

**JECRC**<sup>TM</sup>  
**UNIVERSITY**  
BUILD YOUR WORLD

**Faculty of Sciences**

**Syllabi and Course Structure**

**B. Sc. Zoology**

**JECRC UNIVERSITY, JAIPUR**

**School of Sciences**

**Minutes of Meeting**

Minutes of meeting of Board of Studies of Life Sciences held on 25<sup>th</sup> January 2018 in the Meeting Hall on Ground floor (Dean's Chamber), Engineering Block at 3.00 P.M regarding the revision of final syllabi and credits of the courses in Life Sciences offered in the session 2017-2018.

The following members attended the meeting-

1. Prof (Dr.) Widhi Dubey – Chairperson B.O.S. (Sciences) *Widhi*
2. Dr. Sonali Pandey, Associate Professor, Department of Botany. *Sonali*
3. Dr. (Mrs.) Rajesh Yadav, Asst. Professor-I, Department of Zoology. *Rajesh*
4. Dr. Mona Arora, Asst. Professor-I, Department of Zoology. *Mona Arora*
5. Dr. Seema Bhaduria, Associate Professor, Department of Microbiology. *Seema*
6. Dr. Varsha Gupta, Associate Professor, Department of Microbiology. *Varsha*
7. Dr. Hardik Pathak, Asst. Professor-I, Department of Biotechnology. *Hardik*
8. Dr. Ekta Menghani, Associate Professor, Department of Biotechnology. *Ekta*
9. Dr. Ruchi Seth, Asst. Professor-I, Department of Biotechnology. *Ruchi*

**External Members**

10. Prof. K. P. Sharma, Professor and Former Head, Department of Botany, University of Rajasthan, Jaipur. *K.P. Sharma*
11. Prof. Meenakshi Sharma, Professor of Microbiology, University of Rajasthan, Jaipur. *Meenakshi*
12. Prof. G.C. Jain, Professor of Zoology, University of Rajasthan, Jaipur. *G.C. Jain*
13. Dr. Sarita Sachdeva, Professor & HOD, Department of Biotechnology, Faculty of Engineering & Technology, Manav Rachna International University, Faridabad.

1. At the onset Chairperson welcomed all the Board Members.
2. Dr. Widhi Dubey briefly appraised the agenda of the meeting, to revise the final syllabi and credits of the courses in Life Sciences viz: Botany, Zoology, Biotechnology and Microbiology in the academic session 2017- 18 incorporating the changes/ modifications suggested by 4<sup>th</sup> Academic Council.



3. The total Credits offered in B.Sc (Hons.) Mathematics, Physics and Chemistry was 185 & in B.Sc (Hons.) Biotechnology & Microbiology 170. It was suggested that according to U.G.C guidelines maximum credits for B.Sc Hons courses should be upto 160 and for each 2 Hour Practical 1 Credit is awarded.

Earlier we were awarding 2 credits for 2 hours Practical, now in attached proposed scheme 1 credit is awarded to 2 hours Practical. Hence we are offering total 153 credits for all B.Sc Hons courses in the session 2017-18

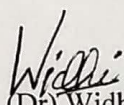
- 4 As per UGC guidelines in B.Sc Hons there should be 14 Core papers, 4 Discipline specific Electives, 4 Generic Electives, 2 Ability enhancement Compulsory Courses and 2 Skill enhancement Courses which are incorporated in the scheme.
- 5 The credit distribution for Project in case of B.Sc Hons Biotechnology and Microbiology has been revised as suggested.
- 6 No Internship programs are offered in B.Sc and M.Sc courses as per UGC guidelines .The suggestion given by Academic Council are noted.
- 7 The Credits for EVS has been raised from 2 to 4 as per UGC guidelines.
- 8 In B.Sc Hons. Microbiology one new paper of 5 credits each (4 credits theory and 1 credit Practical ) has been introduced in I-IV Semesters in place of Seminar which is as follows: Semester I BMI 039A Cytology, BMI 040A Cytology Lab , Semester II BMI 041 A Metabolic Pathway BMI 042 A Metabolic Pathway Lab, Semester III BMI 043 A Genetics BMI 044 Genetics Lab Semester IV BMI 045A Principles of Physiology BMI 046A Physiology Lab, Semester V BMI 047 A Project of 6 Credits.
9. In Semester VI : 4 new papers of Microbiology has been introduced, and one paper of Basics of Chemistry (opt from Chemistry Deptt.) as interdisciplinary paper: .BMI 048 Waste Management BMI 049 Waste Management Lab, BMI 050 Sustainable Development BMI 051 Sustainable Development Lab, BMI 052 IPR, Bioethics and Eenterprenurship BMI 053 IPR, Bioethics and Eenterprenurship Lab, BMI 054 Microbial Biotechnology BMI 055 Microbial Biotechnology Lab, BCE025A Basics of Chemistry BCE 026A Acid-Base Titrations and Radical identification.
- 10 In B.Sc. Hons. Biotechnology one new paper of 5 credits each (4 credits theory and 1 credit Practical ) has been introduced in I-IV Semesters in place of Seminar which are as follows: Semester I BBI062A Basic of Chemistry, BBI058A Practicals of Chemistry, Semester II BBI063A Ecology and Environment Management, BBI064A Practicals of Ecology and Environment, Semester III BBI065A Biostatistics, BBI066A Problem Based on Biostatistics, Semester IV BBI067A Microbial Physiology, BBI068A Practicals of Microbial Physiology.
- 11 In Semester V BBI069A Animal Tissue culture (Title Change), BBI050A Practical of Animal Biotechnology, and BBI071A Project (6 credits),



