

# **GURU NANAK COLLEGE (AUTONOMOUS)**

(Affiliated to University of Madras and Re-Accredited at 'A' Grade by NAAC)

Guru Nanak Salai, Velachery, Chennai – 600042.



## **B.Sc. Advanced Zoology and Biotechnology**

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

## **Syllabus**

(For the candidates admitted in the Academic year 2018-19 and thereafter)

## **VISION**

To instill the scientific dogmas of nature; to provoke the interest towards learning science and allied subjects; to equip the students with scientific skills to acquire competency needed for employment; to inculcate professional ethics and value-based education to improve socio-economic status; to impart interdisciplinary approach for identifying and solving real world scientific problems through research.

## **MISSION**

1. To facilitate an encouraging and exciting environment to develop the scientific temper in students through a curriculum based on fundamental as well as advanced scientific knowledge.
2. To provide technical skills in the respective disciplines through conducting practical training including internship as well as project, this will hone the skills necessary to become a successful mathematician, physicist, chemist, biotechnologist and visual communication professional.
3. To inculcate interdisciplinary knowledge, elective subjects in various fields are offered, thereby providing an opportunity to the students to identify their interest towards a particular field and pursue the passion.

## **PROGRAMME OUTCOME**

- PO1:** Demonstrate an understanding of biology at the level of molecules, cells, systems, organisms and ecosystems
- PO2:** Demonstrate an understanding of key concepts in evolutionary biology, ecology, neurobiology, cell biology, molecular biology, biochemistry, genetics, developmental biology and physiology
- PO3:** Demonstrate scientific quantitative skills, such as the ability to evaluate experimental design, read graphs, and understand and use information from scientific papers
- PO4:** Demonstrate skill in communication of scientific data in standard format
- PO5:** Demonstrate the procedures as per laboratory standards in the areas of Physiology, Biochemistry, Ecology, Biotechnology, Immunology and Microbiology.

## **PROGRAMME SPECIFIC OUTCOME**

- PSO1.** Knowledge about the nature and basic concepts of biological science and evolutionary relationships of major group of animals.
- PSO2.** Realize the applications of biological sciences in Sericulture, Apiculture, Aquaculture, Economic Entomology and Pest Management, Genetic Engineering and Recombinant DNA technology, Microbiology and Industrial Biotechnology and Nanotechnology.

**B.Sc. (Advanced Zoology and Biotechnology)**  
**COURSE STRUCTURE 2018 – 2021 Batch**

| Sem.                                      | Part | Course Component        | Subject Code | Subject Name                                                            | Cdt | Hrs | CIA | ESE | Total |
|-------------------------------------------|------|-------------------------|--------------|-------------------------------------------------------------------------|-----|-----|-----|-----|-------|
| I                                         | I    | Language                | 17UTAMF01    | Tamil I                                                                 | 3   | 6   | 50  | 50  | 100   |
|                                           | II   | English                 | 16UENGF41    | English I                                                               | 3   | 4   | 50  | 50  | 100   |
|                                           | III  | Core I                  | 16UAZTC01    | Diversity and Functional Anatomy of Invertebrates                       | 4   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UAZTC02P   | Practical I – Invertebrata and Chordata                                 | -   | 2   | *   | *   | *     |
|                                           |      | Allied I                | 16UPBTA11    | Botany I                                                                | 3   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UAZTA12P   | Allied Botany Practical                                                 | -   | 2   | *   | *   | *     |
|                                           | IV   | 1. NME/ Basic Tamil     | 16UNME01G    | Aquaculture/ Vermitechnology/Human genetics                             | 2   | 2   |     | 100 | 100   |
|                                           |      | 2. Skill based subjects | 17UGSLS01    | Soft skill I                                                            | 3   | 2   |     | 100 | 100   |
| <b>Total credit =18; Total Hours = 30</b> |      |                         |              |                                                                         |     |     |     |     |       |
| II                                        | I    | Language                | 17UTAMF02    | Tamil II                                                                | 3   | 6   | 50  | 50  | 100   |
|                                           | II   | English                 | 16UENGF42    | English II                                                              | 3   | 4   | 50  | 50  | 100   |
|                                           | III  | Core II                 | 16UAZTC03    | Diversity and Functional Anatomy of Chordates                           | 4   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UPBTA12P   | Practical I – Invertebrata and Chordata                                 | 4   | 2   | 50  | 50  | 100   |
|                                           |      | Allied II               | 16UPBTA13    | Botany II                                                               | 3   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UAZTA12P   | Allied Botany Practical                                                 | 4   | 2   | 50  | 50  | 100   |
|                                           | IV   | 1. NME/ Basic Tamil     | 16UNME02G    | Public health and hygiene/ Dairy farming/Poultry Science and Management | 2   | 2   |     | 100 | 100   |
|                                           |      | 2. Skill based subjects | 17UGSLS02    | Soft skill II                                                           | 3   | 2   |     | 100 | 100   |
| <b>Total credit =26; Total Hours = 30</b> |      |                         |              |                                                                         |     |     |     |     |       |
| III                                       | I    | Language                | 16UTAMF03    | Tamil III                                                               | 3   | 6   | 50  | 50  | 100   |
|                                           | II   | English                 | 16UENGF43    | English III                                                             | 3   | 4   | 50  | 50  | 100   |
|                                           | III  | Core III                | 16UAZTC04    | Cell and Molecular Biology                                              | 4   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UAZTC05P   | Practical II- Cell Biology, Genetics and Evolution                      | -   | 2   | *   | *   | *     |
|                                           |      | Allied III              | 16UCHEA14    | Chemistry I                                                             | 3   | 6   | 50  | 50  | 100   |
|                                           |      |                         | 16UCHEA15P   | Allied Chemistry Practical                                              | -   | 2   | *   | *   | *     |
|                                           | IV   | 1. Skill based          | 16UGSLS03    | Soft skill III                                                          | 3   | 2   |     | 100 | 100   |

|                                           |     |                         |            |                                                                                     |   |   |    |     |     |
|-------------------------------------------|-----|-------------------------|------------|-------------------------------------------------------------------------------------|---|---|----|-----|-----|
|                                           |     | subjects                |            |                                                                                     |   |   |    |     |     |
|                                           |     | 2. EVS                  | 16UEVS401  | Environmental science                                                               | - | 2 | *  | *   | *   |
| <b>Total credit =16; Total Hours = 30</b> |     |                         |            |                                                                                     |   |   |    |     |     |
| IV                                        | I   | Language                | 16UTAMF04  | Tamil IV                                                                            | 3 | 6 | 50 | 50  | 100 |
|                                           | II  | English                 | 16UENGF44  | English IV                                                                          | 3 | 4 | 50 | 50  | 100 |
|                                           | III | Core IV                 | 16UAZTC06  | Genetics and Evolution                                                              | 4 | 6 | 50 | 50  | 100 |
|                                           |     |                         | 16UAZTC05P | Practical II- Cell Biology, Genetics and Evolution                                  | 4 | 2 | 50 | 50  | 100 |
|                                           |     | Allied IV               | 16UCHEA16  | Chemistry II                                                                        | 3 | 6 | 50 | 50  | 100 |
|                                           |     |                         | 16UCHEA15P | Allied Chemistry Practical                                                          | 4 | 2 | 50 | 50  | 100 |
|                                           | IV  | 1. Skill based subjects | 16UGSLS04  | Soft skill IV                                                                       | 3 | 2 |    | 100 | 100 |
|                                           |     | 2. EVS                  | 16UEVS401  | Environmental science                                                               | 2 | 2 |    | 100 | 100 |
| <b>Total credit =26; Total Hours = 30</b> |     |                         |            |                                                                                     |   |   |    |     |     |
| V                                         | III | Core V                  | 16UAZTC07  | Developmental Biology and Endocrinology                                             | 4 | 4 | 50 | 50  | 100 |
|                                           |     | Core VI                 | 16UAZTC08  | Biotechnology and Nanotechnology                                                    | 4 | 4 | 50 | 50  | 100 |
|                                           |     | Core VII                | 16UAZTC09  | Animal Physiology, Biochemistry and Immunology                                      | 4 | 4 | 50 | 50  | 100 |
|                                           |     | Core VIII               | 16UAZTC10  | Biostatistics and Computer Applications for Life Sciences                           | 4 | 4 | 50 | 50  | 100 |
|                                           |     | Core IX                 | 16UAZTC11P | Practical-III Animal Physiology, Biochemistry, Developmental Biology and Immunology | - | 4 | 50 | 50  | 100 |
|                                           |     | Core X                  | 16UAZTC12P | Practical-IV- Environmental Biology, Biotechnology and Microbiology                 | - | 4 | *  | *   | *   |
|                                           |     | Elective – I            | 16UAZTE01  | Medical Laboratory Technique                                                        | 5 | 5 | 50 | 50  | 100 |
|                                           | IV  | Value Education         | 16UVED401  | Value education                                                                     | 2 | 1 | *  | 100 | 100 |
| <b>Total credit =23; Total Hours = 30</b> |     |                         |            |                                                                                     |   |   |    |     |     |
| VI                                        |     | Core VIII               | 16UAZTC13  | Taxonomy, Ecology and Paleontology                                                  | 4 | 4 | 50 | 50  | 100 |
|                                           |     | Core IX                 | 16UAZTC14  | Recombinant DNA technology                                                          | 4 | 4 | 50 | 50  | 100 |

|                                           |                      |            |                                                                                     |   |   |    |    |     |
|-------------------------------------------|----------------------|------------|-------------------------------------------------------------------------------------|---|---|----|----|-----|
| III                                       | Core X               | 16UAZTC15  | Microbiology and Industrial Biotechnology                                           | 4 | 4 | 50 | 50 | 100 |
|                                           | Core XI              | 16UAZTC11P | Practical-III-Animal Physiology, Biochemistry, Developmental Biology and Immunology | 4 | 4 | 50 | 50 | 100 |
|                                           | Core XII             | 16UAZTC12P | Practical-IV Environmental Biology, Biotechnology and Microbiology                  | 4 | 4 | 50 | 50 | 100 |
|                                           | Elective II          | 16UAZTE02  | Sericulture and Apiculture                                                          | 5 | 5 | 50 | 50 | 100 |
|                                           | Elective III         | 16UAZTE03  | Economic Entomology and Pest Management                                             | 5 | 5 | 50 | 50 | 100 |
| V                                         | Extension Activities |            |                                                                                     | 1 | - | -  | -  | -   |
| <b>Total credit =31; Total Hours = 30</b> |                      |            |                                                                                     |   |   |    |    |     |
| <b>OVERALL CREDIT TOTAL = 140</b>         |                      |            |                                                                                     |   |   |    |    |     |

