment and materials for animal cell culture technology, Physical requirement for animal cell and their growth curve in culture.

Commonly used cell lines - their organization and characteristics, Differentiation of cells, Organ culture - techniques, advantage and applications.

Applications of animal biotechnology: Methods of Transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals, Stem cell culture, Transplantation of cultured cells, Bioreactors for large scale production of animal cells.

**Unit-IV: Fermentation Technology**

Fermentation Technology, Primary and Secondary Screening, Strain Improvement, Inoculum Development, Industrial Sterilisation process, Scale-up and Harvest and Recovery.

Types of fermentation - batch, continuous, fed batch process: Submerged and Solid State fermentation process. Basic design of a fermentor and factors affecting fermentor design.

*L. Singh*  
*P. K. Singh*

*Choudhary*  
*A. K. Choudhary*

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*Professor & Head*  
*Department of Zoology*  
*Dr. D. S. Rathore*  
*Dr. D. S. Rathore*

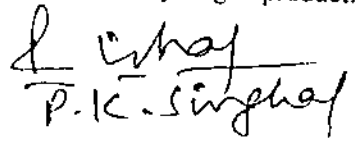
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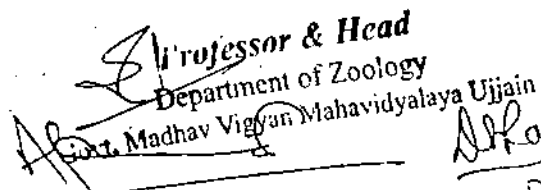


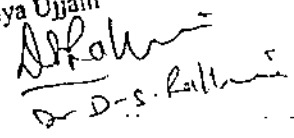
Types of fermentors- Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.

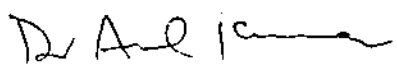
**Unit-V: Environment Biotechnology**

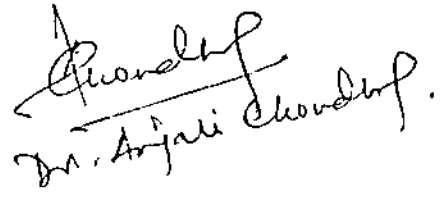
Environment: Basic concept, Significance, Public awareness, Environmental pollution, Assessment of water quality, Treatment of waste-water – Primary, secondary and tertiary treatment, Solid waste management (composting, vermi-composting, methane production).  
Biopesticides- Bacterial and Fungal, Genetically modified crops, Biofertilizers - Nitrogen fixers, PSB, Mycorrhiza and VAM, Microbial leaching, Microbial Enhanced Oil Recovery.  
Bioremediation and Biodeterioration. Modern fuels- Methanogenic bacteria and biogas, microbial hydrogen production.

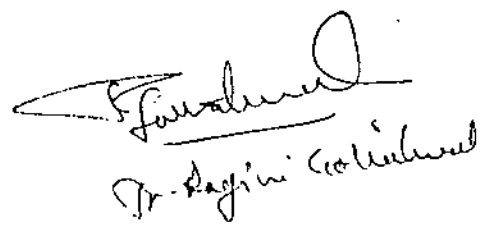
  
P.K. Singh

  
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Department of Zoology  
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Dr. D.S. Kulkarni

  
Dr. Anil Kumar

  
Dr. Anjali Choudhary

  
Dr. Ragini Kulkarni

  
Dr. Deepa Kataria



BT-303 Laboratory  
List of Practicals

1. Chromosomal DNA isolation from Plant cells.
2. Chromosomal DNA isolation from Animal cells.
3. Genomic DNA isolation from Micro-Organisms.
4. Analysis of isolated DNA by Agarose gel electrophoresis.
5. Spectrophotometric analysis of DNA and DNA melting.
6. UV as a physical mutagen
7. Gradient Plate Technique
8. Estimation of DNA using diphenylamine method.
9. Estimation of RNA using orcinol method.
10. Isolation of RNA from Yeast..
11. Isolation of plasmid DNA from bacteria.
12. Effect of UV radiation on microbial cell
13. Demonstration of repair mechanism in microbes.
14. Bacteriophage and determination of latent period of infection
15. Isolation of total RNA from Plant tissue by SDS phenol method.
16. Elution of DNA from agarose gel band.
17. Transformation in E-coli cell.
18. Growth of plant tissue into undifferentiated mass of callus.
19. Preparation of animal cell culture media.
20. Separation and culture of lymphocyte from blood.
21. Demonstration of fermentor.
22. Preparation of wine.
23. Extraction of citric acid from *Aspergillus*.
24. Production of ethanol by yeast.
25. Demonstration of PCR.
26. Immobilization of microbial cells.
27. Extraction and preparation of lactic acid.
28. Extraction and preparation of citric acid.
29. Demonstration of Radial immuno diffusion analysis.
30. Isolation of microorganism from polluted site/ industrial waste.
31. Blood group analysis.

