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

SEMESTER IV

W.E.F. 2021-2022

Core Course-4-Plant Physiology and Metabolism

(Total hours of teaching – 60 @ 04 Hrs/ Week)

Theory:

Learning outcomes:

On successful completion of this course, the students will be able to:

- Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
- > Evaluate the role of minerals in plant nutrition and their deficiency symptoms.
- > Interpret the role of enzymes in plant metabolism.
- Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
- Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
- Evaluate the physiological factors that regulate growth and development in plants.
- Examine the role of light on flowering and explain physiology of plants under stressconditions.

Unit -1: Plant-Water relations

1. Importance of water to plant life: physical properties of water, diffusion, imbibition, osmosis. Water potential, osmotic potential, pressure potential.

- 2. Absorption and lateral transport of water: Ascent of sap.
- Transpiration: structure of stomata and mechanism of stomata movements (K⁺ ionflux).
- 4. Mechanism of phloem transport: Pressure Flow Hypothesis.

10 Hrs.

Unit - 2: Mineral nutrition, Enzymes and Respiration 14 Hrs.

- 1. Essential macro and micro mineral nutrients and their role in plants: symptoms of mineral deficiency.
- 2. Absorption of mineral ions: passive and active processes.
- 3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
- 4. Respiration: Aerobic and Anaerobic,Glycolysis, Krebs cycle, electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit - 3: Photosynthesis and Photorespiration 12 Hrs.

- 1. Photosynthesis: Photosynthetic pigments, absorption and action spectra, Red drop and Emerson enhancement effect.
- 2. Structure of two photosystems: mechanism of photosynthetic electron transport and evolution of oxygen, photophosphorylation.
- 3. Carbon assimilation pathways: C3 cycle, C4 cycle and CAM pathway.
- 4. Photorespiration C2 pathway.

Unit - 4: Nitrogen and lipid metabolism 12 Hrs.

- 1. Nitrogen metabolism: Biological nitrogen fixation asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
- 2. Lipid metabolism:Classification of plant lipids, saturated and unsaturated fatty acids.
- 3. Anabolism of triglycerides, β -oxidation of fatty acids, Glyoxylate cycle.

Unit - 5: Plant growth - development and stress physiology 12 Hrs.

- 1. Growth and Development: Definition, phases and kinetics of growth.
- 2. Physiological effects of Plant Growth Regulators (PGRs) auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
- 3. Physiology of flowering: Photoperiodism, role of phytochromes in flowering.

4. Seed Dormancy:Importance, types and causes, methods of breaking seed dormancy.Seed germination and senescence.



Text books:

- Botany IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- Ghosh, A. K., K. Bhattacharya &G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata.

Books for Reference:

- Aravind Kumar & S.S. Purohit (1998) Plant Physiology Fundamentals and Applications, AgroBotanica, Bikaner
- Datta, S.C. (2007) *Plant Physiology*, New Age International (P) Ltd., Publishers, New Delhi
- Hans Mohr & P. Schopfer (2006)Plant Physiology, Springer (India) Pvt. Ltd., New Delhi
- > Hans-Walter heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
- Hopkins, W.G. & N.P.A. Huner (2014)Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi

- Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi
- Pandey, S.M. &B.K.Sinha (2006)Plant Physiology, Vikas Publishing House, NewDelhi
- Salisbury, Frank B. & Cleon W. Ross (2007)*Plant Physiology*, Thomsen & Wadsworth, Austalia & U.S.A
- Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi
- > Taiz, L.&E. Zeiger (2003)Plant Physiology, Panima Publishers, New Delhi
- > Verma, V.(2007) Text Book of Plant Physiology, Ane Books India, New Delhi

SRI VENKATESWARA UNIVERSITY

B.Sc. DEGREE COURSE IN BOTANY

IV SEMESTER - W.E.F. 2021-22

Botany Core Course - 4-Plant Physiology and Metabolism MODEL QUESTION PAPER

Time: 3 hours

Marks: 75 marks

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer any five of the following questions in Part A.