- 12 In Semester VI following papers were added: BBI072A IPR, Biosafety, Bioethics Entrepreneurship Development, BBI073A Exercise Based on IPR, Entrepreneurship, BBI074A Basics of Forensic Science, BBI075A Practicals on Forensic Science, BBI076A Biotechnology and Human Welfare, BBI077A Practical Based on Biotechnology and Human Welfare, BBI078A Molecular Diagnostics, BBI079A Practical of Molecular Techniques, BBI080A Industrial Fermentations, BBI081A Practicals of Fermentation.
- 13 In Botany and Zoology in each semester the credit of practicals of 2 hours have been reduced to 1 credit and Project (optional for minor subjects) will be of 6 Credits instead of 8 credits. The report of the feedback forms collected from different stake holders regarding the curriculum showed that the curriculum is well balanced and updated regularly and does not require any further changes.
- 14 Chairperson Dr Widhi Dubey circulated the scheme among all the board members for their perusal and final consent.
- 15 The External experts as well as other members went through the scheme discussed among them and looked through the revised syllabi drafted and presented by respective members representing a particular subject and also in the capacity of Head of departments of their concerned subjects.
- 16 The suggestions given by external experts and other board members were incorporated and after minor modifications the syllabi were finally approved.
- 17 In the end the chairperson expressed profound gratitude to the experts for spending so much time for the University.

The meeting ended with vote of thanks to the chair.

Thanks & Regards

  
Prof. (Dr) Widhi Dubey  
Director, School of Sciences

Copy To,

1. The Registrar
2. All HOD's

Cc: The President.

## **DEPARTMENT OF ZOOLOGY**

The curriculum and syllabus for B.Sc. Program conforms to outcome based teaching learning process. In general, several outcomes have been identified and the curriculum and syllabus have been planned in such a way that each of the courses meets one or more of these outcomes. These relate to the skills, understanding and behaviors that students acquire as they progress through the program. Further each course in the program brings out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

1. An ability to apply profound understanding of Chemistry, Zoology and Botany
2. An ability to design and perform experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve scientific problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of scientific solutions in global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills, and modern scientific tools that provide the learning base for future careers in disciplines such as health sciences, agriculture, environmental management, the emerging biotechnologies, publishing, teaching, research and consultancy.

**JECRC UNIVERSITY  
FACULTY OF SCIENCES  
SESSION 2017-18**

**B.Sc. Zoology**

| <b>Semester –I</b>   |   |                |                 |
|----------------------|---|----------------|-----------------|
| <b>Course Code</b>   | <b>Title of Course</b>  | <b>Credits</b> | <b>Category</b> |
| <b>BZO 001A</b>      | <b>Animal Diversity (Non Chordates)</b>                                 | <b>4</b>       | <b>F</b>        |
| <b>BZO 002A</b>      | <b>Non Chordates Lab</b>  | <b>1</b>       | <b>F</b>        |
|                      | <b>Total</b>  | <b>5</b>       |                 |
| <b>Semester –II</b>  |   |                |                 |
| <b>BZO 003A</b>      | <b>Molecular Biology and Genetics</b>                                   | <b>4</b>       | <b>ID</b>       |
| <b>BZO 004A</b>      | <b>Practical Lab on Molecular Biology and Genetics</b>                  | <b>1</b>       | <b>ID</b>       |
|                      | <b>Total</b>  | <b>5</b>       |                 |
| <b>Semester –III</b> |   |                |                 |
| <b>BZO 005A</b>      | <b>Biology of Chordates</b>   | <b>4</b>       | <b>F</b>        |
| <b>BZO 006A</b>      | <b>Chordates Lab</b>  | <b>1</b>       | <b>F</b>        |
|                      | <b>Total</b>  | <b>5</b>       |                 |
| <b>Semester –IV</b>  |   |                |                 |
| <b>BZO 007A</b>      | <b>Developmental Biology, Immunology and Evolution</b>                  | <b>4</b>       | <b>S</b>        |
| <b>BZO 008A</b>      | <b>Practical Lab on Developmental Biology, Immunology and Evolution</b> | <b>1</b>       | <b>S</b>        |
|                      | <b>Total</b>  | <b>5</b>       |                 |
| <b>Semester –V</b>   |   |                |                 |
| <b>BZO 009A</b>      | <b>Ecology, Ethology and Biostatistics</b>                              | <b>4</b>       | <b>S</b>        |
| <b>BZO 010A</b>      | <b>Practical Lab on Ecology, Ethology and Biostatistics</b>             | <b>1</b>       | <b>S</b>        |
|                      | <b>Total</b>  | <b>5</b>       |                 |
| <b>Semester –VI</b>  |   |                |                 |
| <b>BZO 012A</b>      | <b>Animal Physiology and Biochemistry</b>                               | <b>4</b>       | <b>C</b>        |
| <b>BZO 013A</b>      | <b>Practical Lab on Animal Physiology and Biochemistry</b>              | <b>1</b>       | <b>C</b>        |
| <b>BZO 014A</b>      | <b>Project (Optional)</b>   | <b>6</b>       | <b>C</b>        |
|                      | <b>Total</b>  | <b>5</b>       |                 |
|                      | <b>Total Credits</b>  | <b>30</b>      |                 |