# **SEMESTER I**

**GURU NANAK COLLEGE (AUTONOMOUS), CHENNAI – 600 042**  
(Effective for the batch of candidates admitted in 2018 – 2021)

**CORE I**  
**DIVERSITY AND FUNCTIONAL ANATOMY OF INVERTEBRATES**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC01</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: I</b>              | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 90</b> |

**COURSE OBJECTIVES**

To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acellular to multicellular animals. Studies on this group of animals bring to light knowledge of basic functions of life viz., nutrition, respiration, excretion, reproduction etc. and how the organisms of various phyla structurally and functionally adapt themselves for surviving in different ecological conditions. Classification and general characters of the following phyla up to orders with a detailed study of the animals mentioned against each phylum.

**UNIT-I** **(15 hrs)**

Protozoa : *Paramecium*, *Plasmodium*

**UNIT-II** **(18 hrs)**

Porifera : *Sycon*, Canal System in Sponges  
Coelenterata : *Obelia*, *Aurelia*, Polymorphism

**UNIT-III** **(18 hrs)**

Platyhelminthes : *Fasciola*, *Taenia*, Parasitic Adaptations  
Nematoda : *Ascaris*, *Enterobius*, *Ancylostoma*  
Annelida : *Nereis*, Excretory Organs in Annelida

**UNIT-IV** **(21 hrs)**

Arthropoda : *Penaeus*, Larval Forms in Crustacea  
Mollusca : *Pila*, Foot in Molluscs

**UNIT-V** **(18 hrs)**

Echinodermata : *Asterias*, Larval Forms  
Hemichordata : *Balanoglossus* (External Characters Only) and its Systematic Position.

**Books Recommended**

1. Dhama, P.S. and Dhama, J.K., Invertebrates, 5th ed., R. Chand Publisher, 1979.
2. Kotpal, R.L., Invertebrates, Rastogi Publications, Meerut, 2005.
3. Parker, T.J. and Haswell, W.A., Text book of Zoology, Invertebrates, Vol. I edited by Marshall, A.J. and Williams, W.D., CBS Publication & Dist., Delhi, 1990.
4. Barnes, A., Invertebrate Zoology, Harcourt Publishers, International Company, 2001.
5. Chaudhry, S., Fundamental Invertebrate Zoology, S.Vikas & Co. Fatehpura, Jalandhar, 2003.

6. Ekambaranatha Ayyar, M and Ananthkrishnan, T.N. 1993, Outlines of Zoology, Vol.I, Part I and II, Viswanathan and Co. Madras.
7. T.C. Majpuria. 1990, Invertebrate Zoology, Pradeep Pub. Kitab Mahal.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |



## ALLIED ZOOLOGY – I

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 17UAZTA11</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: I</b>              | <b>CREDITS: 3</b> | <b>TOTAL HOURS: 90</b> |

**Unit – I: (20 Hrs)**

Introduction: Invertebrata- General characters and Classification.

**Protozoa** – Type study: *Plasmodium vivax*

**Porifera** – Type study : *Scypha* (sycon)

**Coelenterata** – Type study: *Obelia geniculata*

**Platyhelminthes**- Type study : *Taenia solium*

**Unit – II: (20 Hrs)**

**Annelida** – Type study: Leech

**Arthropoda** – Type study: Prawn

**Mollusca** – Type study: Unio (External morphology and Respiratory system)

**Echinodermata** – Type study: Starfish (External morphology and Water vascular system)

**Unit – III: (15 Hrs)**

**Chordata** – General characters & Classification

**Prochordates** – *Amphioxus* – Structure

**Vertebrates - Pisces**- Type study : Shark

**Unit – IV: (20 Hrs)**

**Amphibia**- Type study: Frog (External morphology, Digestive system, Circulatory System and Reproductive system)

**Reptilia**: Calotes (External morphology, Digestive system, Circulatory System and Reproductive system)

**Unit – V: (15 Hrs)**

**Aves**- Type study: Pigeon (External morphology and Respiratory system);

**Mammalia**- Type study: Rabbit (External morphology and Circulatory system)

**Text Book:**

1. Ekambaranatha Ayyar, M and Ananthkrishnan, T.N. 1993, Outlines of Zoology, Vol.I and II, Viswanathan and Co. Madras.

**Reference Books:**

2. P.S. Dhami and J.K. Dhami – Invertebrate Zoology – S. Chand and Co. New Delhi.
3. Jordan, E.K. and P.S. Verma, 1993. Chordate Zoology, 12<sup>th</sup> edition, S. Chand & Co. Ltd., Ram Nagar, New Delhi.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**NON-MAJOR ELECTIVE  
AQUACULTURE**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UNME01G</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: I</b>              | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

**Unit – I** **(6 hrs)**

History of aquaculture – Purpose and importance of aquaculture – Physical and chemical characteristics features of water bodies (Freshwater brackish water and marine water) – Types of culture systems (Traditional, intensive, semi-intensive and extensive).

**Unit – II** **(6 hrs)**

Selection criteria for cultivable species – Site selection for fish farming – Construction of fish and Prawn ponds – Types of fish ponds (breeding pond, hatchery unit, brooders pond, nursery pond, stocking pond and rearing pond) – Maintenance and management of different ponds. Feeds for cultivable species – natural, supplementary and artificial feeds.

**Unit – III** **(6 hrs)**

Types of culture – Monoculture, Monosex-culture & Poly culture – Integrated fish farming (paddy cum fish culture, paddy cum prawn culture and Duck cum pig cum fish culture) – Induced breeding in Indian major carps.

**Unit – IV** **(6 hrs)**

Culture of air-breathing fishes (Mullet and Cat fish) Sewage fed fish culture – Culture of Pearl Oyster and Edible Oyster.

**Unit – V** **(6 hrs)**

Culture of marine and freshwater prawns – Common fish diseases (bacterial, fungal, viral and parasitic diseases) – Prevention and treatment – Fishing technology (Crafts and gears) – Preservation and Processing of Fish and Prawn – Agencies involved in Aquaculture.

**Text books:**

1. R. Santhanam, N. Sukumaran and Natarajan, - A manual of fresh water aquaculture, Oxford and IBH Publishing Co Pvt. Ltd., Mumbai.
2. B.N. Yadav, - Fish and fisheries, Daya Publishing House, Delhi.

**Reference books:**

1. Mathew Landan, 1991. Introduction to aquaculture, John Wilay and Sons Inc..

2. V.R.P. Sinha, 1993. Acompendium of aquaculture Technologies for developing countries, Oxford and IBH Publishing Company PVT. Ltd.
3. V.G. Jhingran,1991. Fish and fisheries of India, Hindustan Publishing Corporation, Delhi.
4. T.V.R. Pillay – Aquaculture principles and practives, Fishing new Books, Blackwell Science Ltd., Oxford.
5. Shanmugam, K. 1990. Fishery Biology and Aquaculture, Hindustan Pub. Corporation, New Delhi.
6. C.V. Kurian and Sebastein – Prawn and Prawn fisheries of India, Hindustan Publishing House, New Delhi.
7. Elvire Balugal, A. 1984. Aquaculture systems and practices – A selected Review, Daya Publishing House, New Delhi.
8. B.N.Yadav, 1995. Fish Endocrinology, Daya Publishing House, New Delhi.

# **SEMESTER II**

**CORE II**  
**DIVERSITY AND FUNCTIONAL ANATOMY OF CHORDATES**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC03</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: II</b>             | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 90</b> |

**COURSE OBJECTIVES**

To acquaint the students about the structure and function of protochordates and chordates and to make the student understand the basic characters, advancements and adaptations of different types of vertebrates. Detailed study (morphology & anatomy), systematic position, distinctive characters, distribution, ecology, economic importance, if any, of the following animals:

**UNIT-I** **(15 hrs)**

Urochordata : *Herdmania*; Development and Affinities: Alternation of generation in Urochordata.

**UNIT-II** **(20 hrs)**

Cephalochordata : *Branchiostoma*; Development and affinities. Cyclostomata : *Petromyzon*; Migration.

**UNIT-III** **(20 hrs)**

Pisces : *Labeo*, Accessory respiratory organs in fishes, Types of fins Amphibia : *Rana*, Parental care.

**UNIT-IV** **(20hrs)**

Reptilia : *Calotes*, Arcades and fossae  
Aves : *Columba*, Migration in birds; Palate in birds.

**UNIT-V** **(15 hrs)**

Mammalia : *Oryctolagus*, Dentition in mammals.