P. K. Singh  
P. K. Singh

S. S. Choudhary  
S. S. Choudhary

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Dr. A. K. Singh  
Dr. A. K. Singh

Dr. S. S. Lal  
Dr. S. S. Lal

Dr. R. K. Singh  
Dr. R. K. Singh

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Dr. R. K. Singh  
Dr. R. K. Singh

32. Differential count of WBC.
33. To examine flocculation reaction using VIDRI test.
34. To observe the agglutination reaction using WIDAL test
35. Determine the concentration of unknown antigen using Radial Immuno Diffusion technique.

Note: 70% of the above list should be compulsorily performed.

**Scheme of Practical Examination**

MM: 50

Duration: 3 Hrs

1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)

**Suggested Reading**

1. Industrial Microbiology By A. H. Patel
2. Microbial Biotechnology By Hazarce
3. Molecular biology: Avinash & Kakoli Upadhyay
4. Gene Biotechnology: Jogdand
5. Essential of Biotechnology: S.N.Das
6. Text book of Biotechnology: R.C. Dubey
7. Biotechnology & genomics : P.K. Gupta
8. Modern concept of Biotech: H.D. Menon
9. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee

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*P.K. Singhay*  
 P.K. Singhay

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*Dr. Ail Kumar*  
 Dr. Ail Kumar

*D.S. Rathore*  
 D.S. Rathore

*P. P. Kather*  
 P.P. Kather

*Dr. Anjali Choudhary*  
 Dr. Anjali Choudhary

*Dr. P. P. Kather*  
 Dr. P. P. Kather

10. Fundamentals of Microbiology & Immunology : Banerjee & Banerjee
11. Immunology : Rao
12. Biotechnology & Genomics : P.K.Gupta
13. Biotechnology : Satyanarayan
14. Plant tissue culture: Bhajwan
15. Introduction to plant tissue culture: Razadan
16. Introduction to Biotech: Chawla
17. Animal Biotechnology: Srivastava, Singh & Yadav.
18. Text book of Animal Biotechnology, Ramdas and Mecraya.
19. Biotechnology Animal cell, Satish M.K.
20. Animal Biotechnology, Ranga M.M.
21. Text Book of Biotechnology, B.D. Singh. Culture of Animal cell. Freshney.
22. Plant Biotechnology, Jitendra Parkash.
23. Biotechnology in plant science. Kumar N.C.

24. Environmental Biotechnology Agrawal S.K.

*S. Chahal*  
P.K. Gupta

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*Sushila Shrivastava*  
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*Dr. D.S. Rathor*

*Dr. Anjali Choudhary*  
*hms*

*J. Patel*  
Dr. Rajni Sathur

*Dr. Deepa Rathor*  
*Dr. Deepa Rathor*

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2017 – 2020

Structure of B.Sc. Programme (3 Years Degree Course)

Subject – Bioinformatics (as one subject)

YEAR	PAPER(S)	Maximum Marks		
		Total	CCE	External
I	BI 101 : Introduction to Bioinformatics	100	15	42.5 40
	BI 102: Concepts in Bioinformatics		20	42.5 40
	BI 103: Practical	50	-	50
II	BI 201: Introduction to Computers and Programming	100	15	42.5 40
	BI 202 : Structural Bioinformatics		20	42.5 40
	BI 203 :Practical	50	-	50
III	BI 301 : Biostatistics	100	15	42.5 40
	BI 302 : Mathematics for Biological Sciences		20	42.5 40
	BI 303 : Practical a) Practical Work b) Project Work	50	-	50 25 25

*Y. K. Jain*  
27/04/17  
(Y.K. Jain)

*Ravi*  
27/4/17  
(Dr Ravi Mehta)

*Shaque*  
15/7/17  
Prof. Shaque Shaque  
Professor & Head  
Department of Zoology  
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*A. Tripathi*  
27.4.17  
(Dr A. Tripathi)