**Semester IV**

| S. No | Subject   | Lecture (Hr.) | Tutorial (Hrs.) | Practical (Hrs.) | Credits |   | Total Credits | Category |
|-------|---|---------------|-----------------|------------------|---------|---|---------------|----------|
|       |   |               |                 |                  | L       | P |               |          |
| 1     | Major 1A  | 4             | -               | 2                | 4       | 1 | 5             |          |
| 2     | Major 2A  | 4             | -               | 2                | 4       | 1 | 5             |          |
| 3     | Minor 1 (Developmental Biology, Immunology and Evolution) | 4             | -               | 2                | 4       | 1 | 5             | S        |
| 4     | Minor 2   | 4             |                 | 2                | 4       | 1 | 5             |          |
| 5     | Computer Applications                                     | 2             | -               | 2                | 2       | 1 | 3             |          |
| 6     | Communication Skills                                      | 3             | -               | -                | 3       |   | 3             |          |
|       |   |               |                 |                  |         |   | 26            |          |

**Semester V**

| S. No | Subject                                       | Lecture (Hr.) | Tutorial (Hrs.) | Practical (Hrs.) | Credits |   | Total Credits | Category |
|-------|---|---------------|-----------------|------------------|---------|---|---------------|----------|
|       |   |               |                 |                  | L       | P |               |          |
| 1     | Major 1A                                      | 4             | -               | 2                | 4       | 2 | 5             |          |
| 2     | Major 1B                                      | 4             | -               | 2                | 4       | 2 | 5             |          |
| 3     | Minor 1 (Ecology, Ethology and Biostatistics) | 4             | -               | 2                | 4       | 2 | 5             | S        |
| 4     | Minor 2                                       | 4             |                 | 2                | 4       | 2 | 5             |          |
| 5     | Communication Skills                          | 3             | -               | -                | 3       |   | 3             |          |
| 6     | Value Education                               | 3             | -               | -                | 3       |   | 3             |          |
|       |   |               |                 |                  |         |   | 26            |          |

**Semester VI**

| S. No | Subject                                     | Lecture (Hr.) | Tutorial (Hrs.) | Practical (Hrs.) | Credits |   | Total Credits | Category |
|-------|---|---------------|-----------------|------------------|---------|---|---------------|----------|
|       |   |               |                 |                  | L       | P |               |          |
| 1     | Major1A                                     | 4             | -               | 2                | 4       | 1 | 5             |          |
| 2     | Major1B                                     | 4             | -               | 2                | 4       | 1 | 5             |          |
| 3     | Minor1 (Animal Physiology and Biochemistry) | 4             |                 | 2                |         | 1 | 5             | C        |
| 4     | Minor2                                      | 4             | -               | 2                | 4       | 1 | 5             |          |
| 6     | Project                                     |               | -               | -                |         |   | 6             |          |
|       |   |               |                 |                  |         |   | 26            |          |

**Total Credits**

| Credits | I Sem | II Sem | III Sem | IV Sem | V Sem | VI Sem | Total |
|---------|-------|--------|---------|--------|-------|--------|-------|
|         | 27    | 24     | 24      | 26     | 26    | 26     | 153   |



## **Program Educational Objective (PEO's):**

A graduate of the B.Sc. (Chemistry Major with Zoology & Botany Minor) **Program** should:

### **PEO- I**

The student will recognize and be able to apply basic ethical principles to basic and applied biological/biomedical practice and will understand the role of chemical/biological/biomedical science, scientists, and practitioners in society.

### **PEO- II**

The student will be able to facilitate their acquisition of basic and specialist science skills that instill qualities of self-confidence and self-reliance, so that the products of the degree Programmes can play active and informed roles in personal, community, national and international development strategies.

### **PEO- III**

Students will be able to make valuable contributions to contemporary chemical/biological issues of national and international interest.

### **PEO- IV**

Students will be provided with a modern, high-quality foundation education that prepares them for excellence, leadership roles along diverse career paths with encouragement to professional ethics and active participation needed for a successful career.

