

**SRI VENKATESWARA UNIVERSITY  
B.Sc. DEGREE COURSE IN ZOOLOGY  
SEMESTER SYSTEM WITH CBCS**

**SEMESTER IV**

**W.E.F. 2021-2022**

**PAPER – IV: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND  
EMBRYOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

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**Course Outcomes:**

This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall able to –

**C01** Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

**C02** Understand the muscular system and the neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.

**C03** Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms

**C04** Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

**C05** Describe the key events in early embryonic development starting from the formation of gametes upto gastrulation and formation of primary germ layers.

## **Learning Objectives**

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To instil the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

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**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**HOURS: 60 (5X12)**

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**UNIT I: Animal Physiology - I**

- 1.1. Process of digestion and assimilation.
- 1.2. Respiration - Pulmonary ventilation, transport of oxygen and CO<sub>2</sub>  
(Note: Need not study cellular respiration here).
- 1.3. Circulation - Structure and functioning of heart, Cardiac cycle
- 1.4. Excretion - Structure and functions of kidney urine formation, counter current Mechanism

**UNIT II Animal Physiology - II**

- 2.1. Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials in myelinated and non-myelinated nerve fibers.
- 2.2. Muscle contraction - Ultrastructure of muscle, molecular and chemical basis of muscle contraction.
- 2.3. Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas.
- 2.4. Hormonal control of reproduction in a mammal

**UNIT III Cellular Metabolism - I (Bimolecular)**

- 3.1. Carbohydrates - Classification of carbohydrates. Structure of glucose
- 3.2. Proteins - Classification of proteins. General properties of amino acids
- 3.3. Lipids - Classification of lipids

## **UNITIV Cellular Metabolism – II**

- 4.1. Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis.

## **Unit – V Embryology**

- 5.1. Gametogenesis  
5.2. Fertilization  
5.3. Types of eggs  
5.4. Development of Frog up to formation of primary germ layers

### **Co-curricular activities (Suggested)**

Chart on cardiac cycle, human lung, kidney/enthrone structure etc.

Working model of human / any mammalian heart.

Chart of macromere/location of endocrine glands in human body

Chart affixing of photos of people suffering from hormonal disorders

Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students

Chart on structures of bimolecular/types of amino acids (essential and non-essential) Chart preparation by students on Glycolysis / Kreb's cycle/urea cycle etc.

Model of electron transport chain

Preparation of models of different types of eggs in animals

Chart on frog embryonic development, fate map of frog blastula, cleavage etc.

## **REFERENCE BOOKS**

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation*. W.H. Freeman & Company.
2. Florey E. *An Introduction to General and Comparative Animal Physiology*. W.B. Saunders Co., Philadelphia.
3. Goal KA and Salish KV. 1989. *A Text Book of Animal Physiology*, Restage Publications, Meerut, U.P.
4. Hoar WS. *General and Comparative Physiology*. Prentice Hall of India, New Delhi.
5. Menninger AL. Nelson and Cox. *Principles of Biochemistry*. Lange Medical Publications, New Delhi.
6. Prosser CL and Brown FA. *Comparative Animal Physiology*. W.B. Saunders Company, Philadelphia.
7. Developmental Biology by Blinks
8. Developmental Biology by Gerard Karp
9. Chordate embryology by Varna and Agawam
10. Embryology by V.B. Restage
11. Austen CR and Short RV. 1980. *Reproduction in Mammals*. Cambridge University Press.
12. Gilbert SF. 2006. *Developmental Biology*, 8<sup>th</sup> Edition. Sinauer Associates Inc., Publishers, Sunderland, USA.
13. Longo FJ. 1987. *Fertilization*. Chapman & Hall, London.
14. Restage VB and Jay raj MS. 1989. *Developmental Biology*. Kediri Nat Ram Nat Publishers, Meerut, Uttar Pradesh.
15. Staten H and Staten G. 1989. *Molecular Biology of Fertilization*. Academic Press, New York.