**Book Recommended**

1. Dhama, P.S., Dhama, J.K., Chordate Zoology, Dinesh Publishers, Jalandhar, 1982.
2. Kotpal, R.L., Text Book of Zoology- Vertebrates, CBS Publishers, Delhi, 2000.
3. Parker, T.J., and Haswell, W.A., A Text Book of Zoology Vol. II- Vertebrates. Latest edition, CBS Publishers, Delhi edited by Late A.J. Marshall & Williams, W.D.
4. Dodson, E.O., A Text Book of Zoology, CBS Publishers & Distributors, Delhi, 1976.
5. Bhamrah, H.S. and Juneja, K., An introduction to fishes, Anmol Publications, New Delhi, 1990.

**Question paper pattern:**

| <b>Section</b>     | <b>Question Component</b>                                                  | <b>Numbers</b> | <b>Marks</b> | <b>Total</b> |
|--------------------|----------------------------------------------------------------------------|----------------|--------------|--------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>     | <b>20</b>    |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>     | <b>40</b>    |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b>    | <b>40</b>    |
| <b>TOTAL MARKS</b> |                                                                            |                |              | <b>100</b>   |

**Distribution of Questions:**

| <b>Sections</b>  | <b>Units</b> | <b>No. of Questions</b> |                 |
|------------------|--------------|-------------------------|-----------------|
|                  |              | <b>Theory</b>           | <b>Problems</b> |
| <b>Section A</b> | Unit – 1     | <b>2</b>                |                 |
|                  | Unit – 2     | <b>2</b>                |                 |
|                  | Unit – 3     | <b>3</b>                |                 |
|                  | Unit – 4     | <b>3</b>                |                 |
|                  | Unit – 5     | <b>2</b>                |                 |
| <b>Section B</b> | Unit – 1     | <b>1</b>                |                 |
|                  | Unit – 2     | <b>1</b>                |                 |
|                  | Unit – 3     | <b>2</b>                |                 |
|                  | Unit – 4     | <b>2</b>                |                 |
|                  | Unit – 5     | <b>2</b>                |                 |
| <b>Section C</b> | Unit – 1     |                         |                 |
|                  | Unit – 2     | <b>1</b>                |                 |
|                  | Unit – 3     | <b>1</b>                |                 |
|                  | Unit – 4     | <b>1</b>                |                 |
|                  | Unit – 5     | <b>1</b>                |                 |

**CORE - III**  
**PRACTICAL I: INVERTEBRATA AND CHORDATA**

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC02P</b> | <b>PRACTICAL</b>  | <b>MARKS: 100</b>      |
| <b>SEMESTER: I &amp; II</b>      | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**I. DISSECTION**

**A. Cockroach:**

1. External characters
2. Digestive system
3. Nervous system
4. Male Reproductive system
5. Female Reproductive system

**B. Any Bony Fish:**

6. External characters
7. Digestive system
8. Aortic arches

**II. MOUNTING**

Mouth parts of: 1. Cockroach 2. Mosquito 3. Prawn: appendages 4. *Mugil* : Ctenoid scale

**III – SPOTTERS**

**A- Classify giving reasons up to order:**

1. *Paramecium*
2. *Scypha*
3. *Obelia*
4. *Tanea Solium*
5. *Ascaris*
6. *Neanthes*
7. *Penaeus*
8. *Asterias*
9. *Balanoglossus*
10. *Amphioxus*
11. *Scoliodon sorrakowah*
12. *Rana hexadactyla*
13. *Calotes versicolor*
14. *Columba livia*
15. *Oryctolagus cuniculus*



**B- Draw labelled sketches:**

16. *Obelia* medusa
17. Nereis T.S
18. Bipinnaria larva
19. *Amphioxus* T.S
20. Quill feather

**C- Comment on Biological significance:**

21. *Entamoeba*
22. *Paramecium* – Conjugation
23. *Plasmodium*
24. *Ascaris*
25. Heteronereis
26. *Peripatus*
27. Nauplius larva
28. *Sacculina* on crab
29. Sea anemone on Hermit crab
30. *Vipera russelli*
31. Bat

**D – Relate structure and function:**

32. Sponge – Spicules
33. Sponge – Gemmule
34. *Taenia* – Scolex
35. *Neanthes* – Parapodium
36. *Penaeus* – Petasma
37. Starfish - Tube foot.
38. Snake – Poison apparatus
39. Quill feather

**E. Osteology / Palate in Birds / Dentition Frog**

**Osteology**

40. Skull and lower jaw
41. Vertebral column
42. Pectoral girdle
43. Pelvic girdle
44. Forelimb
45. Hindlimb

**Palate in Birds**

46. Pigeon
47. Crow
48. Duck

**Dentition**

49. Rabbit
50. Dog – Dentition

## ALLIED ZOOLOGY - II

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTA13</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: II</b>             | <b>CREDITS: 3</b> | <b>TOTAL HOURS: 90</b> |

**Unit – I:** (20 hrs)

**Cell Biology** – Structure of animal cell, Mitochondria, nucleus and nucleolus and Golgi bodies.  
**Genetics:** Molecular structure of Genes – Gene concept – Gene function – Inborn errors of metabolism – Genetic Engineering and its applications – X and Y – linked inheritance.

**Unit – II:** (20 hrs)

**Developmental Biology:** Gametogenesis – Fertilization - Cleavage and gastrulation of chick and pig.

**Unit – III:** (20 hrs)

**Human Physiology:** Digestion, Excretion, kidney failure and transplantation. Structure of heart, Cardiac cycle, composition of blood, Blood pressure. Heart diseases – Ischemia, Myocardial infarction, Rheumatic heart disease, Stroke. Endocrine glands – Hormones- feedback mechanism – Pituitary, thyroid, Islets of Langerhans, adrenal, sex organs.

**Unit – IV:** (15 hrs)

**Environmental Biology:** Physico-Chemical factors – Environmental Degradation treatment methods on sewage, effluents – Green House Effect.

**Unit – V:** (15hrs)

**Evolution** – Lamarkism and Neo-Lamarckism – Darwinism and Neo-Darwinism - Factors responsible for speciation.

**Text book:**

1. Verma, P.S. and V.K. Agarwal, 2010 Reprint, Cell Biology, Genetics, Molecular Biology, Physiology, Evolution and Ecology, S. Chand & Co., New Delhi – 110 055.

**Reference books:**

1. Sambasiviah, I, Kamalakara Rao, A.P. Augustine Chellapa, S (1983). Text book of Animal Physiology, S. Chand & Co, New Delhi.
2. Verma, P.S. and Agarwal, V.K. (1983). Animal Ecology, S. Chand & Co, New Delhi.
3. Verma, P.S. and Agarwal, V.K. and Tyagi, B.S. (1991). Chordate Embryology S. Chand & Co, New Delhi.
4. Rastogi, V.B. and Jayaraj, M.S. (2000). Text book of Genetics, Kedarnath Ramnath Publishers, Meerut.
5. T.S.Gopalakrishnan, Itta Sambasivaiah and A.P.Kamalakararao, 1984 Principles of organic Evolution, Pearl publications, Chennai.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

## ALLIED ZOOLOGY - PRACTICAL

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTA12P</b> | <b>PRACTICAL</b>  | <b>MARKS: 100</b>      |
| <b>SEMESTER: I &amp; II</b>      | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

### **I. Dissection:**

1. Cockroach: Digestive and Nervous system

### **II. Mounting:**

1. Mouth parts of cockroach
2. Mouth parts of Mosquito

### **III. Spotters:**

*Plasmodium*, *Sycon*, *Obelia geniculata*, *Taenia solium* (Entire & Transverse section), Leech (Entire & Transverse section), Fresh water mussel, *Amphioxus*, Shark (Placoid scale), Pigeon (feathers) and Rabbit.

**NON-MAJOR ELECTIVE  
PUBLIC HEALTH AND HYGIENE**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UNME02G</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: II</b>             | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

**Unit – I** **(6 hrs)**

Scope of Public Health and Hygiene – Concepts of Health and Disease – History of Public Health in India. Nutrition and Health: Classification of foods – Nutritional deficiencies – Vitamin deficiencies – Balanced diet – Nutritional requirements of special groups.

**Unit – II** **(6 hrs)**

Environment and Health: water-sources, Pollution, purification – water quality standards. Air: Ventilation – Air pollution – Noise pollution – Radiation effects – Solid waste and excreta disposal – Sewage treatment.

**Unit – III** **(6 hrs)**

Communicable diseases: Respiratory infections: Measles, Rubella, Mumps, Diphtheria. Intestinal infections: Poliomyelitis, Cholera, typhoid, Amoebiasis. Arthropod infections: Malaria, Filariasis, Dengue. Zoonosis: Rabies, Plague Japanese encephalitis. Surface infections: Tetanus, Leprosy, STD and AIDS

**Unit – IV** **(6 hrs)**

Non-Communicable Diseases: Coronary heart Disease – Hypertension – Diabetes – Obesity – Blindness – stroke. Occupational Health Hazards: Physical, Chemical, Mechanical, Biological and Psychological. Mental health: Causes of mental ill-health- alcoholism and Drug dependence.

**Unit – V** **(6 hrs)**

Health Education: Health planning in India – Health programmes in India – WHO – Non-governmental Voluntary Health Organizations. First aid and Nursing: Methods –Dressing – care – Duties – Preparations.

**Books for Reference:**

1. Park and Park, 1995. Text Book of Preventive and Social Medicine. M/S. Banarsidas Bhanot Publishers, Jabalpur.
2. Verma S. 1998. Medical Zoology, Rastogi Publications, New Delhi.