## **Program Outcome (PO's)**

A graduate of the B.Sc. (Chemistry Major with Zoology & Botany Minor) Program will demonstrate:

PO1: The ability to provide a comprehensive education in chemistry/biology that stresses scientific reasoning and problem solving across the spectrum of disciplines within biology  
**(Scientific Knowledge)**

PO2: The ability to prepare students for a wide variety of post-baccalaureate paths, including graduate school, professional training programs, or entry level jobs in any area of Chemistry & biology. **(Successful Career and Entrepreneurship)**

PO3: The ability to provide extensive hands-on training in statistical analysis, laboratory skills, and field techniques. **(Professional Skills)**

PO4: The ability to communicate effectively through training in written and oral communication of scientific information (**Communication Skills**)

PO5: The ability to design and perform experiments, as well as to analyze and interpret data (**Problem analysis**)

PO6: The ability to function effectively as an individual, and as a member or leader in diverse teams on multidisciplinary environments (**Individual and team work**)

PO7: The ability to learn about the scientific methods and how it facilitates the discovery of new knowledge in chemistry and biology. This includes how to critically evaluate hypotheses and conclusions in science using verifiable data and how to clearly and effectively communicate the major concepts and hypotheses in Chemistry and biology in an appropriate style of presentation. (**Design/development of solutions**)

### **Program Specific Outcomes (PSO's)**

In pursuit of the general objective of producing these self-reliant young biological scientists and contributing to scientific knowledge, the following are the **Program Specific Outcomes** of the B.Sc. (**Chemistry Major with Zoology & Botany Minor**) degree Programme:

PSO1. Understand the nature and basic concepts of cell biology, Biochemistry, Taxonomy and ecology and analyze the relationships among animals, plants and microbes. (**Scientific Knowledge**)

PSO2. Perform procedures as per laboratory standards in the areas of Biochemistry, ethology, Biostatistics, Taxonomy, Economic Zoology and Ecology and Understand the applications of biological sciences in Apiculture, Aquaculture, Pisciculture, Agriculture and Medicine. (**Professional Skills**)

PSO 3: To train academically sound future researchers and intellectuals in the area of general biology, with emphasis in areas on the cutting edge of modern biology, e.g., Molecular biology, Biochemistry, physiology, Genetics, Cytology and Environmental Conservation. (**Successful Career and Entrepreneurship**)

PSO 4: To acquire basic knowledge and skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation and certain applied branches to enable them for self employment. (**Problem-Solving Skills**)

## B.Sc. ZOOLOGY

### Course objectives

- To study individual organisms and populations, as well as their relationships to each other and the environment, with the core foundation of evolution and ecology.
- To comprehend the genetics, anatomy, physiology and behavior along with other specialized fields of interest
- To comprehend the basic phylogenetic relationships of the major groups of vertebrates
- To comprehend and analyze the adaptive changes that have occurred in invertebrates & vertebrates
- To comprehend and analyze the changes in homologous structures which accompanied the invasion of terrestrial habitats by vertebrates
- To recognize, describe, and point out the external and internal features that characterize the major groups of modern day vertebrate & invertebrates
- To recognize and describe the basic habit, habitat & behavior of chordates
- To gain an in-depth knowledge and practical skills in various aspects of animal biology.

### SEMESTER-I

| L | T | P | C |
|---|---|---|---|
| 4 | - | 1 | 5 |

| <b>BZO 001A: Animal Diversity (Non Chordates)</b> |  | <b>CREDIT(S)-4</b> |
|---|--|--------------------|
| <b>Unit I</b>                                     | <b>Animal Diversity (Non chordates)</b><br><b>Taxonomy and classification:</b> General principles of taxonomy - Binomial nomenclature, Trinomial nomenclature, Rules of nomenclature, Concept of Five kingdom, concept of protozoa, metazoan and levels of organization. Basis of Classification: symmetry, coelom, segmentation and embryology. |                    |
| <b>Unit II</b>                                    | <b>Protozoa:</b> General characters and Outline Classification upto class, Locomotion, Economic importance.<br><b>Porifera:</b> General characters and Outline Classification upto class, Economic importance, canal system of sponges.<br><b>Coelenterata:</b> General characters and Outline Classification upto class, Coral and coral reefs. |                    |
| <b>Unit III</b>                                   | <b>Ctenophora:</b> General characters and Outline Classification upto class.<br><b>Platyhelminthes:</b> General characters and Outline Classification upto class,  |                    |

|                |  |
|----------------|--|
|                | parasitic adaptations<br><b>Aschelminthes:</b> General characters and Outline Classification upto class.<br><b>Annelida:</b> General characters and Outline Classification upto class, vermiculture (outline).   |
| <b>Unit IV</b> | <b>Onychophora:</b> Peripatus (salient features) and as connecting link.<br><b>Arthropoda:</b> General characters and Outline Classification upto class, Metamorphosis in insects, General introduction about Apiculture, Sericulture.   |
| <b>Unit V</b>  | <b>Mollusca:</b> General characters and Outline Classification upto class, General introduction about Pearl culture.<br><b>Echinodermata:</b> General characters and Outline Classification upto class, Water vascular system of star fish.<br><b>Hemichordata:</b> Classification (upto class) and Habit, habitat, distribution and General characters. |

