SRI VENKATESWARA UNIVERSITY: TIRUPATI

SEMESTER-IV- W.E.F. 2024-25

COURSE9 : EMBRYOLOGY

Theory **Credits:3** **3hrs/week**

LEARNING OBJECTIVES

- Theobjectiveofthiscourseistoprovideacomprehensiveunderstandingoftheconceptsofearly animal development.
- Studentstakingthiscoursemustdevelopacriticalappreciationofmethodologiesspecificallyused to study the process of embryonic development in animals.
- In this course different concepts of animal development will beelaborated
- Students will be made familiar with different approaches that have been used to study embryology.
- Topics that will be discussed are organogenes is and regeneration.

LEARNINGOUTCOMES:

The overall course outcome is that the student shall develop deeper understanding of concepts of embryology. This course will provide students with a deep knowledge in embryology by the completion of the course the graduate shall able to –

- Understandthehistoricalperspective andconceptsofembryology
- Acquireknowledgeon gametogenesis,fertilizationandcleavage patterns
- Understandthefateof germinallayersand extraembryonicmembranes
- Explaintheprocessofregenerationincertainanimals
- Examinetheprocessoforganogenesis

SYLLABUS:

UNIT-I:

1.1 Historical perspective and basic concepts : Phases of development
1.2 Cell - Cellinteraction, Pattern formation, Differentiation and growth
1.3 Differentialgene expression,
1.4 Cytoplasmic determinants and a symmetric cell division

Activity: Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writing after watching any video on the above

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT-II:

2.1 Gametogenesis, Spermatogenesis, Oogenesis;
2.2 Types of eggs, Egg membranes; Fertilization (External and Internal)
2.3 Planes and patterns of cleavage; Types of Blastulae; Fatemaps
2.4 Early development offrogand chick up to gastrulation

Activity: Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writingafterwatching any video on the above/Model preparation on cleavage planes

Evaluation:InstructorsupposedtoprepareadetailedRubricsfortheevaluationoftheabove activity

UNIT-III:

3.1 Fate of Germ Layers
3.2 Extra – embryonic membranes
3.3 Placenta(Structure, types and functions of placenta)
3.4 Amniocentesis

Activity:Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Chart preparation on the placenta

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV:

4.1 Metamorphosis: Changes, hormonal regulations in amphibians
4.2 Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (in Turbellarians)
4.3 Ageing: Concepts and Theories
4.4 Teratogenicagents and their effects on embryonic development

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Flow chart preparationon the process ofmetamorphosis highlighting the periodical changes vs hormone activity

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V:

5.1 Organogenesis of Central Nervous system
5.2 Organogenesis of Eye, Ear
5.3 Organogenesis of Skin

5.3OrganogenesisofCirculatorysystem
(*Organogenesis in Human need to be explained)

Activity: Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writingafterwatching any video on the above /Flow chart preparation on the process of organogenesis highlighting the gradual developments of organ systems

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (Suggested)

- Preparationofmodelsofdifferenttypesofeggsinanimals
- Chartonfrogembryonicdevelopment,fatemapof frogblastula,cleavageetc.
- Charton theorganogenesis
- RBPTonthe Placenta
- Modelof extraembryonicmembrane
- Laboratoryobservation ofchick embryonicdevelopment

REFERENCESBOOKS:

- Developmental BiologybyBalinksy
- Developmental BiologybyGerard Karp
- ChordateembryologybyVarmaandAgarwal
- EmbryologybyV.B.Rastogi
- AustenCRandShortRV.1980.*ReproductioninMammals*.CambridgeUniversityPress.
- Gilbert SF. 2006. *Developmental Biology,* 8th Edition. Sinauer AssociatesInc.,Publishers, Sunderland, USA.
- Longo FJ.1987.*Fertilization.*Chapman&Hall,London.
- RastogiVBandJayarajMS.1989.*DevelopmentalBiology.*KedaraNathRamNathPublishers, Meerut, Uttar Pradesh.
- SchattenHandSchatten G.1989.*MolecularBiologyofFertilization.* AcademicPress,NewYork.