# **SEMESTER III**

**CORE - IV**  
**CELL AND MOLECULAR BIOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC04</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: III</b>            | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 90</b> |

**COURSE OBJECTIVES**

To enable the students to learn various aspects of cell biology.

**UNIT I**

**(20 hrs)**

Plasma membrane: Different models of plasma membrane (in brief), Fluid mosaic model in detail, Differentiation at cell surface.

**UNIT II**

**(15 hrs)**

Endoplasmic reticulum: Morphology, Chemical Composition, Morphological Differentiation, Functions and its Role During Mitosis.  
Microbodies : Structure, Chemical Composition, Functions and Origin of Peroxisomes and Glyoxysomes.

**UNIT-III**

**(20 hrs)**

Mitochondria : Morphology including vital examination, Light and Ultramicroscopic Structures, Structural Variations with Regard to Functions, Chemical Composition, Role in Cell Physiology, Mitochondria as Semi-autonomous Organoids.  
Lysosomes: Morphology, Chemistry, Polymorphism in Relation to Cytosis, Cell Ageing and Cell Autophagy.

**UNIT-IV**

**(20 hrs)**

Nucleus: Nuclear Envelope, Nuclear Permeability, Structure of Interphase Nucleus, Structure and Cytochemistry of Nucleus, Structure and Biogenesis of Ribosomes.  
Centrioles : Basal bodies, Cilia, Flagella, Microtubules, Amoeboid movement.

**UNIT-V**

**(15 hrs)**

Golgi complex: Morphology, Chemical Composition, Relationship with other cell components, its function with special reference to cell secretion.

**Books Recommended**

1. DeRobertis, EDP, De Robertis, E.M.F. Cell Biology and Molecular Biology. Eighth Edition. W.B. Saunders Co., Philadelphia, 1995.
2. Powar, C.B., Cell Biology, Himalaya Publishing House, Bombay.
3. Alberts, B. Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. Molecular Biology of the Cell Gerland Publ. Inc., New York.
4. Darnell, J., Lodish, JH. & Baltimore, D. Molecular Cell Biology, Oxford & IBHPublishing Co., New Delhi.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |



# **SEMESTER IV**

**CORE – V**  
**GENETICS AND EVOLUTION**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC06</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: IV</b>             | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 90</b> |

**COURSE OBJECTIVES**

To enable the students to learn various aspects of hereditary. To give an insight into evolution of genetic material, its functional aspects and changes in the environment that bring about evolution.

**UNIT-I (20 hrs)**

Physical basis of heredity – Mendelism, interaction of genes, multiple alleles, chromosome structure and function in Eukaryotes (except in chemistry, models and concepts). Polytene chromosomes, lampbrush chromosomes.

**UNIT-II (20 hrs)**

Sex determination - Chromosomes & Sex Chromatin

Chromosomal changes- Structural aberrations and its significance. Numerical changes, Polyploidy and its types. Nature of genes-Double helix structure of DNA, Mechanisms of DNA replication. Changes in genes-Spontaneous mutations and Induced Mutations, Physical and Chemical Mutagens.

**UNIT-III (15 hrs)**

Linkage of genes, Crossing over, Sex linkage in *Drosophila* and Man, Criss-cross inheritance, Colour blindness and Haemophilia. Cytoplasmic inheritance. Human Genetics-Normal and abnormal karyotypes.

**UNIT – IV : Evolution ( 20 hrs)**

Lamarckism and Neo-Lamarckism – Darwinism and Neo-Darwinism – Mutation Theory – Geological time scale – Dating of Fossil – Living and Extinct Fossils. Mimicry & Colouration – Batesian and Mullerian – Convergent, Divergent and Parallel Evolution – Co-evolution, Adaptive radiation in mammals.

**UNIT – V (15 hrs)**

Isolating mechanisms – different types – Species Concept – definition and origin of species – Allopatric and Sympatric speciation – Genetic drift – Founder’s Principle. Evolution of Man.

**Books recommended**

1. U. Goodenough: Genetics. IIIrd Edition, Washington University, SaundersCollege Publishing.
2. O.P. Swanson, Timothy Herz and William, J. Young : Cytogenetics-The chromosome in division, inheritance and evolution, Prentice Hall.
3. B.S. Gardner & D.P. Smustad : Principles of Genetics, John Wiley & Sons. Sixth Edition.
4. A.M. Winchester. Genetics-A survey of the Principles of Heredity, Oxford & IBH Publishing Co., New Delhi.

5. P.K. Gupta : Genetics, Rastogi Publishers, Meerut.
6. P.K. Gupta : Cytology Genetics, and Molecular Biology; Rastogi Publishers, Meerut.
7. Verma, P.S. and V.K. Agarwal, 2002, Concept of Evolution, S. Chand & Co., Ram Nagar, New Delhi – 110 055.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE VI**  
**PRACTICAL II - CELL BIOLOGY AND GENETICS**

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC05P</b> | <b>PRACTICAL</b>  | <b>MARKS: 100</b>      |
| <b>SEMESTER: III &amp; IV</b>    | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**CELL BIOLOGY**

1. Micrometry – Use of Microscopes- Microscopes – Light microscope, CameraLucida, Stage and Ocular Micrometer.
2. Blood smear preparation – Differential Count of WBC.
3. Counting of RBC and WBC using Haemocytometer (Demonstration)
4. Mounting of Buccal epithelium and observing living cells using vital staining.
5. Mitosis in Onion root tip squash
6. Meiosis in grasshopper testis squash (Demonstration)
7. Study of prepared slides of histology
  - a. Columnar epithelium
  - b. Ciliated epithelium
  - c. Glandular epithelium
  - d. Connective tissue
  - e. Cartilage T.S.
  - f. Bone T.S.
  - g. Cardiac tissue
  - h. Striated muscle
  - i. Non-striated muscle
  - j. Nervous tissue
  - k. Ovary T.S.
  - l. Testis T.S.

**GENETICS**

1. Observation of common mutants of Drosophila
2. Preparation of mount of salivary gland chromosomes of Chironomus larva
3. Identification of human blood groups
4. Study on Normal Karyotype - male and female, Down syndrome, Turner and Klinefelter syndrome

# **SEMESTER V**

**CORE - VII**  
**DEVELOPMENTAL BIOLOGY AND ENDOCRINOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC07</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: V</b>              | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES**

To enable the students to know about the development of all the vertebrates from an egg to the embryo. To acquaint the students with the functions of various endocrine glands and their secretions i.e. hormones

**UNIT I (12 hrs)**

Origin of germ cells- Process of Spermatogenesis and Oogenesis; Structure of human sperm, Types of sperms, Types of eggs.

**UNIT II (12 hrs)**

Mechanism and Physiology of Fertilization. Early development- Cleavage, Blastulation, Gastrulation and Tubulation in Frog and Chick. Presumptive areas, Organizers and Inductors.

**UNIT III (12 hrs)**

Development of membranes and Formation of placenta. Types of placentae in mammals, pregnancy tests. Bio-chemical basis of embryology, regeneration, metamorphosis.

**UNIT-IV (12 hrs)**

Introduction to hormones and their mode of action. Gonadal hormones in Mammals. Hormonal control of metabolism, Development, Somatic pigmentation and Reproduction in insects.

**UNIT-V (12 hrs)**

Structure of Endocrine Glands-Pituitary, Thyroid, Adrenal and Pancreas of Vertebrates. Biological Actions of Hormones of Pituitary, Thyroid, Adrenal and Pancreas.

**Books Recommended**

1. An Introduction to Embryology, Saunders Company.
2. Turner, C.D. and Bagnars, W.B. (1976) General Endocrinology, Saunders Company.
3. Highnam, K.C. and Hill, L.(1981) Comparative Endocrinology of invertebrates, Enwaral Arnold Ltd., London.
4. Golds Worthy, G.J. Robinson, J. and Mordue, W. 1981. Endocrinology, John Wiley and Sons, New York.
5. Tombes, A.S.(1970) An Introduction to invertebrates endocrinology, Academic Press, New York.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE – VIII**  
**BIOTECHNOLOGY AND NANOTECHNOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC08</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: V</b>              | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES**

To enable students to be familiar with the basics of biotechnology together with a fundamental knowledge on the application of nanotechnology

**UNIT I** **(12 hrs)**

Definitions and history of Biotechnology. Structure of *E.coli*, Bacterial conjugation, Transduction, Transformation, Structure of Bacteriophage – Lytic and Lysogenic Cycle. Major areas of Biotechnology – Agriculture, Food and Pharmaceutical industry and Beverages. Indian scenario in Biotechnology – Centers, Activities Achievements and Bio-industries in India

**UNIT II** **(12 hrs)**

Vectors – Types, plasmids (pBR 322, pBR 327), Phage – M13, Cosmid insertion vectors, Replacement vectors, Shuttle vectors and High expression vectors. DNA fragment, Enzymes – Nucleases, Restriction enzymes, Polymerase and Ligases.

**UNIT III** **(12 hrs)**

Gene cloning in *E.coli*. Isolation of DNA – Insertion of DNA – Use of Linkers and Adapters – Transformation – Uptake of DNA by host cell – Selection of clones identification of recombinants insertional inactivation.

**UNIT IV** **(12 hrs)**

Tissue culture: Culture media – Composition and Preparation. Principles and techniques of plant and animal cell culture. Importance of cell line culture.

**UNIT V** **(12 hrs)**

Nanotechnology: Definition - Nanoscience and nanotechnology. Applications of nanotechnology – Nanomaterials in medicine – Medical implants – Nanomaterials for water purification – Nanomaterials in food – Nanomaterials for the environment - Elimination of pollutants – Veterinary applications.