**Course Outcomes (COs) of the course “Animal Diversity (Non Chordates)”:**

On completion of the course, students are able to:

- CO1 Understand general taxonomic rules on animal classification, the principles and methods of taxonomy, the Levels of structural organization and the Basis of Classification -coelom, symmetry, segmentation and its types.
- CO2 Classify the phylum Protozoa, Porifera & Coelenterata using examples, Understand the Locomotion in Protozoa, canal system of sponges, Coral and coral reefs & economical importance of Protozoa, Porifera.
- CO3 Classify Phylum Ctenophora, helminthes & Annelida with taxonomic keys, and a basic idea of vermiculture, parasitic adaptations.
- CO4 Write down the classification and characteristics of Phylum Onychophora & Arthropoda, and Understand Metamorphosis in insects, Apiculture, Sericulture.
- CO5 Write down the classification and characteristics of Phylum Mollusca, Echinodermata & Hemichordata and Understand the process of pearl formation and water vascular system of star fish.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

| <i>Course Outcome</i> | <b>Program Outcome</b> |     |     |     |     |     |     | <b>Program Specific Outcome</b> |      |      |      |
|-----------------------|------------------------|-----|-----|-----|-----|-----|-----|---------------------------------|------|------|------|
|                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CO1                   | H                      | L   | L   | L   | L   | L   | L   | H                               | M    | L    | L    |
| CO2                   | H                      | L   | L   | L   | L   | L   | L   | H                               | M    | L    | L    |
| CO3                   | H                      | M   | L   | L   | L   | L   | L   | H                               | M    | L    | L    |



|     |   |   |   |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | H | M | L | L | L | L | L | H | M | L | L |
| CO5 | H | L | L | L | L | L | L | H | M | L | L |

H = Highly Related; M = Medium L = Low

**Suggested books**

- R.L.Kotpal :Modern text book of biology – Invertebrate –(Rastogi Publication, Meerut).
- Dhama and Dhama : Invertebrate Zoology ( S. Chand & Co. New Delhi).

**SEMESTER II**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>4</b> | <b>-</b> | <b>1</b> | <b>5</b> |

| <b>BZO 003A: Molecular Biology and Genetics</b> |   | <b>Credit(s)-4</b> |
|---|---|--------------------|
| <b>Unit I</b>                                   | <b>Genetic Material:</b> Nucleic acids- Identification of genetic material, Evidences that DNA is the genetic material, Evidences that RNA is the genetic material, DNA: structure, polymorphism. <b>DNA Replication (Prokaryotes and Eukaryotes):</b> Experiments of Messelson and Stahl; Mechanism of replication, Enzymology of DNA replication (Enzymes and Proteins associated with DNA replication), Elementary idea about DNA repairs. |                    |
| <b>Unit II</b>                                  | RNA– Central Dogma, Types of RNA (mRNA, rRNA, tRNA), Synthesis of RNA (Transcription in Prokaryote and Eukaryotes), RNA processing, RNA splicing. Protein synthesis – Translation in Prokaryotes and Eukaryotes.  |                    |
| <b>Unit III</b>                                 | Genetic Code – Essential features, Wobble hypothesis.<br><b>Heredity:</b> Mendel and his work, Laws of Inheritance, Monohybrid Cross, Dihybrid Cross<br>Multiple allelism   |                    |
| <b>Unit IV</b>                                  | Gene interaction (Intragenic and Intergenic interaction)<br>Sex- linked Inheritance<br><b>Gene</b> – Concept, types and functions of gene.  |                    |
| <b>Unit V</b>                                   | <b>Regulation of gene expression:</b> Inducible system; Lac operon, Repressible system; Tryptophan.<br>Cytoplasmic inheritance in animals<br>Mutations, Eugenics, Genetic counseling, Euthenics, Euphenics  |                    |

**Course Outcomes (COs) of the course “Molecular Biology and Genetics”**

On completion of the course, students are able to:

CO1 Understand about the genetic material (Nucleic acids) and DNA replication.

CO2 Understand about various types of RNA and process of Transcription & Translation.

CO3 Understand the Genetic Code, Mendelism & Multiple allelism.

CO4 Understand the concept of gene & gene interaction, and Sex- linked Inheritance.