Part B consists of 5 Units. Answer one full question (A or B) from each unit (i.e., Q.No 9 from Unit – I, Q.No 10 from Unit – II, Q.No 11 from Unit – III, Q.No 12 from Unit – IV, Q.No 13 from Unit – V). Each question carries 10 marks.

PART – A

Answer any <u>Five</u> of the following question.

(5X5=25M)

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

PART – B

(A)	
	OR
(B)	
(A)	
	OR
(B)	
(A)	
	OR
(B)	
(A)	
	OR
(B)	
(A)	
	OR
(B)	

Answer All The Questions. Each question carries 10 marks (5X10= 50M)

SRI VENKATESWARA UNIVERSITY

B.Sc. DEGREE COURSE IN BOTANY SEMESTER SYSTEM WITH CBCS SEMESTER IV W.E.F. 2021-2022

Core Course -5 Cell Biology, Genetics and Plant Breeding

(Total hours of teaching – 60 @ 04 Hrs/Week)

Theory:

Learning outcomes:

On successful completion of this course, the students will be able to:

- > Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
- Explain the organization of a eukaryotic chromosome and the structure of genetic material.
- Demonstrate techniques to observe the cell and its components under a microscope.
- Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
- Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
- > Evaluate the structure, function and regulation of genetic material.
- Understand the application of principles and modern techniques in plant breeding.
- > Explain the procedures of selection and hybridization for improvement of crops.

Unit - 1: The Cell

- 1. Cell theory: prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
- 2. Ultra-structure of a cell wall.
- 3. Ultra-structure of plasma membrane and various theories on its organization. Functions of Plasma membrane with special reference to transportation.
- 4. Polymorphic cell organelles (Plastids): ultra structure of chloroplast. Plastid DNA.

12 Hrs.

12 Hrs.

- Prokaryotic vs eukaryotic chromosome. Morphology of a eukaryotic 1. chromosome.
- 2. Euchromatin and Heterochromatin; Karyotype and ideogram.
- Brief account of chromosomal aberrations structural and numerical 3. changes.
- 4. Organization of DNA in a chromosome (solenoid and nucleosome models).

Unit - 3: Structure and functions of DNA 12 Hrs.

- 1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi-conservative method).
- 2. Brief account on Transcription, types and functions of RNA. Gene concept, genetic code and Translation.
- 3. Regulation of gene expression in prokaryotes Lac Operon.

Unit - 4: Mendelian and Non-Mendelian genetics 14Hrs.

- 1. Mendel's laws of inheritance. Incomplete dominance and co-dominance, Multiple allelism.
- 2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
- 3. A brief account of linkage and crossing over: Chromosomal mapping 2 point and 3 point test cross.
- 4. Concept of maternal inheritance (Corren's experiment on Mirabilis jalapa): Mitochondrial DNA.

Unit - 5: Plant Breeding

- 1. Plant Breeding and its scope: Genetic basis for plant breeding. Plant Introduction and acclimatization.
- 2. Definition, procedure, applications and uses, advantages and limitations of (a) Mass selection (b) Pure line selection and (c) Clonal selection.
- 3. Hybridization Types and technique: Heterosis (hybrid vigour).
- 4. A brief account on Molecular breeding DNA markers in plant breeding. RAPD, RFLP.