**SRI VENKATESWARA UNIVERSITY**  
**B.Sc. DEGREE COURSE IN ZOOLOGY**  
**CBCS - SEMESTER IV - W.E.F. 2021-2022**  
**MODEL QUESTION PAPER**

**ZOOLOGY - PAPER - IV**

**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY**

**Time : 3 hours**

**Max. Marks : 75**

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**I. Answer any FIVE of the following :**

**5X5=25 M**

**Draw labeled diagrams wherever necessary**

1. Assimilation
2. Cardiac cycle
3. Chloride Shift
4. Counter current mechanism
5. Pancreas
6. Structure of Glucose
7. Glycolysis
8. Types of eggs.

**II. Answer any FIVE of the following:**

**5x10=50 M**

**Draw labeled diagrams wherever necessary**

9. Describe the process of digestion.

OR

Explain structure and function of the kidney.

10. Write about the secretions of Pituitary Gland.

OR

Describe the molecular & chemical basis of muscle contraction.

11. Write about classification of Carbohydrates.

OR

Write about Lipids.

12. Write about glycolysis & Krebs cycle.

OR

Describe about glycogen metabolism & glucose exogenesis.

13. Explain about Spermatogenesis.

OR

Write about the development of frog up to blastula.

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**SEMESTER IV - W.E.F. 2021-2022**  
**ZOOLOGY - PAPER - IV**

**PRACTICAL: ANIMAL PHYSIOLOGY, CELLULAR**  
**METABOLISM AND EMBRYOLOGY**

**Periods: 24**

**Max. Marks: 50**

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**Learning Objectives:**

Identification of an organ system with histological structure

- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity *in vitro*
- Identification of various bimolecular of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of earl embryonic development in animals

**I. ANIMAL PHYSIOLOGY**

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. T.S. of duodenum, liver, lung, kidney, spinal cord

**II. CELLULAR METABOLISM**

1. Estimation of total carbohydrate by Enthroner method.
2. Qualitative tests for identification of ammonia, urea and uric acid
3. Protocol for Isolation of DNA in animal cells.

**III. EMBRYOLOGY**

- 2 Study of T.S. of testis, ovary of a mammal
- 3 Construction of fate map of frog blastula

**REFERENCE BOOKS:**

Harper's Illustrated Biochemistry

Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley & sons. Inc.

Lab Manual on Blood Analysis and Medical Diagnostics, S. Chan and Co. Ltd.

Laboratory techniques by Plummer



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**SEMESTER IV - W.E.F. 2021-2022**  
**ZOOLOGY PRACTICAL MODEL PAPER**

**ANIMAL PHYSIOLOGY, CELLULAR METABOLISM & EMBRYOLOGY**

- |     |   |                  |
|-----|---|------------------|
| 3.1 | Qualitative tests for identification of Carbohydrates / Proteins / Lipids<br>15 marks |                  |
| 3.2 | Qualitative tests for identification of Ammonia / Urea / Uric acid<br>marks           | 15               |
| 3.3 | Embryology slide and fate map of frog blastula one each                               | 5 x 2 = 10 marks |
| 3.4 | Certified Record  | 10 marks         |
|     |   | -----            |
|     |   | 50 marks         |
|     |   | -----            |

Note: Without submission of a certified record student should not be allowed to write the examination.

# **SRI VENKATESWARA UNIVERSITY**

W.E.F. 2021-22

## **ZOOLOGY – SEMESTER IV**

### **COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

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#### **Course Outcomes:**

This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall able to –

- CO1** To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.
- CO2** To describe immunological response as to how it is triggered (antigens) and regulated (antibodies)
- CO3** Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.
- CO4** Get familiar with the tools and techniques of animal biotechnology.

#### **Learning Objectives**

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major Histocompatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- To understand principles of animal culture, media preparation.