CO5 Understand the terms Mutations, Eugenics, Genetic counseling, Euthenics, Euphenics and gene regulation, Cytoplasmic inheritance in animals

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

| <i>Course Outcome</i> | <b>Program Outcome</b> |     |     |     |     |     |     | <b>Program Specific Outcome</b> |      |      |      |
|-----------------------|------------------------|-----|-----|-----|-----|-----|-----|---------------------------------|------|------|------|
|                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CO1                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO2                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO3                   | H                      | M   | L   | L   | M   | L   | L   | H                               | M    | M    | L    |
| CO4                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO5                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | M    | L    |

H = Highly Related; M = Medium L = Low

***Suggested books***

- De Roberties, E.D.P.and De Roberties, E.M.F.: Cell and Molecular Biology, B.I. Publications Pvt. Ltd. Lippincott Williams and Wilkins.
- Lodish, H, Matsudaira, P. and Darnell, J. Molecular cell biology, W.H. Freeman and company.
- Rastogi V.B.: Genetics , Rastogi Publications, Meerut.
- Freifelder, D. Essential of Molecular biology, Narosa Publishing House.

**SEMESTER-III**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>4</b> | <b>-</b> | <b>1</b> | <b>5</b> |

|                                       |   |                     |
|---------------------------------------|---|---------------------|
| <b>BZO 005A: Biology of Chordates</b> |   | <b>CREDIT(S): 4</b> |
| <b>Unit I</b>                         | <b>Protochordata:</b> Classification upto order, General characters<br>Ascidia: retrogressive metamorphosis, salient features of Amphioxus. |                     |

|                 |  |
|-----------------|--|
| <b>Unit II</b>  | <b>Agnatha:</b> Classification upto order, General characters, Salient features: Petromyzon, Ammocoet larva.<br><b>Gnathostomata:</b> Classification upto order, General characters, Salient features of Ostracoderm.  |
| <b>Unit III</b> | <b>Pisces:</b> Classification upto order, Migration in fishes, Scales and fins in fishes, Pisciculture<br>Salient features: Dipnoi (Lung fishes), Scoliodon. , Difference between Chondrichthyes & Osteichthyes  |
| <b>Unit IV</b>  | <b>Amphibia:</b> Classification upto order, General characters, Adaptive radiation in Amphibian, Neoteny, Parental care.<br><b>Reptilia:</b> Classification upto order, General characters, Poisonous and non-poisonous snakes, poison apparatus.  |
| <b>Unit V</b>   | <b>Aves:</b> Classification upto order, General characters, Flight adaptation and Migration in birds, Perching mechanism; Structure and types of feathers.<br><b>Mammals:</b> Classification upto order, General characters, Dentition, hair and its development, Adaptive radiation in mammals. |

### Course Outcomes (COs) of the course “Biology of Chordates”

On completion of the course, students are able to:

CO1 Understand and study the classification of Protochordata, Ascidia & Amphioxus

CO2 Understand the classification of Agnatha & Gnathostomata, Characters of Petromyzon, Ammocoet larva, Ostracoderm.

CO3 Understand the classification of Pisces, and basics of pisciculture, Scales, Fins, migration in fishes.

CO4 Understand the classification of Amphibia, Reptilia, and the General Topics like Adaptive radiation in Amphibian, Neoteny, Parental care in Amphibians, Poisonous and non-poisonous snakes, poison apparatus.

CO5 Understand the classification of Aves, Mammals and the General Topics like perching mechanism, flight adaptation, migration and feathers in birds and adaptation, hair and dentition in Mammals.

### MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| <i>Course Outcome</i> | <b>Program Outcome</b> |     |     |     |     |     |     | <b>Program Specific Outcome</b> |      |      |      |
|-----------------------|------------------------|-----|-----|-----|-----|-----|-----|---------------------------------|------|------|------|
|                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CO1                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO2                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |

|     |   |   |   |   |   |   |   |   |   |   |   |
|-----|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | H | L | L | L | L | L | L | H | L | L | L |
| CO4 | H | L | L | L | L | L | L | H | L | L | L |
| CO5 | H | L | L | L | L | L | L | H | L | L | L |

H = Highly Related; M = Medium L = Low

**Suggested books**

- R.L.Kotpal :Modern text book of biology –Vertebrate –(Rastogi Publication, Meerut).
- Young, J.Z. : Life of Vertebrate.(E L B S) 1983.Oxford.
- Dalela, R.C. : A text book of Chordate Zoology, (Jai Prakash Nath publications, Meerut.).

**SEMESTER-IV**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>4</b> | <b>-</b> | <b>1</b> | <b>5</b> |

|  |   |
|--|---|
| <b>BZO007A: Developmental Biology, Immunology and Evolution CREDIT(S): 4</b> |   |
| <b>Unit I</b>  | Animal development: Gametogenesis (Spermatogenesis and oogenesis - vitellogenesis), fertilization, cleavage and morulation, blastulation, gastrulation, fate map, morphogenetic movement, Significance of cleavage and gastrulation. Parthenogenesis              |
| <b>Unit II</b>   | Elementary idea about embryonic induction: primary organizer and competence. Developmental stages of chick (upto 96 hours).   |
| <b>Unit III</b>  | Immunology -Overview of immune system; types of immunity<br>Mechanism of humoral immunity, Immunity regulating cells : Macrophages, lymphocytes (B & T types), Plasma cells and memory cells.<br>Antigens: Properties of antigens, Haptens                        |
| <b>Unit IV</b>   | Antibodies: Basic structure, classes and function, Antigen-Antibody interaction: precipitation reaction, agglutination reaction, neutralization reaction, complement and lytic reaction and phagocytosis.   |
| <b>Unit V</b>  | Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism or mutation theory. Natural Selection, Genetic basis of evolution : Speciation, Isolation, Variation, Adaptations, Mimicry.<br>Palaentology- fossils; geological division of earth crust; Continental drift. |