**TEXT BOOKS:**

1. Purohit Mathur, 1999 .Biotechnology Fundamental and applications. Botanica Publications.

**REFERENCE BOOKS:**

1. T.A. Brown .2010. Gene cloning and Introduction. Wiley Blackwell.
2. Brown J.A. 2001 – Genetics – A Molecular approach 3<sup>rd</sup> edition – Nelson Ternes.



3. Old R. W and S.B. Primrose. 1994. Principles of Gene manipulation – 5<sup>th</sup> edition – Blackwell Scientific publications.
4. John. R. W. Masters 2000. Animal cell culture – A practical approach 3<sup>rd</sup> Edition. Oxford univ press.
5. Glick B.R. and Jack J. Pasternak, 1994 . Molecular biotechnology ASM press.
6. P Ramdoss, 2009. Animal Animal Biotechnology Recent Concepts and Developments, MJP Publishers.
7. Subbiah Balaji, 2010. Nanotechnology. MJP Publishers.
8. S Shanmugam, 2011. Nanotechnology. MJP Publishers.
9. Rakesh Rathi, Nanotechnology, S. Chand & Co.
10. B K Parthasarathy, 2007. Nanotechnology in Life Science Gyan Books.
11. Kumar, 2010. Principles of Nanotechnology, Scitech Publication (India).

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE – IX**  
**ANIMAL PHYSIOLOGY, BIOCHEMISTRY AND IMMUNOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC09</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: V</b>              | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES:**

To make the students understand the physiological and biochemical processes going on inside the vertebrates together with an exposure to immunological components.

**UNIT-I**

**(7 hrs)**

Enzymes: Classification, Nomenclature, General Properties, Regulation of Enzyme Activity, Enzyme inhibition. Digestion: Intracellular and extracellular digestion, digestive enzymes, Digestion by means of symbionts, Intestinal absorption.

**UNIT-II**

**(15 hrs)**

Respiration: Nature of Respiratory Organs, Transport of Respiratory Gases, Control of Respiration. Muscle: Muscle contraction – Physiology and Chemistry. Excretion: Structure of Kidney and Nephron, Physiology of urine formation. Circulatory System: Blood components, Functions of components, Cardiac output and Heart rate, Physiology of heart, Control of Cardiovascular function. Nervous system : Structural elements, Nerve impulse, Resting and Action potentials, Conduction of Action Potential, Synaptic Transmission.

**UNIT III**

**(8 hrs)**

Metabolism: Carbohydrate metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis and Glycolysis; Kreb's cycle, Regulation of Carbohydrate Metabolism, Electron Transport Chain, Oxidative Phosphorylation; Lipid Metabolism, Protein Metabolism

**Unit – IV**

**(15 hrs)**

Overviews of immune system – Historical perspectives, Innate and Acquired immunity. Cells of the Immune System: Hematopoiesis and Differentiation, B-lymphocytes, T- lymphocytes, Macrophages, Dendritic cells, Natural Killer Cells and Lymphocyte Activated Killer Cells, Eosinophils, Neutrophils & Mast Cells. Organs of the Immune System: Primary and Secondary Lymphoid Organs: Thymus, Bursa of Fabricii, Spleen, Lymph Nodes, Lymphatic System, Mucosa Associated Lymphoid Tissue (MALT), Cutaneous –Associated Lymphoid Tissues. Complement system: Major Histocompatibility Complex.

**UNIT V**

**(15 hrs)**

Antigens – types, properties- Haptens – Adjuvants – Vaccines – Types – Toxoids – Antitoxins – Immunoglobulins – structure, types, and properties – Theories of antibody production – Complement structure, properties, function and pathway – Antigen-antibody reaction – in-vitro methods – Agglutination – Precipitation – Complement fixation – Immuno-fluorescence – ELISA – RIA.

**Books Recommended**

1. Guyton, A.X. (1986) Text Book of Medical Physiology, 7th edition, Saunders Company.
2. Best, J.P. (1985) Best and Taylor's physiological basis of medical practice (11th ed.) William and Wilkins.
3. Hoar, W.S. (1983) General and comparative physiology, Adaptation and Environment (3rd ed.) Cambridge University Press.
4. Roitt I.M. 2000. Essential Immunology. Blackwell Scientific Publishers
5. Chakravarty, A. K. 1996. Immunology, Tata Mc Graw Hill, New Delhi.
6. Lehninger A.L., Nelson D.L., Cox M.M. (2005). Principles of biochemistry (W. H. Freeman, USA).
7. Stryer L, J. M. Berg, J.L. Tymoczko (2001). Biochemistry (W.H. Freeman and Company, New York).
8. Rawn J.D. (1989). Biochemistry (Neil Patterson).
9. Voet D., Voet, J.G. (2004). Biochemistry (John Wiley & Sons).
10. Voet, D., Voet, J.G. and Pratt, C.W. (2008). Fundamentals of biochemistry: Life at the molecular level (John Wiley & Sons).

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE - X**  
**BIostatISTICS AND COMPUTER APPLICATION IN LIFESCIENCE**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC10</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: V</b>              | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES:**

All the data generated in biological sciences needs statistical verification to prove its significance so computer aided analysis of the same is need of the hour. Therefore knowledge of computer in 1st year is important.

**UNIT – I** **(12 hrs)**

An introduction, Types of data, Collection, Classification and Tabulation of the Primary data, Secondary Data, Discrete data and Continuous data, Diagrammatic and Graphical representation of grouped data, Frequency Distribution {univariate and bivariate}, Cumulative frequency distribution and their graphical representation, Histogram frequency polygon. Concept of central tendency or location and measures of dispersion

**UNIT – II** **(12 hrs)**

Normal distribution. Simple Correlation. Hypothesis testing- Student's t-test; Chi-square analysis.

**UNIT – III** **(12 hrs)**

Computers: General introduction to computers, Organization to computers, Digital and Analogue computers, Computers algorithms: Milestones in hardware and software-batch oriented/online/real time applications.

**UNIT – IV** **(12 hrs)**

Data storage devices: Primary storage: Storage addressed and capacity, ROM, RAM, Input/output devices: Key-tape/diskette devices, light pen Mouse, Joystick, Source data automation. Printed outputs: Serial, line, page, Printers, Plotters, Voice Response Units.

**UNIT V** **(12 hrs)**

MS – Word: File operations – New, Open, Save & Print – Editing – Cut, Copy, Paste, Find & Replace – Insert – Page numbers & Pictures – Format – Font, Bullet and Numbering, Paragraph & Background – Tools – Spelling & Grammar – Data – Sort.

MS – Excel: Presentation of Biostatistical data using Excel – Auto-sum, Paste function, Chart wizard, Sort function & Drawing. Uses of Internet, Networking of computers.

**Reference Books:**

1. P.N. Arora & P.K. Malhotra (1996). Biostatistics (Himalaya Publishing House, Mumbai).
2. Sokal & Rohlf (1973). Introduction to biostatistics (Toppan Co. Japan).
3. W.J. Evens, G.R. Grant (2005). Statistical methods in bioinformatics: An introduction (Springer).
4. P.K. Sinha (2004). Computer fundamentals (BPB).
5. Suresh K. Basandra (2008). Computers today (Galgotia Publications Pvt. Ltd., New Delhi).

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>1</b>         | <b>1</b> |
|                  | Unit – 2 | <b>1</b>         | <b>1</b> |
|                  | Unit – 3 | <b>1</b>         | <b>2</b> |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 |                  | <b>1</b> |
|                  | Unit – 2 |                  | <b>1</b> |
|                  | Unit – 3 | <b>1</b>         | <b>1</b> |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 |                  | <b>1</b> |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**ELECTIVE - 1**  
**MEDICAL LABORATORY TECHNIQUES AND BIOINSTRUMENTATION**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTE01</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: V</b>              | <b>CREDITS: 5</b> | <b>TOTAL HOURS: 75</b> |

**COURSE OBJECTIVES:**

To familiarize students with various laboratory techniques undertaken before medical intervention and the instruments utilized in common laboratories.

**Unit I (15 hrs)**

Introduction – Scope of the subject. Collection of specimens, Records and Preparation of reports. Cleaning, Maintenance and Care of Glasswares.

**Unit II (15 hrs)**

Sterilization – Physical and Chemical Methods. Disposal of Specimens and Infected Materials, Safety Precautions and First Aid Treatment for Superficial wounds, Burns, Chemical Poisoning, Contamination of infected microbiological specimens and Electric shock.

**Unit III (15 hrs)**

Urine: Analysis of urine samples, Chemical parameters routinely required to be analysed. Pregnancy test. Analysis of stools, semen, Cerebrospinal fluid for chemical investigation.

**Unit IV (15 hrs)**

Pathology: Organisms causing infectious diseases. Viruses – Measles, Poliomyelitis, Hepatitis, HIV. Bacteria – Tuberculosis, Whooping cough – Tetanus – Diptheria, Cholera. Protozoans – Amoebic dysentery, Malaria, Leishmaniasis. Helminths –filariasis, Cysticercosis.

**Unit V (15 hrs)**

Principles use and maintenance of laboratory instruments like Autoclave, Hot air oven, Incubators, Water bath, Refrigerator, Centrifuge, Colorimeter, pH meter, Haemoglobinometer, Haemocytometer, Microtomes, Balances.

**Text book:**

1. Sood Ramnik, 1985. Medical Laboratory Technology. Jaypee brothers, NewDelhi, 384 pp.

**Reference Book:**

2. Baker F.J. and Silverton R.E. Introduction to Medical Laboratory Technology.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

# **SEMESTER VI**



**CORE – XI**  
**TAXONOMY, ECOLOGY & PALAEOONTOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC13</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: VI</b>             | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES**

To enable the students to identify, classify and name the organism according to international code of zoological nomenclature. To acquaint the student with different procedures of taxonomy and different methods of analysis of variations and theories of classification. To educate the students about the basic environmental phenomena and enable them to understand the adaptations of the animals to their environment. To make the students understand the importance of Palaeontology and to acquaint the students with origin of different vertebrates and ancestries of some vertebrates.