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Verified and Approved by Dr.M.VANI HOD & BOS Chairperson (Zoology)

Four Year Honours Degree Examination

Choice Based Credit System

II BSC- SEMESTER – IV

Model Question Paper - 2024-2025

SUB: ZOOLOGY Major& Minor

PAPER :EMBRYOLOGY

TIME : 3 Hrs **Max. Marks : 70**

Section-A

Answer any FIVE of the following **5 x 4 = 20 M**

1. Cytoplasmic determinants.
2. Fate maps.
3. Fertilization.
4. Germ layers.
5. Amniocentesis.
6. Modes of regeneration.
7. Teratogenic agents.
8. Structure of eye.

Section – B

Answer any FIVE of the following **5 x 10 = 50 M**

Unit – I

9. Describe the basic concepts of development.

OR

10. Write about the differential gene expression.

Unit – II

11. Explain the process of spermatogenesis.

OR

12. Write about the planes and patterns of cleavage.

Unit – III

13. Write an essay on extra embryonic membranes.

OR

14. Describe the structure and functions of placenta.

Unit – IV

15. Give an account of metamorphosis in amphibians.

OR

16. Explain about the concepts and theories of ageing.

Unit – V

17. Describe the organogenesis of central nervous system.

OR

18. Write about the organogenesis of skin.

COURSE9:EMBRYOLOGY

Practical **Credits:1** **2hrs/week**

LEARNINGOBJECTIVES

- Theobjectiveofthis courseis to provideacomprehensivepractical knowledgeon the embryology
- Mustdevelopacritical understandingoftheearlyembryological events
- Acquireknowledgeon thedevelopmental stages of chick
- Understandthe histologyof placenta

SYLLABUS:

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavagestages,blastula,gastrula,neurula,tail-budstage,tadpole(externalandinternalgillstages)
2. Studyofwholemountsofdevelopmentalstagesofchickthroughpermanentslides:Primitivestreak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of different sections ofplacenta (photomicrograph/ slides)
4. Projectreportonchick embryodevelopment

RFERENCEWEB LINKS:

- https://praxilabs.com/en/3d-simulations/cultivation-and-preparation-of-the-virus-in-chick-embryo-virtual-lab
- https://vlab.amrita.edu/
- https://www.vlab.co.in/
- https://www.youtube.com/watch?v=p_tx88He8Pk
- https://core.ac.uk/download/143957972.pdf
- https://egyankosh.ac.in/bitstream/123456789/57549/1/Exercise%207%20Chick%20Embryo.pdf
- http://www.macollege.in/app/webroot/uploads/department_materials/doc_501.pdf
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf

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Choice Based Credit System

II BSC- SEMESTER – IV

Model Practical Question Paper - 2024-2025

SUB: Zoology Major& Minor

PAPER : EMBRYOLOGY

Time : 2Hrs Max. Marks : 50

Practicals

1. Identification of given spotters A, B, C, D, E, and F with neat labelled diagram and write its characters. 6 X 5 = 30 Marks

2. Project Report on Chick embryo development 10 Marks

2. Certified Record 10 Marks

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50 Marks

SRI VENKATESWARA UNIVERSITY: TIRUPATI

SEMESTER-IV- W.E.F. 2024-25

COURSE 10 : ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

Theory **Credits:3** **3hrs/week**

LEARNINGOBJECTIVES

- Toacquireknowledgeof organsystemsfunction.
- Todeveloptheabilityto integratephysiologyfrom thecellularandmolecularleveltotheorgan system and organismic level of organization.
- ToEffectivelyread,evaluateandcommunicatescientificinformationrelatedtophysiological processes in the body.
- Togainadeep knowledgeof currenttopicsin physiology.

LEARNINGOUTCOMES:

The overall course outcome is that the student shall develop deeper understanding of concepts of Physiology.This course will provide students with a deep knowledge in physiology bythe completion of the course the graduate shall able to –

- Understandthe physiologyofdigestion and hormonalcontrol of digestion
- Developa comprehensivepictureof respiratoryphysiology
- AcquireknowledgeontheRenal physiology
- Understandthe physiologyof Nerveand muscle
- Understand thephysiologyof heart

SYLLABUS:

UNIT-I : Physiology of Digestion

1.1 Structural organization and functions of gastrointestinaltract and associatedglands;
1.2 Vitamins & Mineral composition of food & Mechanical and chemical digestion of food;
1.3 Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins;
1.4 Hormonal control of secretion of enzymesin Gastrointestinaltract.