**Course Outcomes (COs) of the course “Developmental Biology, Immunology and Evolution”**

On completion of the course, students are able to:

CO1 Understand the process of: Gametogenesis, Fertilization and early development, Parthenogenesis



CO2 Understand the concept of embryonic induction: primary organizer and competence, Developmental stages of chick (upto 96 hours).

CO3 Understand the concept of Immunology, Mechanism of immunity, Immunity regulating cells, Antigens & Haptens

CO4 Understand the Basic structure, classes and function of Antibodies, Antigen-Antibody interaction

CO5 Understand the process of evolution, Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Speciation, Isolation, Variation, Adaptations, Mimicry, fossils; geological division of earth crust and Continental drift.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

| <i>Course Outcome</i> | <b>Program Outcome</b> |     |     |     |     |     |     | <b>Program Specific Outcome</b> |      |      |      |
|-----------------------|------------------------|-----|-----|-----|-----|-----|-----|---------------------------------|------|------|------|
|                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CO1                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO2                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO3                   | H                      | M   | L   | L   | M   | L   | L   | H                               | M    | L    | M    |
| CO4                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |
| CO5                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | L    | L    |

H = Highly Related; M = Medium L = Low

***Suggested Books***

- Gilbert, S.F. (2006) 8th edn. Developmental Biology, Sinauer Associates, Inc.
- Kindt, T. J., Goldsby, R. A., Osborne, B. A., Kuby, J. (2006). Immunology. VI Edition W.H. Freeman and Company.
- Rastogi, V.B.: Organic Evolution, Rastogi Publications, Meerut.
- Rastogi, V.B.: Development Biology, Rastogi Publications, Meerut.

**SEMESTER-V**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>4</b> | <b>-</b> | <b>1</b> | <b>5</b> |

**BZO 009A: Ecology, Ethology and Biostatistics**

**CREDIT(S): 4**

|                 |  |
|-----------------|--|
| <b>Unit I</b>   | <p><b>Ecology</b> :Basic concepts of ecology.<br/>Biogeochemical cycles- O<sub>2</sub>, CO<sub>2</sub>, N, P, H<sub>2</sub>O cycle and role of microbes.<br/><b>Population Ecology:</b> Density and methods of its measurement, natality, mortality, age and ratio distribution, biotic potential, dispersal and dispersion of population, population interactions and propagation.</p>                    |
| <b>Unit II</b>  | <p><b>Community Ecology:</b> Characteristics of natural communities structure, composition, stratification, host-parasite interactions.<br/><b>Ecological Succession:</b> Types and patterns of succession, concept of climax (mono-, di-, polyclimax), ecotone and edge effect, niche.<br/>Major biomes of the world.</p>   |
| <b>Unit III</b> | <p><b>Ethology</b><br/><b>Concepts of Ethology-</b> Motivation, Fixed Action Patterns (FAP), Sign Stimulus; Innate Releasing Mechanism (IRM); Action Specific Energy (ASE); Learning; Imprinting.<br/><b>Methods of Studying Behaviour :</b> Studies in Laboratory- Neuroanatomical, Neurophysiological and Neurochemical techniques.<br/>Brief account on Pheromones, Biological Clocks, Orientation.</p> |
| <b>Unit IV</b>  | <p><b>Biostatistics</b><br/><b>Introduction:</b> Definition, Functions, scope and application of biostatistics.<br/><b>Frequency distribution:</b> Collection and tabulation of data, Graphical presentation of frequency distribution- Bar diagram, Histogram, Frequency Polygon, smooth frequency curve, ogives, Pie charts.</p>   |
| <b>Unit V</b>   | <p><b>Measures of Central Value:</b> Average; Mean, Mode, Median. Mean and Standard Deviation.<br/><b>Statistical Inference:</b> Standard error of mean and standard deviation; student's 't' test</p>   |

### Course Outcomes (COs) of the course “Ecology, Ethology and Biostatistics”

On completion of the course, students are able to:

CO1 Understand the basic concepts of ecology, biogeochemical cycles & Population Ecology:

CO2 Understand the Characteristics of Community; Ecological Succession and Major biomes of the world

CO3 Understand the concepts of Ethology, Methods of Studying Behavior and a Brief idea about Pheromones, Biological Clocks, Orientation.

CO4 Understand the Functions, scope and application of biostatistics, Data Classification and Graphical presentation of frequency distribution.