**UNIT-I (12 hrs)**

Definitions and perspectives of systematics, Classification and Taxonomy; History, Goals and Importance of Taxonomy; Procedures of taxonomy-identification, Classification, Nomenclature, Phena, Taxa, Category; Key and its significance; Higher taxa and Linnean hierarchy; History and Theories of Classification; International Code of Zoological Nomenclature-Principles and Objectives and Rules for Nomenclature, Type system and Priority for different taxa. Population structure of species; Polytypic species, Race, Variety, Cline, Subspecies, Semi-species, Super species.

**UNIT-II (12 hrs)**

Ecology-Definition, Subdivision of Ecology and Scope of Ecology. Ecological Factors- Temperature and Light as Ecological Factors. Ecosystem - Definition, Components of Ecosystem, Grazing and Detritus type of food chain, Food Web and Trophic levels. Ecological pyramids- Pyramids of number, Biomass and Energy.

**UNIT-III (12 hrs)**

Energy flow-Flow of energy through a food chain in relation to laws of thermodynamics. Biogeochemical cycles – Nitrogen and Phosphorous Cycle. Laws of limiting factor- Leibigs's law of minimum, Shelford's law of tolerance and concept of limiting factors. Ecological niche – Concept of ecological niche. Ecological succession – Definition, Types of succession.

**UNIT – IV (12 hrs)**

Freshwater habitats – Lentic and Lotic; Marine habitat- Zonation  
National and International Environmental Organizations, Red Data Book. Wildlife Management

**UNIT – V (12 hrs)**

Introduction to Palaeontology : Stratigraphy ; Principles, Importance, Successive stratigraphic steps, History, Fossils and fossilization. General account of Palaeo-Meso- and Cenozoic Eras with a mention of important fossil groups in different Eras, Periods and Epochs.

**Books Recommended**

1. Dobzhansky, T., Genetics and the origin of species. Columbia, Univ. Press, New York.
2. Mayr, E., Systematics and the origin of species, Columbia Univ. Press, New York.
3. Mayr, E., Principles of Systematic Zoology, McGraw-Hall, New York.
4. Krebs, J.C., Ecology, Harper & Row, Publ., New York.
5. Odum, E.P., Fundamentals of Ecology, Saunders College Publishers, Philadelphia.
6. Kendeigh, S.C., Ecology with special reference to animals, Prentice-Hall of and New Delhi.
7. Smith, Ecology, Harper & Row Publishers, New York.
8. Stirton, R.A., Time, life and man, C.B.S. Publishers & Distribution, Delhi.
9. Colbert, E.H., Evolution of Vertebrates, C.B.S. Publishers & Distribution, Delhi

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE - XII**  
**GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC14</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: VI</b>             | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES**

To facilitate students to understanding the basic concepts involved in genetic manipulation and the application of rDNA technology.

**Unit –I (12 hrs)**

Introduction to Gene Cloning, DNA Manipulative Enzymes-Nucleases, Ligases, Polymerases, Modifying Enzymes, Restriction Enzymes and its Nomenclature, reverse transcriptase, topoisomerases, plasmids- Basic features of plasmids, Plasmid Classification, Blunt And Sticky Ends, Linkers Adapters, Homopolymer Tailing.

**Unit – II (12 hrs)**

Vectors: Cloning vectors for *E. coli*- Nomenclature, pBR 322, pBR 327, pUC 8, pGEM3Z. Methods of identification of recombinants: Insertional inactivation, Blue/white selection. Bacteriophages: Basic features, Phage and its vector, Lytic & Lysogeny, Linear and Circular forms of Lambda Vector, Insertion and Replacement Vectors; Identification of Recombinant Phages, Cosmid, Phagemid, Bacterial Artificial Chromosomes (BACs), Shuttle Vectors.

**Unit – III (12 hrs)**

Cloning vectors for yeast and fungi, YE<sub>p</sub>, YI<sub>p</sub>, YR<sub>p</sub>, artificial chromosomes, YAC, application of YAC, Identification of a recombinants from a gene library, Methods of clone identification, Radioactive and non- radioactive DNA and RNA labeling techniques, Nick translation , Random priming, Site directed mutagenesis (Cassette , Primer Extension, RT, Real Time, Multiplex, Inverse).

**Unit- IV (12 hrs)**

Southern, Northern and western blotting, colony hybridization, *In situ* hybridization , Genomic Cloning, Transformation of *E. coli*, Yeast and Plant cells. PCR: Types, Applications and Limitations. Applications of rDNA Technology to Medicine, Agriculture & Environment.

**Unit V (12 hrs)**

DNA sequencing- Restriction fragment probe, Sanger Coulson Method. Maxam Gilbert Method- RFLP- Techniques and Application. Genetic Finger Printing- Polymerase Chain Reaction- Taq Polymerase Primers, Human Genome Project. Applications of Genetic Engineering- Alcohol Production, Medicine- Insulin and Hepatitis Vaccine Production

**Text book:**

1. Dubey, R.C. 1995, A Text Book of Biotechnology, S.Chand & Co. Ltd., Ram Nagar, New Delhi –110 055.

**Reference Books:**

1. J. Sambrook, D.W.Russell (2001). Molecular cloning: A laboratory manual (Cold spring

Harbour Laboratory Press).

2. R.M. Old, S.B. Primrose (2001). Principles of gene manipulation (Wiley- Blackwell).
3. B. D. Hames, S. J. Higgins (1995). Gene probes: A. practical approach (Oxford University Press).
4. Tuan Rocky S. (1997). Recombinant gene expression protocols (Edition Illustrated, Publisher Springer).
5. White Bruce A. (1997). PCR cloning protocols: from molecular cloning to genetic engineering (Humana Press).
6. Sandy B. Primrose, Richard Twyman (2006). Principles of gene manipulation and genomics (Wiley Blackwell).
7. Terence A. Brown (2006). Gene cloning and DNA analysis: An introduction (Wiley-Blackwell).

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**CORE - XIII**  
**MICROBIOLOGY AND INDUSTRIAL BIOTECHNOLOGY**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC15</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: VI</b>             | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**COURSE OBJECTIVES:**

Microbes are playing significant role in understanding medical science and industries so study of microbes from basic to advance level, with understanding of biochemistry, cell structure and application makes this paper significant.

**UNIT – I** **(12 hrs)**

History of Microbiology: A. Leewenhook, L. Pasteur, R. Koch, J. Lister, J. Tyndall. Biogenesis Vs abiogenesis, Koch Postulates, Discovery of Antibiotics. Principle of Microscopy: Bright field, Dark field, Phase Contrast, Fluorescent, Electron Microscopy.

**UNIT – II** **(12 hrs)**

Microbial Classification: Bacteria, Fungi and Algae. Morphology of Bacteria, Viruses and Fungi with major emphasis on bacterial structure specially cell wall. Gram positive and Gram negative bacteria. Microbial spores, Sporulation/ germination process.

**UNIT – III** **(12 hrs)**

Microbial growth, Nutritional biodiversity, Phases of growth, Generation time, Growth rate. Chemostat and Turbidostat, Microbes in extreme environment like high temperature and high/ low pH values, Sterilization.

**UNIT –IV** **(12 hrs)**

Dairy Microbiology – Pasteurization – Milk products – Curd, Butter and Cheese; Food Microbiology – Fermented food - Food spoilage - Food poisoning – Physiochemical methods in food preservation. Soil Microbiology – Common soil microbes – Symbiotic and asymbiotic organisms. Water Microbiology - Microbiology of drinking water –Waterborne diseases.

**UNIT V** **(12 hrs)**

Production of Industrial Enzymes such as Proteases, Amylases, Lipases, Cellulases. Biopreservatives (Nisin) Cheese, Biopolymers (Xanthan Gum, PHB), Antibiotics, (penicillin). Production of Recombinant Proteins having Therapeutic and Diagnostic Applications, Products of Plant and Animal Cell Culture.

**Text Books:**

1. Dubey, R.C. 1995, A Text Book of Biotechnology, S.Chand & Co. Ltd., Ram Nagar, New Delhi –110 055.
2. Sundara Rajan, S, 2002, College Microbiology – Vol. I to IV, Vardhana Publications, Bangalore –560 095.

**Reference Books:**

1. Pelczar Jr. M.J. Chan E.C.S. and Kreig N.R. 2001 Microbiology – McGraw Hill Inc. New York.
2. Stainer R.Y., Ingraham J.L., Wheelis M.L. and Painter P.R. 1999 General Microbiology – Macmillan Education Ltd. London.
3. Purohit Mathur. 1999. Biotechnology Fundamentals and applications. Botanica Publications.
4. Higgins I.J., Best G.J., and Jones J. 1996, Biotechnology – Principles and applications, Blackwell Scientific Publications, Oxford London.
5. Gupta P.K. Elements of Biotechnology 2001, Rastogi Publications, Meerut.
6. Rittmann, B.E. and P.L. McCarty, 2001. Environmental biotechnology: principles and applications. McGraw- Hill, New York.
7. Ahmed, N., F.M. Qureshi and O.Y. Khan, 2001. Industrial environmental Biotechnology, Horizon Press.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

**ELECTIVE - II**  
**SERICULTURE AND APICULTURE**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTE02</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: VI</b>             | <b>CREDITS: 5</b> | <b>TOTAL HOURS: 75</b> |

**COURSE OBJECTIVES:**

Silkworm and honey bee rearing, besides being a favorite past time, has also become a small scale cottage industry. This paper enables students to understand the culture techniques

**Unit I** **(15 hrs)**

History of Sericulture: Types of Silkworm – Mulberry, Tasar, Muga and Eri. Mulberry Silkworms: Morphology and Life cycle of silkworms. Silkworm rearing: Rearing house and equipments.