12 Hrs.



Text books :

- > Botany III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- Ghosh, A.K., K.Bhattacharya&G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
- Chaudhary, R. C. (1996) Introduction to Plant Breeding, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Books for Reference:

- S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, NewDelhi
- > P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
- B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
- A.V.S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, NewDelhi
- Cooper, G.M. & R.E. Hausman (2009) The Cell A Molecular Approach, A.S.M.
 Press, Washington
- Becker, W.M., L.J. Kleinsmith& J. Hardin (2007) The World of Cell, Pearson

Education, Inc., New York

- De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002)Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
- Robert H. Tamarin (2002)Principles of Genetics, Tata McGraw –Hill Publishing Company Limited, New Delhi.
- Gardner, E.J., M. J. Simmons & D.P. Snustad (2004)Principles of Genetics, JohnWiley & Sons Inc., New York
- Micklos, D.A., G.A. Freyer& D.A. Cotty (2005) DNA Science: A First Course, I.K. International Pvt. Ltd., New Delhi
- Chaudhari, H.K.(1983)Elementary Principles of Plant Breeding, TMHpublishersCo., New Delhi
- Sharma, J.R. (1994)Principles and Practice of Plant Breeding, Tata McGraw-HillPublishers, New Delhi
- Singh,B.D. (2001)Plant Breeding : Principles and Methods ,Kalyani Publishers, Ludhiana Pundhan Singh (2015) Plant Breeding for Undergraduate Students, KalyaniPublishers, Ludhiana.
- Gupta, S.K. (2010)Plant Breeding : Theory and Techniques, Agrobios (India), Jodhpur
- Hayes, H.K., F.R. Immer& D.C. Smith (2009) Methods of Plant Breeding, Biotech Books, Delhi.

SRI VENKATESWARA UNIVERSITY

B.Sc. DEGREE COURSE IN BOTANY

IV SEMESTER - W.E.F. 2021-22

<u>PAPER-V</u> Core Course - Cell Biology, Genetics and Plant Breeding MODEL QUESTION PAPER

Time: 3 hours

Note: This question paper contains two parts A and B.

Part A is compulsory which carries $\overline{25}$ marks. Answer any five of the following questions in Part A.

Part B consists of 5 Units. Answer one full question (A or B) from each unit (i.e., Q.No 9 from Unit – I, Q.No 10 from Unit – II, Q.No 11 from Unit – III, Q.No 12 from Unit – IV, Q.No 13 from Unit – V). Each question carries 10 marks.

PART – A

Answer any *Five* of the following question.

 1.

 2.

 3.

 4.

 5.

 6.

 7.

 8.

(P.T.O)

(5X5=25M)

Marks: 75 marks

PART – B

9.	(A)
	OR
	(B)
10.	(A)
	OR
	(B)
11.	(A)
	OR
	(B)
12.	(A)
	OR
	(B)
13.	(A)
	OR
	(B)

Answer All The Questions. Each question carries 10 marks (5X10= 50M)

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

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 –

CO1 Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.

CO2 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.

CO3 Describe the structure, classification and chemistry of biomolecules and enzymes responsible for sustenance of life in living organisms

CO4 Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various biomolecules

CO5 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.

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS SEMESTER IV W.E.F. 2021-2022

ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

HOURS: 60 (5X12)

Max. Marks: 100

UNIT I: Animal Physiology - I

- 1.1. Process of digestion and assimilation.
- 1.2. Respiration Pulmonary ventilation, transport of oxygen and CO2 (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 nonessential) 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
- Austen CR and Short RV. 1980. Reproduction in Mammals. Cambridge University Press.
- 12. Gilbert SF. 2006. *Developmental Biology*, 8^{the} Edition. Sinecure Associates Inc., Publishers, Sunderland, USA.
- 13. Longo FJ. 1987. Fertilization. Chapman & Hall, London.
- Restage VB and Jay raj MS. 1989. Developmental Biology. Kediri Nat Ram Nat Publishers, Meerut, Uttar Pradesh.
- 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

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. 5x10=50 M II. Answer any FIVE of the following: 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.

Verified by Dr. M. Vani, Hod of Zoology, S.V.Arts College, Tirupati, BOS

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS SEMESTER IV - W.E.F. 2021-2022

ZOOLOGY - PAPER - IV

PRACTICAL: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

Periods: 24

Max. Marks: 50

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 Enthrone 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

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS 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 15 marks
- 3.2 Qualitative tests for identification of Ammonia / Urea / Uric acid 15 marks
- 3.3 Embryology slide and fate map of frog blastula one each $5 \ge 2 = 10$ 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

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, hyridoma 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.