Activity:Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writingafterwatching any video on the above /Chart preparation on the hormonal control of secretion of enzymes Evaluation:InstructorsupposedtoprepareadetailedRubricsfortheevaluationoftheabove activity

UNIT-II: Physiology of Respiration

2.1 Structural organization of Respiratory system, Mechanism of respiration, Control of respiration
2.2 Pulmonary ventilation; Respiratory volumes and capacities;
2.3 Transport of oxygen in blood and dissociation curves and the factors influencingit
2.4 Transport of Carbondioxide in blood; dissociation curves and the factors influencingit, Carbon monoxide poisoning

Activity : Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writingafterwatching any video on the above /Group discussion on the CO poisoning/Debate on the dissociation curves

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT-III: Renal Physiology

3.1 Structure of kidney and its functional unit
3.2 Mechanism of urine formation
3.3 Regulation of water balance
3.4 Regulation of acid-base balance

Activity: Assignment /Students Seminar/Quiz/Project/Peerteaching/Report writingafterwatching any video on the above /Group discussion on the Urine formation/Working model of Kidney
Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT-IV : Physiology of exciting tissues

4.1 Neuron structure and types
4.2 Nerveimpulsetrans mission - (Myelinated, Non-myelinated, synaptic)
4.3 Ultrastructure of muscle
4.4 Molecular and chemical basis of muscle contraction

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the impulse trasnmisson/Debate on the dissociation curves

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V: Physiology of Heart

5.1 Structure of mammalian heart, Coronary circulation;
5.2 Structure and working of conducting my ocardialfibers. Origin and conduction of cardiac impulses
5.3 Cardiac Cycle – Cardiac out put and its regulation
5.4 Nervous and chemical regulation of heartrate. Blood pressure and its regulation

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the phases of Cardiac output /case study on the Blood Pressure

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co- curricular activities (Suggested)

- Chartoncardiaccycle,humanlung,kidney/nephron structureetc.
- Workingmodel of human /anymammalianheart.
- Workingmodel of human / anymammalianurineformation
- Chart/modelofsarcomere
- Chart/model on nerveimpulse transmission

REFERENCESBOOKS:

- EckertH.*AnimalPhysiology:MechanismsandAdaptation.*W.H.Freeman&Company.
- FlorayE.*AnIntroductiontoGeneralandComparativeAnimalPhysiology.*W.B.SaundersCo., Philadelphia.
- GoelKAandSatishKV.1989.*ATextBookofAnimalPhysiology*,RastogiPublications,Meerut, U.P.
- HoarWS.*General andComparativePhysiology.*PrenticeHall ofIndia,NewDelhi.
- LehningerAL.NelsonandCox.*PrinciplesofBiochemistry.*LangeMedicalPublications,NewDelhi.
- ProsserCL andBrownFA.*ComparativeAnimalPhysiology.*W.B.SaundersCompany, Philadelphi

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Four Year Honours Degree Examination

Choice Based Credit System

II BSC- SEMESTER – IV

Model Question Paper - 2024-2025

SUB: Zoology Major

PAPER : ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

TIME : 3 Hrs MAX. MARKS : 70

Section-A

Answer any FIVE of the following 5 x 4 = 20 M

1. Absorption of carbohydrates.
2. Transport of gases.
3. Pulmonary ventilation.
4. Regulation of water balance.
5. Muscle contraction.
6. Nerve impulse.
7. Coronary circulation.
8. Cardiac cycle.

Section – B

Answer All Questions 5 x 10 = 50 M

Unit – I

9. Write about the structural organization and functions of gastrointestinal tract.

OR

10. Explain about the hormonal control of enzymes in gastrointestinal tract.

Unit – II

11. Describe the mechanism of respiration.

OR

12. Give an account of dissociation curves and the factors influencing it.

Unit – III

13. Explain the structure and functions of kidney.

OR

14. Write about the regulation of acid-base balance.

Unit – IV

15. Describe the structure and types of neuron.

OR

16. Explain about the ultra structure of muscle.

Unit – V

17. Discuss about the origin and conduction of cardiac impulses.

OR

18. Write an essay on blood pressure and its regulation.

COURSE10: ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

Practical **Credits:1** **2hrs/week**

LEARNING OBJECTIVES

- Toacquireknowledgeof anatomyof certainimportant organs.
- Todeveloptheabilitytotest the biologicalsample likesalivaand urine.
- ToEffectivelyestimatetheblood haemoglobin.
- ToAcquireskillto usethe sphygmomanometer in recordingblood pressure.
- Toobservethe ECG

SYLLABUS:

1. Examinationofsectionsofmammalianoesophagus,stomach,duodenum,ileum,rectumliver, trachea, lung, kidney
2. StudyofactivityofSalivaryamylaseunderoptimumcondition
3. QualitativetestsforidentificationofCarbohydrates
4. QualitativetestsforidentificationofProteins
5. Qualitativetestsforidentificationof Fats
6. Urinetest forsugar, albumin
7. EstimationofhaemoglobinusingSahli'shaemoglobinometer
8. Recordingof blood pressureusingasphygmomanometer
9. Recordingoffrog'sheart beatunderinsituandperfused conditions
10. ECGobservation-Spotting/identificationof curvesfromthegivenECG

RFERENCEWEB LINKS:

- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
- https://library.csi.cuny.edu/oer/virtuallabs-simulations#anatomy
- https://www.labster.com/simulations?course-packages=animal-physiology
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf
- https://physiology.elte.hu/gyakorlat/jegyzet/Physiology_Pactical_(2013).pdf

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Four Year Honours Degree Examination

Choice Based Credit System

II BSC- SEMESTER – IV

Model Practical Question Paper - 2024-2025

SUB: Zoology Major

PAPER : ANIMAL PHYSIOLOGY : LIFE SUSTAINING SYSTEMS

TIME : 2 Hrs MAX. MARKS : 50

Practicals

1. Estimation of haemoglobin using sahli'shaemoglobinometer. 15 Marks
2. Any two qualitative tests for identification of carbohydrates. 10 Marks
3. Identify the given spotters A, B and C with neat labelled diagram and write its characters.
   3 x 5 = 15 Marks

4. Certified Record 10 Marks

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50 Marks

SRI VENKATESWARA UNIVERSITY: TIRUPATI

SEMESTER-IV- W.E.F. 2024-25

COURSE 11 : IMMUNOLOGY

Theory Credits:3 3hrs/week

LEARNING OBJECTIVES

- Topromotecritical thinkingamongstudents.
- Toprovidestudentswith afoundationinimmunological processes
- To provide students with knowledge on how the immune system works building on their previousknowledge
- Toclearlystate theroleoftheimmunesystem.
- Tocompare andcontrasttheinnateversusadaptiveimmune systems.
- Toprovideanoverview oftheinteractionbetweentheimmunesystemandpathogens.

LEARNING OUT COMES:

The overall course outcome is that the student shall develop deeper understanding of concepts of immunology. This course will provide students with a deep knowledge in immunology by the completion of the course the graduate shall able to –

- Articulatetherolesofinnate recognitionreceptorsinimmuneresponses
- Compareandcontrasthumoral versuscell-mediatedimmune responses
- Distinguishvariouscelltypesinvolvedinimmune responsesandassociatedfunctions;
- Distinguishandcharacterizeantibodyisotypes,development,and functions
- Understandthe roleofcytokinesin immunityandimmunecell activation;
- UnderstandthesignificancetheMajorHistocompatibilityComplexintermsofimmuneresponse and transplantation

SYLLABUS:

UNIT–I: Over view of Immune system

1.1 Introduction to basic concepts in Immunology
1.2 Innate and adaptive immunity
1.3 Cells of immune system
1.4 Organs of immune system

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Model chart preparation of cells/organs of immune system

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT–II : **Antigens**

2.1 Basic properties of antigens
2.2 Band T cell epitopes, paratopes
2.3 Hap tens and adjuvants
2.4 Factors influencing immunogenicity

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of organogenesis

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT–III : Antibodies

3.1 Structure of antibody
3.2 Classes of antibodies
3.3 Functions of antibodies
3.4 Monoclonal antibodies

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of antibodies

Evaluation:Instructor supposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT–IV: Working of Immune system

4.1 Structure and functions of major his to compatibility complexes
4.2 Exogenous path way of antigen presentation and processing
4.3 Endogenous path way of antigen presentation and processing
4.4.Basicpropertiesandfunctionsofcytokines

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of MHC

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

UNIT–V : Immune system in health and disease

5.1 Gell and Coombs'classification and brief description of various types of hypersensitivities
5.2 Introduction to concepts of auto immunity and immuno deficiency
5.3 General introduction to vaccines Types of vaccines, Immunization programme
5.4 Organtrans plantation – Graft rejection, immune suppressors

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of classification of Hypersensitivity