**Unit II** **(15 hrs)**

Silk reeling: Selection of raw material for reeling – Storage and preservation of raw materials. Marketing and the role of Central Silk Board in the Development of sericulture.

**Unit III** **(15 hrs)**

Apiculture: Bee keeping down the ages – Present status of Apiculture in India – Species of Honey bees. Embryology and life history – Anatomy and Physiology of honeybee.

**Unit IV** **(15 hrs)**

Bee colony, Castes. Natural colonies and their yield. Types of beehives – structure – location, care and management.

**Unit V** **(15 hrs)**

Honey yield in national and international market. Uses of honey and beeswax in Indian medicine.

**Reference Books:**

1. Manual of Silkworm Rearing: Manual of Mulberry Cultivation by Food and Agricultural Organization (FAO), United States.
2. Yoshimaro Tanaka. Sericology, central Silk Board, 99-B, Meghdoot, Merine Drive, Bombay.
3. Yokoyama, T. synthesized science of Sericulture.
4. Kovaleve, P.A. Silkworm breeding Stocks, Central Silk Board, Merine Drive, Bombay.
5. NPCS Board of Consultants & Engineers. 2007 Publisher: NIIR PROJECT CONSULTANCY SERVICES.
6. Singh, D., Singh, D. Pratap. 2006. A Handbook of Beekeeping. AGROBIOS (INDIA)
7. Sardar Singh. Bee keeping in India.
8. Cherian and Ramanathan, S. Bee keeping in south India.
9. Sharma P.L. and Singh, S.H. Book of Bee keeping

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |



**ELECTIVE - III**  
**ECONOMIC ENTOMOLOGY AND PEST MANAGEMENT**

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTE03</b> | <b>THEORY</b>     | <b>MARKS: 100</b>      |
| <b>SEMESTER: VI</b>             | <b>CREDITS: 5</b> | <b>TOTAL HOURS: 75</b> |

**COURSE OBJECTIVES**

India being an agricultural oriented country, economic losses through agriculture is a major concern. This study facilitates an understanding of insects pests and diseases of major crops cultivated in India and their management strategies.

**Unit I (15 hrs)**

Brief account of morphology, Classification (Major orders) and Development (Metamorphosis) of insects.

**Unit II (15 hrs)**

Beneficial and Harmful Insects. Economic importance of Honeybees, Silkworm and Lac insect – Parasitic and Predatory Insects. Damages to plants, animals and man by insects. Brief account of any three pests of 1. Rice, Cholan and Pulses 2. Sugarcane 3. Cotton 4. Groundnut, Gingely and Coconut 5. Brinjal, Tomato and Lady's finger 6. Cardomam, Chilies, Tea and Coffee 7. Mango and Citrus.

**Unit III (15 hrs)**

Insect pests of stored grains – Insect vectors of plants, animals and man – Other insects affecting the health of man domestic animals.

**Unit IV (15 hrs)**

Insect pest control methods (Physical, mechanical, biological and chemical) – Classification of pesticides and their modes of action.

**Unit V (15 hrs)**

Plant protection appliances used – Basic principles of insecticide formulations and their application in pest control. Pesticides and environmental pollution – Precautions in handling pesticides.

**Text book:**

1. David, B.V. and T. Kumarasamy, 1984. Elements of Economic Entomology, Popular Book Depot, Madras, 536 pp.

**Reference Books:**

1. Nayar, K.K., T.N. Ananthkrishnan and B.V. David. 1992. General and Applied Entomology. Tata McGraw Hill Publishing Co., Ltd., New Delhi – 110 051.
2. David, B.V., 1992. Pest Management and Pesticides Indian Scenario, Namratha Publications, Madras.

3. Metcalf, C.L. and W.P. Flint, 1973. Desctructive and Useful Insects. 4<sup>th</sup> Ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi – 110 051, 1087 pp.
4. Roy D.N. and A.W.A. Brown (Eds), 1981. Entomology Medical and Veterinary (3<sup>rd</sup> Ed.) The Bangalore Printing and Publishing Company, Bangalore –18.
5. Ramakrishna Iyer, T.V., Economic Entomology, Government Publications.Madras.

**Question paper pattern:**

| Section            | Question Component                                                         | Numbers        | Marks     | Total      |
|--------------------|----------------------------------------------------------------------------|----------------|-----------|------------|
| <b>Section A</b>   | <b>Definition / Very short answer</b><br>Answer any 10 out of 12 Questions | <b>1 - 12</b>  | <b>2</b>  | <b>20</b>  |
| <b>Section B</b>   | <b>Short Answer</b><br>Answer any 5 out of 8 Questions                     | <b>13 - 20</b> | <b>8</b>  | <b>40</b>  |
| <b>Section C</b>   | <b>Detailed Answer</b><br>Answer any 2 out of 4 Questions                  | <b>21 - 24</b> | <b>20</b> | <b>40</b>  |
| <b>TOTAL MARKS</b> |                                                                            |                |           | <b>100</b> |

**Distribution of Questions:**

| Sections         | Units    | No. of Questions |          |
|------------------|----------|------------------|----------|
|                  |          | Theory           | Problems |
| <b>Section A</b> | Unit – 1 | <b>2</b>         |          |
|                  | Unit – 2 | <b>2</b>         |          |
|                  | Unit – 3 | <b>3</b>         |          |
|                  | Unit – 4 | <b>3</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section B</b> | Unit – 1 | <b>1</b>         |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>2</b>         |          |
|                  | Unit – 4 | <b>2</b>         |          |
|                  | Unit – 5 | <b>2</b>         |          |
| <b>Section C</b> | Unit – 1 |                  |          |
|                  | Unit – 2 | <b>1</b>         |          |
|                  | Unit – 3 | <b>1</b>         |          |
|                  | Unit – 4 | <b>1</b>         |          |
|                  | Unit – 5 | <b>1</b>         |          |

## CORE – XIV

### PRACTICAL III - ANIMAL PHYSIOLOGY, BIOCHEMISTRY, DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC11P</b> | <b>PRACTICAL</b>  | <b>MARKS: 100</b>      |
| <b>SEMESTER: V &amp; VI</b>      | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

#### ANIMAL PHYSIOLOGY

1. Use of Kymograph unit, B.P. apparatus, Respirometer.
2. Survey of Digestive enzymes in cockroach.
3. Estimation of Oxygen consumption in a fish with reference to body weight.
4. Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine.

#### BIOCHEMISTRY

1. Qualitative analysis of sugar (Glucose, Fructose, Lactose, Starch, Dextrin)
2. Estimation of Glycogen (Anthrone method) (Demonstration)
3. Estimation of Protein (Biuret method) (Demonstration)

#### DEVELOPMENTAL BIOLOGY

1. Study of the following prepared slides, museum specimens and materials.
2. Sections of testis and ovary showing the maturation stages of gametes.
3. Slides of mammalian Sperm and Ovum.
4. Study of Egg types – Frog's egg, Hen's egg.
5. Slides of cleavage stages, blastula, gastrula and neurula of frog.
6. Slides of different stages of chick embryo. 18 Hours (primitive streak stage), 24Hours, 48 Hours, 72 hours and 96 Hours.
7. Placenta of sheep, Pig and Man.

#### IMMUNOLOGY

1. Immuno electrophoresis-antigen, antibody reactions – agglutination - precipitation ring test. (Demonstration)
2. ABO, Rh typing

**CORE - XV**  
**PRACTICAL IV - ENVIRONMENTAL BIOLOGY, BIOTECHNOLOGY AND**  
**MICROBIOLOGY**

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE : 16UAZTC12P</b> | <b>PRACTICAL</b>  | <b>MARKS: 100</b>      |
| <b>SEMESTER: V &amp; VI</b>      | <b>CREDITS: 4</b> | <b>TOTAL HOURS: 60</b> |

**ENVIRONMENTAL BIOLOGY**

1. Estimation of O<sub>2</sub>, salinity, pH, free CO<sub>2</sub>, Carbonates and bicarbonates, Calcium in water samples.
2. Use of Rain guage, Maximum & minimum thermometer, Hygrometer, Anemometer and Barometer.
3. Plankton study – Fresh water and marine plankton.
4. Adaptations of aquatic and terrestrial animals based on a study of museum specimens -rocky, sandy, muddy shore animals, flying and burrowing animals.
5. Study of natural ecosystem and field report of the visit.

**BIOTECHNOLOGY**

1. Demonstration of PCR technique.
2. Blotting techniques
  - (a) Southern blot
  - (b) Northern blot
  - (c) Western blot
3. Paper chromatography (Demonstration)
4. Instrumentation – Components and application of instruments – Centrifuge - Electrophoresis – Colorimeter-Spectrophotometer.
5. Visit to industries, laboratory – report to be submitted.

**MICROBIOLOGY**

1. Media preparation- Broth, agar, slants, plating
2. Spotters: *Staphylococcus aureus*, *E.coli*, *Rhizopus*, *Aspergillus flavus*, *A.niger*, *Pencillium*, *Candida albicans*.
3. Instruments- Autoclave, culture plate, Inoculation chamber
4. Staining: Simple and differential staining.