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS 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. Riot
- 2. Immunology by Kobe
- 3. Sere Krishna V. 2005. *Biotechnology –I, Cell Biology and Genetics.* New Age International Publ. New Delhi, India

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS SEMESTER IV W.E.F. 2021-2022

COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Time: 3 hrs

Max. Marks: 75

5X10=50

5X5=25M

I. Answer any FIVE of the following: 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: 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.

Verified by Dr. M. Vani, Hod of Zoology, S.V.Arts College, Tirupati, BOS

SRI VENKATESWARA UNIVERSITY B.Sc. DEGREE COURSE IN ZOOLOGY SEMESTER SYSTEM WITH CBCS SEMESTER IV W.E.F. 2021-2022 PRACTICAL SYLLABUS

COURSE – 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Periods: 24

Max. Marks: 50

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

<u>S. V. UNIVERSITY: TIRUPATI</u> <u>ZOOLOGY PRACTICAL MODEL PAPER</u> IMMUNOLOGY AND ANIMAL BIO-TECHNOLOGY

1.	Determine the blood group in the given sample marks		15
2.	Identify the given immunological spotters A & B marks	5 x 2 =	= 10
3.	Identify the given protein by western blotting technique marks		15
4.	Certified Record marks		10
		50 mai	rks

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

SEMESTER - IV

Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

- 1. Tolearnaboutthelawsofabsorptionoflightenergybymoleculesandthesubsequentphotoch emical reactions.
- $2. \ \ To understand the concept of quantum efficiency and mechanisms of photochemical reaction$

s.

UNIT - I

OrganometallicCompounds

8h

Definitionandclassification

compoundsonthebasisofbondtype,Conceptofhapticityof

organicligands. Metalcarbonyls: 18 electron rule, electron count of mononuclear,

polynuclearandsubstituted

metalcarbonylsof3dseries.Generalmethodsofpreparationofmonoandbinuclearcarbonylsof 3d series.P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT - II

Carbohydrates

Occurrence, classification and their biological importance, Monosaccharides:

Constitutionandabsolute

configurationofglucoseandfructose,epimersandanomers,mutarotation,determinationofringsiz eofglucose andfructose,Haworthprojectionsandconformationalstructures;Interconversions ofaldosesandketoses; Killiani-FischersynthesisandRuffdegradation; Disaccharides– Elementarytreatmentofmaltose, lactoseand sucrose.Polysaccharides–Elementarytreatmentof starch.

UNIT-III

Amino acids and proteins

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

6h

oforganometallic

8h

Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT- IV

NitrogenContainingFunctionalGroups

Preparation, properties and important reactions of nitrocompounds, amines and diazonium salts.

1. Nitro hydrocarbons

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines:

Introduction, classification, chiralityin amines (pyramidal inversion), importance and general methods of preparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. DistinctionbetweenPrimary,

secondaryandtertiaryaminesusingHinsberg'smethodandnitrousacid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimidesynthesis,Hoffmann-

Bromamidereaction, Carbylaminereaction, Mannichreaction, Hoffmann's exhaustive methylation, Hofmann-eliminationreaction and Copeelimination.

Diazonium

Salts:Preparationand

5h

3h

11h

syntheticapplicationsofdiazoniumsaltsincludingpreparationofarenes, haloarenes, phenols, cyanoandnitrocompounds. Couplingreactionsofdiazoniumsalts (preparationofazo dyes).