CO5 Understand the measures of central tendency and dispersion like Computation of arithmetic mean, mode and median, Standard Deviation, Standard error of mean and student's 't' test

### MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| <i>Course Outcome</i> | <b>Program Outcome</b> | <b>Program Specific Outcome</b> |
|-----------------------|------------------------|---------------------------------|
|-----------------------|------------------------|---------------------------------|

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 | PSO3 | PSO4 |
|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | M   | L   | L   | L   | L   | L   | L   | M    | L    | L    | L    |
| CO2 | M   | L   | L   | L   | L   | L   | L   | M    | L    | L    | L    |
| CO3 | M   | L   | M   | L   | L   | L   | L   | M    | L    | L    | M    |
| CO4 | H   | L   | H   | L   | M   | L   | M   | H    | M    | L    | H    |
| CO5 | H   | L   | H   | L   | M   | L   | M   | H    | M    | L    | H    |

H = Highly Related; M = Medium L = Low

### ***Suggested Books***

- Odum, E.P.: Fundamental of Ecology, W.B. Saunders, New Delhi.
- Verma, P.S. and Agarwal, U.K.: Environmental Biology, S. Chand and co., New Delhi.
- Gupta, P.K.: Environmental Biology, Rastogi Publication, Meerut.
- Manning, A.: An introduction to Behaviour, Edward Arnold, London.
- Mathur, R.: Animal Behaviour, Rastogi Publications, Meerut.
- Bailey: Biostatistics
- Gupta, S.P.: Biostatistics.

## **SEMESTER-VI**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>4</b> | <b>-</b> | <b>1</b> | <b>5</b> |

| <b>BZO 012A: Animal Physiology and Biochemistry</b> |  | <b>CREDIT(S): 4</b> |
|---|--|---------------------|
| <b>Unit I</b>                                       | <b>Animal Physiology</b><br><b>Physiology of Digestion:</b> Alimentary canal, mechanism of digestion<br><b>Physiology of Respiration:</b> Mechanism of breathing: exchange of gases, transport of oxygen & carbon dioxide in blood, regulation of respiration.   |                     |
| <b>Unit II</b>                                      | <b>Physiology of Circulation:</b> Composition and function of blood, mechanism of blood clotting, heartbeat, cardiac cycle, homeostasis.<br><b>Physiology of nerve impulse and Reflex Action:</b> Functional architecture of a neuron, origin and propagation of nerve impulse, synaptic transmission, reflex action.  |                     |
| <b>Unit III</b>                                     | <b>Physiology of muscle contraction:</b> Functional architecture of skeletal muscles, chemical and biophysical events during contraction and relaxation of muscle fibre.<br><b>Physiology of Excretion:</b> Nitrogenous excretory products, role of liver in formation of these end products, Functional architecture of a nephron, mechanism and regulation of urine formation. |                     |

|                |   |
|----------------|---|
| <b>Unit IV</b> | <b>Physiology of endocrine glands:</b> Types of Endocrine glands– pituitary, adrenal, thyroid, islet of langerhan’s, gonads (testes & Ovary).     |
| <b>Unit V</b>  | <b>Biochemistry</b><br>Structure, function and significance of Carbohydrates, Proteins and Lipid.<br>Metabolism of Carbohydrate, Protein & Lipid. |

### Course Outcomes (COs) of the course “Animal Physiology and Biochemistry”

On completion of the course, students are able to:

CO1 Understand the Physiology of Digestion & Respiration.

CO2 Understand the Physiology of Circulation & nerve impulse and Reflex Action.

CO3 Understand the Physiology of muscle contraction & Excretion

CO4 Understand the Physiology & Types of Endocrine glands.

CO5 Understand the Structure, function, significance and Metabolism of Carbohydrates, Proteins and Lipid.

### MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

| <i>Course Outcome</i> | <b>Program Outcome</b> |     |     |     |     |     |     | <b>Program Specific Outcome</b> |      |      |      |
|-----------------------|------------------------|-----|-----|-----|-----|-----|-----|---------------------------------|------|------|------|
|                       | PO1                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1                            | PSO2 | PSO3 | PSO4 |
| CO1                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | M    | L    |
| CO2                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | M    | L    |
| CO3                   | H                      | M   | H   | M   | L   | L   | L   | H                               | L    | M    | L    |
| CO4                   | H                      | L   | L   | L   | L   | L   | L   | H                               | L    | M    | L    |
| CO5                   | H                      | L   | M   | L   | L   | L   | L   | H                               | H    | M    | M    |

H = Highly Related; M = Medium L = Low

#### *Suggested books*

- A Textbook of Animal Physiology; Berry, A.K.; Emkay Publisher, Delhi
- Text Book of Medical Physiology; Chatterjee, M.N and Shinde, R.; Jaypee brothers.
- Animal physiology and biochemistry, Dr. K.V. Sastry; rastogi publications, Meerut, India.
- Leninger, A.D. Principles of Biochemistry, CBS Publishers and Distributors, Shahdra, Delhi.
- Jain,J.L. Fundamentals of Biochemistry ,S.Chand publishers New Delhi.