## NME – VERMITECHNOLOGY

|                                |                   |                        |
|--------------------------------|-------------------|------------------------|
| <b>SUBJECTCODE:19UNME402GG</b> | <b>THEORY</b>     | <b>MARKS 100</b>       |
| <b>SEMESTER: II</b>            | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

**UNIT I: (6hrs)**

Introduction: Definition and concept of vermiculture. Soil: major types (red soil, black soil, alluvial soil). Influence of soil organisms in vermitechology- bacteria, earthworms, entomofauna mites etc. Litter degradation and decomposition. Problems in vermiculture and remedial solutions.

**UNIT II: (6hrs)**

Types of earthworms: Endemic and exotic species of earthworms. Ecological classification of earthworms- epigeic, anecic and endogeic forms. Physical, chemical and biological changes caused by earthworms in soil- drilospheres and vermicasts.

**UNIT III: (6hrs)**

Vermicomposting- Vermicomposting materials, Vermicomposting methods (raised bed method and pot method). Establishment of vermiculture unit: materials required and maintenance of vermiculture unit.

**UNIT IV: (6hrs)**

Vermicompost - harvesting of vermicompost - quality, properties and advantages over chemical fertilizers, packaging and marketing- cost benefit analysis.

**UNIT V: (6 hrs)**

Natural enemies of earthworms- Pests, parasites and pathogens affecting earthworms. Uses of earthworms in food and medicine- ayurvedic and unani medicine. Recycling of food wastes in vermitechology. Application and scope of vermitechology.

**Text Books:**

1. Ismail,S.A. 1997. Vermicology. The biology of Earthworm.Orient Longman, India, 92pp.
2. Ranganathan, L.S. – 2006 – Vermicomposting technology – from soil health to human health.

**Reference books:**

1. E.L. Jordan and P.S.Verma.1993. Invertebrate Zoology, 12 th Edition, S.Chand & Co., Delhi.
2. Naren kumar, Dutta ,Principles and practice of soil science.
3. N.S. Subba Rao, Soil Microbiology. 4. P.K.Gupta, Vermicomposting. 5. T.V Sathe , Vermiculture and Organic Farming

## NME- HUMAN GENETICS

|                                  |                   |                        |
|----------------------------------|-------------------|------------------------|
| <b>SUBJECT CODE: 19UNME402GG</b> | <b>THEORY</b>     | <b>MARKS 100</b>       |
| <b>SEMESTER: II</b>              | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

### Unit – I (6 hrs)

Introduction: The growth of Human Genetics. Human chromosomes: preparation of human Chromosome complement; Banding techniques; Karyotype preparation; classification; application. Chromosome mapping; cytological maps; cloning and gene arrangement. Human genome project; Social ethical and legal implications. Modes of inheritance; Pedigree charts; construction of pedigree charts for autosomal dominant and recessive traits, sex linked recessive traits and Y linked traits.

### Unit – II (6 hrs)

Multiple allelic inheritance; ABO blood groups; Rh blood group and significance. Polygenic inheritance; skin colour in man and Intelligence. Sex determination – heterogametic theory; Hy antigens; SRY genes; Sex chromatin; Lyon hypothesis. Sex limited and sex influenced genes. Chromosome anomalies; Syndromes – Down, Klinefelter, Turner, XYY, Intersex, Cri-du-chat, Philadelphia.

### Unit – III (6 hrs)

Common genetic disorders: Metabolic blocks in phenylalanine metabolism albinism. Genetic cause, diagnosis and treatment of the following disorders – thalassemia and sickle cell anemia, Haemophilia, muscular dystrophy, Diabetes and hypertension. G6PD and favism – Primaquine sensitivity. Congenital defects – Critical period in fetal development - chromosome anomalies and spontaneous absorption.

### Unit – IV (6 hrs)

Genes and mental illness; Schizophrenia and psychosis, self-mutilation and Lesh Nyhan syndrome. Immunogenetics: Antibody diversity; histocompatibility; HLA genes. Heritability and Environment: Twin studies and impact of environmental factors on heredity. DNA polymorphism – DNA profiling and applications. Dermatoglyphics and genetic analysis.

### Unit – V (6 hrs)

Genetic counseling – Determining risk; consanguinity; Teratogen; age 35 threshold; strategies – Prenatal diagnosis: Ultrasound scanning; Amniocentesis; Chronic villus sampling; AFP Test; Triple test; genetic screening; options available. Management of genetic disorders: Therapeutic measures; Gene therapy; alternative reproductive technologies; stem cell therapy. Cancer and genes; protooncogenes, oncogenes and anti-oncogenes; BRAC genes.

#### Text Book:

1. Edlin.G. (1984) Human Genetics, Jones and Bartlett publishers, Boston.

#### Reference Books

1. Elane Mangae and Mangae (1993), Human genetics. Freeman and company.
2. Ricki. L. (1994) Human Genetics. WCB Publishers.
3. Sam Singer (1985) Human Genetics, Freeman and Company, New York.
4. Ursula Good enough (1985) Genetics. Holt Reinhart and Winstan New York. 36 36

## NME- DAIRY FARMING

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECTCODE: 19UNME402GG</b> | <b>THEORY</b>     | <b>MARKS 100</b>       |
| <b>SEMESTER: II</b>             | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

### **Unit – I** **(6 hrs)**

Dairy breeds & breeding: Scope of Dairy farming – Dairy breeds of India – cattle & buffaloes – Exotic cattle breeds. Selection of dairy cows. Systems of breeding – Hybrid vigour – grading-up, pure breeding. Merits and demerits of inbreeding and out breeding. Anatomy and physiology of mammary gland – milk secretion and milk let-down/ejection.

### **Unit – II** **(6 hrs)**

Feeding and Nutrition: Structure of digestive system and physiology of digestion. Importance of colostrums feeding. Common cattle feed ingredients and their nutritive values – minerals, feed additives. Fodder preservation methods- hay and silage making. Ration formulation. Computation of balanced ration.

### **Unit – III** **(6 hrs)**

Live stock diseases: Viral diseases – rinderpest, Foot and mouth disease and cow pox. Bacterial diseases – Mastitis, Anthrax, Tuberculosis, Haemorrhagic – septicaemia, Brucellosis. Metabolic disorders – Milk fever, ketosis and bloat. A brief account of external and internal parasites.

### **Unit – IV** **(6 hrs)**

Dairy Technology & Marketing: Milk – composition and Nutritive value – Techniques to detect milk adulteration – Spoilage of milk – pasteurization of milk – Preparation of Dahi, Butter and Ghee. Role of Co-operative societies in milk production & Marketing.

### **Unit – V** **(6 hrs)**

Farm management: housing and equipment for dairy cows. care and management of newborn calves – technique of producing quality milk. Structure of reproductive system and physiology of reproduction . Artificial insemination – Semen collection, storage & insemination Techniques.

#### **Text Book:**

1. G.C. Banerjee – A Text book of Animal Husbandry – Oxford & IBH Publication, New Delhi.

#### **Books Reference:**

1. GH Schmidt; T.D. Van Vleck, - Principles of Dairy science – Surget Pvt. Ltd., 1982.
2. N.S.R. Sasting or C.K.Thamos – Farm Animal Management – Vikas Publishing HouseP. Ltd., 1976.
3. Dr. A.K. Sabetic – Animal Reproduction and Artificial insemination: NCERT, 1989.
4. M.M. Rai, - Dairy Chemistry and Animal Nutrition – Kalrant Publishers, 1985.
5. C.K.Thomas and N.S.R.Sastry, 1990.Dairy Bovine Production, Kalyani Publishers, New Delhi.
6. ICAR, 2002 Handbook of Animal Husbandry- The Indian Council of Agricultural Research, New Delhi.

## NME -POULTRY SCIENCE AND MANAGEMENT

|                                 |                   |                        |
|---------------------------------|-------------------|------------------------|
| <b>SUBJECTCODE: 19UNME402GG</b> | <b>THEORY</b>     | <b>MARKS 100</b>       |
| <b>SEMESTER: II</b>             | <b>CREDITS: 2</b> | <b>TOTAL HOURS: 30</b> |

### **Unit – I** **(6 hrs)**

External features of fowls – skeletal system – digestive system – endocrine system – feathers – Respiratory system – reproductive system. Genetics of fowls: Breeds of fowls – inheritance of morphological characters (List of autosomal and sex linked character – breeding methods – systems of breeding – modern method of breeding.

### **Unit – II** **(6 hrs)**

Poultry industry in India– choosing commercial layers and broilers – Poultry housing –deep litter and cage system-merits and demerits.

### **Unit – III** **(6 hrs)**

Practical aspects of chick rearing –brooding management- grower and layers –management of broilers – lighting, summer winter management – debunking.

### **Unit-IV**

**(6 hrs)**

Poultry Nutrition: Energy – protein and aminoacids – Vitamins – essential organic elements – Non – nutrition feed additives – feed stuffs for poultry – feed formation.

### **Unit – V** **(6 hrs)**

Diseases: Viral, bacterial, fungal and parasitic disease of poultry. Vaccines and vaccination programme.

### **Reference Books :**

1. Gopalakrishnan C.A and G.Murley Mohan Lal 1997, Livestock and Poultry enterprises for rural development, Vikash, New Delhi.
2. Gnaanamani M.R., 1998 Modern aspects of commercial poultry keeping, Giri.
3. Banarjee G.C., 1992 Poultry, Oxford and IBH, New Delhi.
4. Chauhan H.V.S. and S.Roy, Poultry diseases, diagnosis and treatment New Age International, 1996.
5. John William S. (Ed) 2003. Poultry for sustainable Food Production and Livelihood. Loyola Publication.