*Sandhya*  
27.04.17  
(Dr. Sandhya Pandey)

*Sugandha*  
27/4/17  
Dr. Sugandha Singh

*S. Rathore*  
Co-Ordinator  
BIOINFORMATICS DEPTT.  
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*H.S. Rathore*  
22/5/17  
Prof. Dr. H.S. RATHORE  
DEAN  
Faculty of Life Sciences  
Vikram University,  
UJJAIN, 456 010. India

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2017-18

**B.Sc. FIRST YEAR**

**THEORY PAPER 1**

**BI 101: INTRODUCTION TO BIOINFORMATICS**

**Objectives:** To enable students to learn important databases and tools commonly employed to Bioinformatics.

**UNIT I Introduction**

Definition, History, Branches of Bioinformatics, Aims, Scope & research Areas, Human genome project, Role of computer in Bioinformatics, Bioinformatics in India, BIO-IT-The Flourishing future. Application of bioinformatics.

**UNIT II Introduction to database**

Introduction to genomics & proteomic data; Post genomics era, Data acquisition –functions and purposes, Biological databases-relational and object orient concepts. Information retrieval, concepts of digital libraries, information retrieval from biological databases ENTREZ-SRS, Methods for presenting large quantities of data, sequence viewer, structure viewer, RASMOL, ligand explorer.

**UNIT III Introduction to Nucleic Data Bases**

Primary & Secondary Data Base, gene banks, ENBC nucleotide, sequence data bank- DDBJ- RNA sequence data bases: 16S & 23S rRNA, Mutation data bases, HIV sequence data base, NON CODE sequence submission tools, sequin, webin, sqkura, bank etc.

**UNIT IV Protein sequence data bases**

Protein sequence data bases – PIR, SWISSPROT, UNIPROT-Tr EMBL, EXPASY,NCBI,Protein, Databases – PRF, UNIPROT-MIPS-O/P-protein sequence motif database, E blocks- eblocks- PROSITE, PROTEIN DOMAIN, databases, ADDA, INTERPRO, Pfame-protein

**UNIT V Introduction to structure data bases**

PDB- PDBSum SCOP-CATH-MMDB-EMSD-SWISS-MODEL repository-ModBase-Protein MODEL portal, Eurocarb DB-DIP-BNND, STRNG

**Books Recommended:**

- 1 Orpita Basu & Simminder Kaur, Thakural " Bioinformatics Databases, Tools, Algorithm,2007 Oxford University Press"
- 2 Higgins,D.Willie, Taylor " Bioinformatics; Sequence,Structure and Data Bank, A Practical Approach,2000, 1st Ed, Oxford University Press
- 3 Allwood T, David Parry Smith ; Introduction to bioinformatics, 2008 Pearson Education, Singapore D.ED.
- 4 Murthy, C.S.V., 2016, Himalaya Publishing House

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UJJAIN (M.P.)

2017-18

THEORY PAPER 2

BI 102: CONCEPTS IN BIOINFORMATICS

**Objectives:** To provide students with foundation in the important concepts of Bioinformatics.

**UNIT I**

Introduction, sequence alignment, Scoring matrix, PAM BLOSUM, Gaps and Gap penalties, Different Gap weights, Biological significance of Gaps.

**UNIT II**

Pairwise sequence alignment, DotPlot analysis, Dynamic programming, Needleman-Wunch algorithm, Smith-Waterman algorithm, Edit distance dynamic programming, Database similarity search, BLAST, FASTA.

Multiple sequence alignment, sum of pairs, Divide and Conquer, Progressive and Iterative alignment, ClustalW, TCPFFEE, Profile methods, Gribskov profile, PSI\_BLAST.

**UNIT III**

Phylogenetic relationships, Clustering and Phylogeny, Phylogenetic analysis, Concept of Phylogenetic Tree, Methods of Phylogeny analysis, Distance and character based methods, Motif detection, Protein family databases.

**UNIT IV**

Data mining, Introduction, Definition, Data mining problems, Cluster analysis, Data mining techniques, Tools and Methods. Management of Databases. DBMS, Difference between DBMS and file system.

**UNIT V**

Metabolic pathway database (KEGG pathway database), Concept of Metabolome and Metabolomics, Drug discovery and Design, Target identification, Target validation, Lead identification, Lead Optimization, Preclinical Pharmacology and Toxicology, Chemoinformatics tools for Drug discovery, Chemical structure representation (SMILE & SMART), Chemical databases: CSD, ACD, WDI, ChEMBL, PUBCHEM.