UNIT- V

Photochemistry

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield-Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and

its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non-spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning

ClassTests, WorksheetsandQuizzes

Presentations, Projects and Assignments and Group Discussions: Enhances critical thinkings kills and personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

- 1. Concise coordination chemistry by Gopalan and Ramalingam
- 2. Coordination Chemistry by Basalo and Johnson
- 3. Organic Chemistry by G.Mareloudan, Purdue Univ
- 4. Text book of physical chemistry by S Glasstone
- 6. Concise Inorganic Chemistry by J.D.Lee
- 7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
- 8. A Text Book of Organic Chemistry by Bahl and Arunbahl
- 9. A Text Book of Organic chemistry by I L FinarVol I
- 10. A Text Book of Organic chemistry by I L FinarVol II
- 11. Advanced physical chemistry by Gurudeep Raj

LABORATORY COURSE -IV 30hrs(2 h / w)

Practical Course-IVOrganic Qualitative analysis

50 M

(At the end of Semester- IV)

Course outcomes:

At the end of the course, the student will be able to;

- 1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- 2. Determine melting and boiling points of organic compounds
- 3. Understandtheapplication of concepts of different organic reactions studied in theory part of organic chemistry

Organic Qualitative analysis

50 M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION SEMESTER-IV CHEMISTRY COURSE -IV: INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours

PART-A

Maximum Marks: 75 5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

- 1. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.
- 2. What are epimers and anomers. Give examples.
- 3. Discuss about iso electric point and zwitter ion.
- 4. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.
- 5. Explain Tautomerism shown by nitro alkanes
- 6. Discuss the basic nature of amines.
- 7. Write the differences between thermal and photochemical reactions.
- 8. Derive heat capacities and derive $C_p C_v = R$

PART-B

Answer ALL the questions. Each carries TEN marks

9 (a). What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.

(or)

- (b). Discuss the general methods of preparations of mono & bi-nuclear carbonyls of 3d series.
- 10 (a). Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.

(or)

- (b). (i) Explain Ruff's degradation.(ii) Explain Kiliani- Fischer synthesis.
- 11.(a). What are amino acids? Write any three general methods of preparation of amino acids.

(or)

- (b). Discuss the aromatic character of Furan, Thiophene and Pyrrole.
- 12.(a). Write the mechanism for the following.(i) Nef reaction(ii) Mannich reaction(or)
 - (b). (i) Explain Hinsberg separation of amines.(ii) Discuss any three synthetic applications of diazonium salts.
- 13.(a). What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.

(or)

(b). Define entropy. Describe entropy changes in the reversible and irreversible process.

SEMESTER - IV

CourseV(INORGANIC & PHYSICAL CHEMISTRY) 60 hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

- 1. Understand of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation values
- 2. Applicationofquantizationtospectroscopy.
- 3. Varioustypesofspectraandtheiruseinstructuredetermination.

INORGANIC CHEMISTRY

UNIT-I

Coordination Chemistry

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.

UNIT-II

1. InorganicReactionMechanism:

Introductiontoinorganicreactionmechanisms.Conceptofreaction

pathways,transitionstate,intermediateand activatedcomplex. Labile and inert complexes, ligand substitution reactions - SN¹ and SN², Substitution reactions insquare planar complexes, Trans-effect, theories of transeffect and its applications

2. Stability of metal complexes:

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

BioinorganicChemistry:

Metalionspresentinbiological systems, classification of elements according to their action in biolog ical system.Geochemical effectonthedistributionofmetals,Sodium/Kpump, carbonicanhydrase and carboxypeptidase.

concepts

12 h

26 h

4h

2h

8h

Excessanddeficiencyofsometracemetals.Toxicityofmetalions(Hg,Pb,CdandAs), reasonsfortoxicity,Useof chelatingagentsinmedicine,Cisplatinasananti-cancerdrug. Ironanditsapplicationinbio-systems,Haemoglobin,Myoglobin.Storageandtransferof iron.

PHYSICAL CHEMISTRY

UNIT-III

1 .Phase rule

6hConcept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT-IV

Electrochemistry

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes,Kohlrausch's law and its applications, Definition of transport number,determination of transport number by Hittorf's method. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations.