Evaluation:Instructorsupposedtoprepareadetailed Rubricsfortheevaluationoftheabove activity

Co-curricularactivities(suggested)

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Chartsontypesofcellsandorgansofimmune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity),bloodgroupsintheclass(antigensandantibodiesdulyreported)etc., as per the creativity and vision of the lecturer and students

REFERENCESBOOKS:

- JudyOwen,JenniPunt,SharonStranford2013KubyImmunology: InternationalEditionW.H. Freeman
- AbbasAK,2011,CellularandMolecular Immunology7thEd.ElsevierHealthSciences–India.
- DelvesP,MartinS,BurtonD,RoittIM2011Roitt'sEssentialImmunology.12thEd.Wiley-Blackwell Scientific Publication, Oxford.
- MurphyK,2011Janeway'sImmunobiology.8th Ed.GarlandSciencePublishers,New York.
- PeakmanM,andVerganiD.(2009).BasicandClinicalImmunology.2ndeditionChurchill Livingstone Publishers, Edinberg.
- RichardCoico,GeoffreySunshine2008Immunology:AShortCourse,6thEditionWiley-Blackwell
- SudhaGangal2013TextbookofBasicandClinicalImmunologyOrientBlackswanPrivate Limited **-New Delhi**

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Four Year Honours Degree Examination

Choice Based Credit System

II BSC- SEMESTER – IV

Model Question Paper - 2024-2025

SUB: Zoology Major

PAPER :COURSE 11 : IMMUNOLOGY

TIME : 2 Hrs MAX. MARKS : 70

Section-A

Answer any FIVE of the following **5 x 4 = 20 M**

1. Lymphocytes
2. Thymus
3. Haptens
4. Adjuvants
5. Structure of Antibody
6. Endogenous pathway
7. Vaccines
8. Graft rejection

Section –B

Answer All Questions 5 x 10 = 50 M

9. A. Describe the Innate Immunity

(OR)

B. Write an essay on cells of Immune System

10. A. Write about basic properties of Antigens

(Or)

B. Describe the B and T cell epitopes and paratopes

11. A. Describe the Production of Monoclonal Antibodies

(or)

B. Explain the classes of Antibodies

12. A. describe the structure and functions of Major histocompatibility complexes

(or)

B. Explain the Exogenous pathway of antigen production

13. A Write about concepts of auto immunity

(or)

B. Describe the various types of Hypersensitivity

COURSE11 : IMMUNOLOGY

Practical **Credits:1** **2hrs/week**

LEARNINGOBJECTIVES

- Toacquireknowledgeonthe distributionoflymphoid organs
- To studythehistologyoflymphoidorgans
- Toacquaintwith theprocessof bloodgroupingwith kit
- ToacquaintwiththeELISA test
- Toacquaintwith theWidaltest

SYLLABUS:

1. Demonstrationoflymphoidorgans(asperUGCguidelines)
2. Histologicalstudyofspleen,thymusandlymphnodes(throughprepared slides)
3. Bloodgroupdetermination
4. DemonstrationofELISA
5. DemonstrationofImmunoelectrophoresis
6. Testingfor Typhoid antigens byWidaltest.
7. DifferentialLeukocyteCount
8. Isolationofmonocytesfromblood.
9. RapidPlasmaReagin(RPR) Test

RFERENCEWEB LINKS:

- https://vlab.amrita.edu/?sub=3&brch=69
- https://ivl1-au.vlabs.ac.in/List%20of%20experiments.html
- https://ivl2-au.vlabs.ac.in/List%20of%20experiments.html
- https://www.medicine.mcgill.ca/physio/vlab/immun/vlabmenuimmun.htm
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf
- http://www.lucp.net/books-pdf/Lab%20Manual%20Dr.%20Idris%20Adewale%20Ahmed/15.%20BASIC%20IMMUNOLOGY **.pdf**
- https://www.avit.ac.in/lab/immunology_bioprocess_engineering_lab/download/17BTCC89/lab_manual.pdf
- https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

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Four Year Honours Degree Examination

Choice Based Credit System

II BSC- SEMESTER – IV

Model Practical Question Paper - 2024-2025

SUB: Zoology Major

PAPER :COURSE11 : IMMUNOLOGY

TIME : 2 Hrs MAX. MARKS : 50

1. Experiment- Test 15 marks

2. Experiment 15 marks

3. Identification of A & B Spotters 10 marks

4. Certified Record 10 marks