**Books Recommended:**

- 1 Orpita Basu & Simminder Kaur, Thakural " Bioinformatics Databases, Tools, Algorithm, 2007 Oxford University Press"
- 2 Higgins, D. Willie, Taylor " Bioinformatics; Sequence, Structure and Data bank, A Practical Approach, 2000, 1st Ed, Oxford University Press
- 3 Allwood T, David Parry Smith; Introduction to bioinformatics, 2008 Pearson Education, Singapore D.ED.
- 4 Murthy, C.S.V., 2016, Himalaya Publishing House
- 5 Ghosh, Z and Mallick, B, 2008, Bioinformatics - Principles and Applications.

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Page 3 of 12

M. Jainmal  
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H. K. ...  
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S. ...  
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Orta  
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Sugandha  
27/4/17

Co-Ordinator

BIOINFORMATICS DEPTT.

Govt. Madhav Vigyan Mahavidyalaya

UJJAIN (M.P.)

2017-18

**BI 103: PRACTICAL**

**LIST OF PRACTICALS**

1. To explore NCBI.
2. To explore GenBank .
3. To compare data files from NCBI, DDBJ and EMBL.
4. To Perform Sequence alignment using online Blast.
5. To Perform Sequence alignment using offline Blast.
6. To Perform Sequence alignment using Fasta.
7. To Explore PDB.
8. Perform sequence alignment using clustal w.
9. Study phylogenetic relationship using phylip
10. Draw phylogenetic tree using MEGA
11. Find motif using motif search
12. Study drug bank database
13. Explore secondary database prosite and pfam
14. Study OMIM database

(Note: 75% of the practicals from the prescribed list should be completed every year)

**Scheme for Practical Examination**

1. Major Exercise	15 Marks
2. Minor Exercise	10 Marks (05+05)
3. Spotting (Related to theory papers)	10
4. Viva-voce Examination	10
5. Lab Journals (Sessionals)	05
<b>TOTAL MARKS</b>	<b>50</b>

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2018-19

B.Sc. SECOND YEAR

THEORY PAPER 3

BI 201: INTRODUCTION TO COMPUTERS AND PROGRAMMING

**Objective:** To equip students with fundamental knowledge and concepts of Computers and Basic Programming Skills.

**UNIT I** Introduction to Computers

Overview and function of computers, Characteristics of computers, History of Computers, Evolution. Generation of Modern Computers, Classification of Computers, Micro-computers, Mini computers, Main Frame, Super computers, Special purpose computer ( Comparison in their memory, power, cost and Size), PC types:- Tower,- Desktop, Notebook, Laptops, Handheld, Palmtop, PDA, Types of Modern Computers, Workstations, Servers.

**UNIT II** Computer components and Number System

Components of a computer, Input devices, Output device, CPU, Memories (RAM and ROM), Secondary storage devices, Hard Disk, Magnetic tapes, Zip drives, Digital tapes, CD-ROM, DVD, BluRay, Number system , introduction, Decimal , Binary, Octal, Hexadecimal number systems and their inter conversion.

**UNIT III** Operating system (OS) and software Development

Hardware and Software definitions, Introduction to O/S, Functions, Classification real time, single user single task, single user multi task, Basic description about DOS, WINDOWS, Windows server NT/2000, UNIX/LINUX, MVS, Overview of Software development. Software development phases, problem definition, analysis, algorithm design and representation, coding and debugging (simple description about each phase).

**UNIT IV** Flow charts, Pseudo codes and Programming Languages

Basic flowchart symbols and their meaning, Pseudo codes, definition and importance, Syntax and Semantics, Programming approaches, Procedural, Object oriented programming languages, Definition, categories, low level languages, Machine language, Assembly language, Advantages and disadvantages, High level languages, Advantages and disadvantages, Interpreters, Compilers and Translators, Overview of compilation process, Types of High level languages. Introduction to Pearl.

**UNIT V** Multimedia and Internet

Multimedia, Introduction, Characteristics, Elements and Applications, The internet and its resources, World Wide Web(WWW), Associated tools, services, resources and various terminologies, An overview of Computer viruses, virus definitions, symptoms, transmission, danger and general precautions.