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metalmetal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations.

Fuel cells- Basic concepts, examples and applications

UNIT-V

ChemicalKinetics:

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity,

14 h

34 h

14h

factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Co-curricular activities and Assessment Methods

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- 2. Concise Inorganic Chemistry by J.D.Lee
- 3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
- 4. Advanced physical chemistry by Gurudeep Raj
- 5. Principles of physical chemistry by Prutton and Marron
- 6. Advanced physical chemistry by Bahl and Tuli
- 7. Inorganic Chemistry by J.E.Huheey
- 8. Basic Inorganic Chemistry by Cotton and Wilkinson
- 9. A textbook of qualitative inorganic analysis by A.I. Vogel
- 10. Atkins, P.W.&Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 10th Ed(2014).
- 11. Castellan, G.W. Physical Chemistry 4th Ed. Narosa (2004).
- 12. Mortimer, R. G. Physical Chemistry3rdEd. Elsevier: NOIDA, UP(2009).
- 13. Barrow, G.M. Physical Chemistry

SEMESTER - IV

CourseV	LABORATORY COURSE	30 hrs (2 h / w)
Practical-Cou	urse -VConductometric and Potentiometric '	Titrimetry 50 M

Course outcomes:

At the end of the course, the student will be able to;

- 1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- 2. Apply conceptsof electrochemistry in experiments
- 3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry 50 M

- 1. **Conductometric titration-** Determination of concentration of HCl solution using standard NaOH solution.
- 2. Conductometric titration- Determination of concentration of CH₃COOH Solution using standard NaOH solution.
- 3. **Conductometric titration** Determination of concentration of CH₃COOH and HCl in a mixture using standard NaOH solution.
- 4. Potentiometric titration- Determination of Fe (II) using standard K₂Cr₂O₇ solution.
- 5. Determination of rate constant for acid catalyzed ester hydrolysis.

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION SEMESTER-IV CHEMISTRY COURSE V: INORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours

Maximum Marks: 75

PART- A5 X 5 = 25 Marks

Answer any FIVE of the following questions. Each carries FIVE marks

- 1. Write note on Jahn-Teller distortion.
- 2. Explain Labile & inert complexes.
- 3. Explain Job's method for determination of composition of complex.
- 4. Explain Thermodynamic derivation of Gibb's phase rule.
- 5. Explain any two conductometric titrations.
- 6. Write note on Fuel Cells with examples and applications.
- 7. What is enzyme catalysis? Write any three factors effecting enzyme catalysis.

8. Derive Michaels- Menten equation.

PART- B 5 X 10 = 50 Marks

Answer ALL the questions. Each carries TEN marks

9 (a). Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT.

(or)

- (b). Define CFSE. Explain the factors effecting the magnitude of crystal field splitting energy.
- 10 (a). Explain Trans effect. Explain the theories of trans effect and write any two applications of trans effect.

(or)

- (b). (i) Write the biological functions of Haemoglobin and Myoglobin.(ii) Write note on use of chelating agents in medicines.
- 11.(a). Define Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.

(or)

- (b). (i) Explain phase diagram for NaCl-water system.(ii) Explain briefly about Freezing mixtures.
- 12.(a). Define Transport number. Write experimental method for the determination of transport number by Hittorf method.

(or)

- (b). (i) Define single electrode potential.(ii) Explain four types of electrodes with examples.
- 13.(a). Explain general methods for determination of order of a reaction.

(or)

(b).Explain Collision theory and Activated complex theory of bimolecular reactions.

SUBJECT EXPERTS

Prof. C. Suresh Reddy Professor, Department of Chemistry S.V. University Tirupati.

Dr. M. Mahaboob Pacha Lecturer in Chemistry Government Degree College Ramachandrapuram – 533255

SYLLABUS VETTED BY

Prof. N.V.S. Naidu, Professor, Department of Chemistry S.V. University Tirupati.