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**SEMESTER IV**  
**W.E.F. 2021-2022**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**HOURS : 60 (5X12)**

**Max. Marks: 100**

**Unit-I Immunology – I (Overview of Immune system)**

- 1.1 Introduction to basic concepts in Immunology
- 1.2 Innate and adaptive immunity, Vaccines and Immunization programme
- 1.3 Cells of immune system
- 1.4 Organs of immune system

**Unit-II Immunology-II (Antigens, Antibodies, MHC and Hypersensitivity)**

- 2.1 Antigens: Basic properties of antigens, epitomes, happens and adjuvant; Factors influencing immunogenicity.
- 2.2 Antibodies: Structure of antibody, Classes and functions of antibodies.
- 2.3 Structure and functions of major histocompatibility complexes I.
- 2.4 Hypersensitivity – Classification and Types

**Unit – III Techniques**

- 3.1 Animal Cell, Tissue and Organ culture media: Natural and Synthetic media,
- 3.2 Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines
- 3.3 Stem cells: Types of stem cells and applications
- 3.4 Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)

#### **Unit – IV Applications of Animal Biotechnology**

- 4.1 Genetic Engineering: Basic concept, Vectors, Restriction End nucleases and Recombinant DNA technology.
- 4.2 Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, fish; applications.
- 4.3 Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, superovulation, Embryo transfer, Embryo cloning.

#### **Unit – V**

- 5.1 PCR: Basics of PCR.
- 5.2 Hybridization techniques: Southern, Northern and Western blotting.
- 5.3 DNA fingerprinting: Procedure and applications.
- 5.4 Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing; Agriculture: Monoculture in fishes, polyploidy in fishes

#### **Co-curricular activities (suggested)**

Organizing awareness on immunization importance in local village in association with NCC and NSS teams

Charts on types of cells and organs of immune system

Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students

Visit to research laboratory in any University as part of Zoological tour and exposure and/ or hands-on training on animal cell culture.

Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

## **REFERENCE BOOKS**

1. Immunology by Ivan M. Riet
2. Immunology by Kobe
3. Sere Krishna V. 2005. *Biotechnology -I, Cell Biology and Genetics*. New Age International Publ. New Delhi, India

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**SEMESTER IV**  
**W.E.F. 2021-2022**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**Time: 3 hrs**

**Max. Marks: 75**

**I. Answer any FIVE of the following:**

**5X5=25M**

**Draw labeled diagrams wherever necessary**

1. Auto Immunity
2. Vaccines
3. Haptenes
4. Antigens
5. Culture media
6. Trans genesis
7. In vitro fertilization
8. Blotting techniques

**II. Answer any FIVE of the following:**

**5X10=50**

**Draw labeled diagrams wherever necessary**

9. Write essay on Adaptive immunity.

OR

Describe about the organs of immune system.

10. Explain the types of antibodies.

OR

Enumerate the types of Hypersensitivity.

11. Write in detail about stem cells.

OR

Explain the procedure & applications of antibodies

12. What are vectors discuss in detail about the types of vectors.

OR

Describe the artificial insemination & super ovulation

13. Give an account of DNA finger printing.

OR

Describe the different types of fermentation.

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**W.E.F. 2021-2022**  
**PRACTICAL SYLLABUS**

**COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY**

**Periods: 24**

**Max. Marks: 50**

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**Learning Objectives:**

- Acquainting student with immunological techniques vis-à-vis theory taught in the class room
- Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- Demonstrate basic laboratory skills necessary for Biotechnology research
- Promoting application of the lab techniques for taking up research in higher studies

**I. IMMUNOLOGY**

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
  - a. ELISA
  - b. Immunoelectrophoresis

**II. Animal biotechnology**

1. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
2. Cleaning and sterilization of glass and plastic wares for cell culture.
3. Preparation of culture media.

## REFERENCE BOOKS

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson
2. Practical Immunology A Laboratory Manual; **LAP LAMBERT Academic Publishing**
3. Manual of laboratory experiments in cell biology by Edward, G
4. Laboratory Techniques by Plummer



**S. V. UNIVERSITY: TIRUPATI**  
**ZOOLOGY PRACTICAL MODEL PAPER**  
**IMMUNOLOGY AND ANIMAL BIO-TECHNOLOGY**

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- |  |            |
|--|------------|
| 1. Determine the blood group in the given sample<br>marks            | 15         |
| 2. Identify the given immunological spotters A & B<br>marks          | 5 x 2 = 10 |
| 3. Identify the given protein by western blotting technique<br>marks | 15         |
| 4. Certified Record<br>marks   | 10         |

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50 marks  
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Note: Without submission of certified record student should not allowed to write the examination.