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**Recommended Books:**

1. Glenn Brookshear J., "Computer Science: An Overview", 2011 11<sup>th</sup> ed, Addison-Wesley Publishers.
2. Alexis Leon & Mathews Leon, "Fundamentals of Information Technology". 2009, 2<sup>nd</sup> ed, Vikas Publishing House Pvt. Ltd.
3. Rajaraman V, " Fundamentals of Computer", 2004, 4<sup>th</sup> ed, Prentice Hall India Pvt. Ltd.
4. Francis Glasborrow & Roberta Allen, " A Beginner's Introduction to Computer Programming", 2003, John Wiley and Sons.
5. Anurag Seetha, " Introduction to Computers and Information Technology", 2005 Ram Prasad and Sons Bhopal
6. Basandra S.K., " Computer Today", 2011, 1<sup>st</sup> ed, Ga

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## THEORY PAPER 4

### BI 202: STRUCTURAL BIOINFORMATICS

**Objectives:** To understand the levels of structural organization of macro molecules and experimental methods of structural determination. To know the approaches for structural analysis.

#### UNIT I Macromolecular structure

Nucleic acids – DNA and RNA, Protein-Primary, secondary, tertiary and quaternary structures, Amino acids, Ramchandran plot.

#### UNIT II Macromolecular Interactions

Protein-Protein, Protein- Nucleic acid, Protein- Carbohydrates, Structure of Ribosome.

#### UNIT III Principles of Protein folding

Overview of experimental techniques to study macro molecular structure, Methods to study 3D structure – X-ray, NMR, Cryo electron microscopy, Microarray., MALDI-TOFF.

#### UNIT IV Proteomics

Proteomics, Homology modelling, Protein tertiary structure, Prediction, Methodology

#### UNIT V Genomics

Introduction, Genome mapping, assembly annotative and comparison, Comparative Genomics, Free of life and some completed Genomics, Drug research in the era of Genome sequencing.

#### Books Recommended:

1. Watson, J.D., Baker, T.A., Bell, S.P. et al., 2008, Molecular Biology of the Gene, Cold Spring Harbor, New York.,
2. Sheehan, D. 2010, Physical Biochemistry: Principles and Applications, Wiley Blackwell
3. Baxevanis, A.D. and Ouellette, B.F., 2005, Bioinformatics – A Practical Guide to the Analysis of Genes & Proteins, John Wiley & Sons, Inc, USA.

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## BI 203: PRACTICAL

### LIST OF PRACTICALS

1. String concatenation.
2. Using perl perform translation
3. Using Perl perform transcription
4. Perform parsing of BLAST output and PDB file using perl.
5. To perform C/C++ line/circle Computer Graphic program.
6. Find ORF's in all six reading frames of a given DNA sequence.
7. To access the SCOP database to study protein classification.
8. To access CATH database.
9. To determine similarities and differences between the PDB entries of the protein which have been identified by X-ray crystallography and NMR.
10. To conduct secondary structure prediction using J-Pred secondary structure prediction server.
11. Predict secondary structure using GOR server.
12. Explore HSSP or FSSP databases.

(Note: 75% of the practical from the prescribed list should be completed every year)

### Scheme for Practical Examination

1. Major Exercise	15 Marks
2. Minor Exercise	10 Marks (05+05)
3. Spotting (Related to theory papers)	10
4. Viva-voce Examination	10
5. Lab Journals (Sessionals)	05
<b>TOTAL MARKS</b>	<b>50</b>

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2019-20

**B.Sc. THIRD YEAR****THEORY PAPER 5****BI 301: BIOSTATISTICS**

**Objectives:** To review the basic concepts of statistics relevant to biology data handling.

**UNIT I Introduction**

Biostatistics: Definition, standard terms, population sample, unit, variable, parameters, limitations and uses of statistics.

**UNIT II Data Collection**

Data and its collection, classification of data, purpose of classification, advantages, types of classification, Tabulation of data, Objectives of tabulation, rules of tabulation, Difference between classification and Tabulation, Diagrammatic presentation of data, Line diagram, Bar diagram, Percentage bar diagram, Pie diagram, Graphical representation of data, Histogram, Frequency curve, frequency polygon, Olives.

**UNIT III Central Tendency and Probability**

Mean, Mode, Median and their merits, Mean deviation, measures of dispersion, Range, Standard deviation and its relative measures, Probability, Distribution, Basics of Binomial, Poisson and Normal distribution and their applications to Biology.

**UNIT IV Correlation and regression analysis**

Concepts of correlation, coefficient of correlation, Types of correlation, Scatter diagram or Dot diagram method, Kar Pearson's coefficient of correlation, Spearman's rank correlation coefficient, Probable error in correlation, Regression: meaning, linear regression, regression coefficient and its properties, Regression equations, Fitting, Prediction, Difference between correlation and regression.

**UNIT V Statistical Analysis**

Test of significance, Null hypothesis, alternative hypothesis, simple hypothesis and composite hypothesis, two types of errors, single tail and two tailed test, Large sample test, Test of significance of a single mean and difference between two means, Student's "t" test, test of significance of a single mean and difference between means when  $n_1 = n_2$  and  $n_1 \neq n_2$ , Chi square test for goodness of fitness, Analysis of variance, meaning, assumptions, one way classification and two way classification (simple problems)

**Recommended Books:-**

1. Zar, J.H. "Biostatistical Methods", 2009, 5<sup>th</sup> ed, Prentice Hall Publications

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2. Gurumani N, "Introduction to Biostatistics", 2004, 1<sup>st</sup> ed, MJP Publishers Chennai
3. Sunder Rao, P.S.S, & Richards, J. "An Introduction to Biostatistics", 2003, 3<sup>rd</sup> ed, CMC
4. Denial W.W. "Biostatistics- A Foundation for analysis in the Health Sciences", 1999, 1<sup>st</sup> ed, John Wiley & Sons.
5. Bishop O.N., "Statistics for Biology", 3<sup>rd</sup> ed, Prentice Hall Press

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2019-20

## THEORY PAPER 6

### BI 302: MATHEMATICS FOR BIOLOGICAL SCIENCES

**Objectives:** To review the basic concepts of mathematics relevant to biology.

#### UNIT I Series

Basic series and series AP, standard AP, Sum of first n terms of AP, GP, standard GP, sum of n terms in GP, geometric mean, HP, Basic logarithmic and exponential series.

#### UNIT II Vectors and Matrices

Sets, inverse of a matrix, matrix method, Cramer's rule, vectors, addition and subtraction, dot product, cross product, gradient, divergence, curl.

#### UNIT III Basic Calculus

Differentiation and Integration, concept of limit, continuity, differentiation, maxima and minima, introduction to partial differentiation, integral calculus, definite integral.

#### UNIT IV Numerical Computation

Errors in computer arithmetic, normalization, polynomial interpolation, solution of non-linear equations, Errors, convergence of solutions, Iterative methods for system of linear equations, Numerical differentiation and integration.

#### UNIT V Trigonometry and Analytical Geometry

Trigonometric ratios, De Moivre's theorem, the general equation of a straight line, slope of a line, intercept of a line, angle between two lines, intersection of two lines, The general equation of a circle.

#### Recommended Books:-

1. Boas M.L. "Mathematical Methods in the Physical Sciences", 2005, 3<sup>rd</sup> ed, Wiley Publication.
2. Prasad G., "text book of Differential Calculus", 2003, 4<sup>th</sup> ed, Poothishala Publications.
3. Prasad G., "text book of Integral Calculus", 2003, 3<sup>rd</sup> ed, Poothishala Publications.
4. Ayers F, "Matrices and Vectors", 1962, 1<sup>st</sup> ed, Schaum Outline Series Publishing Co.
5. Schwartz, J.T. "Introduction to Matrices and Vectors", 2001, Courier.

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## BI 303: PRACTICAL

### LIST OF PRACTICALS

1. Find Mean, median, mode using excel.
2. Study formulas in excel.
3. Construct bar diagrams and pie charts.
4. Construct ogives.
5. Construct histogram.
6. Perform correlation analysis.
7. Find standard deviation.
8. Explore Mfold.
9. Explore Ensemble
10. Hex docking server.
11. Swiss-model/Modeller
12. Binomial Theorem.
13. To use various HTML tags.

(Note: 75% of the practical from the prescribed list should be completed every year)

### Scheme for Practical Examination

#### a) Practical Work (25 Marks)

- |  |          |
|--|----------|
| 1. Major Exercise                      | 06 Marks |
| 2. Minor Exercise                      | 04 Marks |
| 3. Spotting (Related to theory papers) | 10 Marks |
| 4. Lab Journals (Sessionals)           | 05 Marks |

#### b) Project Work (25 Marks)

- |                          |          |
|--------------------------|----------|
| 1. Project Report        | 10 Marks |
| 2. Project Presentation  | 10 Marks |
| 3. Viva-voce Examination | 05 Marks |

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