।। सा विद्या या विमुक्तये ।।
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade
ACADEMIC (1-BOARD OF STUDIES) SECTION
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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे **CBCS Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२०**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

1. B.Sc.-II Year-Biophysics	2. B.Sc.-II Year-Bioinformatics
3. B.Sc.-II Year-Biotechnology	4. B.Sc.-II Year-Biotechnology (Vocational)
5. B.Sc.-II Year-Food Science	6. B.Sc.-II Year-Botany
7. B.Sc.-II Year-Horticulture	8. B.Sc.-II Year-Agro Chemical Fertilizers
9. B.Sc.-II Year-Analytical Chemistry	10. B.Sc.-II Year-Biochemistry
11. B.Sc.-II Year-Chemistry	12. B.Sc.-II Year-Dyes & Drugs Chemistry
13. B.Sc.-II Year-Industrial Chemistry	14. B.C.A. (Bachelor of Computer Application)-II Year
15. B.I.T. (Bachelor of Information Technology)-II Year	16. B.Sc.-II Year-Computer Science
17. B.Sc.-II Year-Network Technology	18. B.Sc.-II Year-Computer Application (Optional)
19. B.Sc.-II Year-Computer Science (Optional)	20. B.Sc.-II Year-Information Technology (Optional)
21. B.Sc.-II Year-Software Engineering	22. B.Sc.-II Year-Dairy Science
23. B.Sc.-II Year-Electronics	24. B.Sc.-II Year-Environmental Science
25. B.Sc.-II Year-Fishery Science	26. B.Sc.-II Year-Geology
27. B.Sc.-II Year-Mathematics	28. B.Sc.-II Year-Microbiology
29. B.Sc.-II year Agricultural Microbiology	30. B.Sc.-II Year-Physics
31. B.Sc.-II Year Statistics	32. B.Sc.-II Year-Zoology

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदवी–सीबीसीएस अभ्यासक्रम/२०२०–२१/**३३३**

दिनांक : १५.०७.२०२०.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

Swami Ramanand Teerth Marathwada University, Nanded

FACULTY OF SCIENCE & TECHNOLOGY

B.Sc. Second Year
Zoology
(Structure and Syllabus)

Choice Based Credit System (CBCS) Course Structure
Semester Pattern Syllabus
Effective from June, 2020

Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year (Semester III& Semester IV) Syllabus w.e.f. June, 2020

Semester Pattern; Subject: Zoology

Class/ Semester	Course Number		Name of the Course/ Paper	Instruction Hrs/Week	Total Periods/ Practicals	Marks for		Total Marks	Credits
						Internal (CA)	External (ESE)		
B.Sc. S.Y. Semester III	CCZ-III Physiology and Biochemistry	Section –A	PAPER VI: Physiology	03	45	10	40	50	Credit:02
		Section-B	PAPER VII: Biochemistry	03	45	10	40	50	Credit:02
	CCZP-II	[CCZ III (Section A & Section B)	Practical Paper- X: Physiology and Biochemistry (Practical based on P-VI & VII)	03	30	10	40	50	Credit:02
	SECZ-I		SEC-I Any one Skill to be chosen out of Two SECZ –I (A) : Haematology SECZ –I (B) : Urinology	03	45	25	25	50	Credit:02
B.Sc. S.Y. Semester IV	CCZ-IV Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering	Section –A	PAPER VIII: Cell Biology and Genetics	03	45	10	40	50	Credit:02
		Section-B	PAPER IX: Evolutionary Biology & Genetic Engineering	03	45	10	40	50	Credit:02
	CCZP-II	[CCZ IV (Section A & Section B)	Practical Paper- XI: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering (Practical based on P-VIII & IX)	03	30	10	40	50	Credit:02
	SECZ-II		SEC-II Any one Skill to be chosen out of Two SECZ –II (C): Histotechnology SECZ –II (D): Apiculture	03	45	25	25	50	Credit:02
			Total Credit for Semester III & IV			**110**	**290**	**400**	**Credit:16**

CCZ: Core Course Zoology, **CCZP:** Core Course Zoology Practical, **CA:** Continuous Assessment;

ESE: End of Semester Examination, **SECZ:** Skill Enhancement Course Zoology

SECZ: CA-25: Seminar-15 & Test-10 **ESE-25:** Report Submission-10; Overall Skill Judgment-10 and Presentation-05

ESE for SECs SECZ-I & SECZ-II and Practical Papers CCZP-II & CCZP-III for both semesters III & IV respectively will be at the end of Academic Year in Annual Pattern.

Practical Internal Evaluation (Continuous Assessment CA)= 10 Marks

Submission of Record book & Excursion Report =05 Marks; Internal Test on Practicals=05 Marks

Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Credit System (CBCS) Course Structure
Faculty of Science & Technology
B.Sc. Second Year (Semester III & Semester IV) Syllabus w.e.f. June, 2020
Semester Pattern; Subject: Zoology
NEWLY DESIGNED CBCS CURRICULA OF B.Sc. SECOND YEAR ZOOLOGY

Zoology deals with study of the **animals**. It embodies study of the structure, development, classification, habits, genetics, distribution and evolution of all animals. There are several specializations available to students pursuing this field. Among the several branches of zoology like cell biology, genetics, biochemistry, physiology, evolution; the branch of genetic engineering has grown into a huge area of research and application recently. All these fields of biology have contributed immensely to the progress of humankind.

The University has introduced the Choice Based Credit System (CBCS) in its curricula. Following is a briefing about CBCS as envisaged by the UGC.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS structure provides an opportunity for the students to choose from the prescribed core, elective/minor or skill based courses. The courses can be evaluated following the grading system, as prescribed by the Examination Cell of the University. A uniform grading system in the entire higher education in India will benefit the students to move across institutions to begin with. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

CORE COURSES:

The Core Courses (CC) offered to students of B.Sc. II Year Zoology are aimed at preparing the students for their study in the last year of graduation and their future career. The students are exposed to the varied fields of zoology as a foundation for them to take up higher studies. After completion of their graduation, the students would also be able to take up entrepreneurship related to biological sciences.

THE SALIENT FEATURES:

Physiology & Biochemistry and **Cell Biology, Genetics, Evolutionary Biology & Genetic Engineering** are the two papers offered to the B.Sc. II year students in III & IV semesters respectively. "Physiology & Biochemistry" attempts to deal with the mode of life and physiology of animals from different taxonomic groups and from different environmental conditions. As also, this paper deals with Understanding of the relationship, environmental and evolutionary, is the core of the first paper. Added to it is also an aspect on the developmental aspects of different species of animals. The second paper on "Cell Biology, Genetics, Evolutionary Biology & Genetic Engineering" deals with study of cells, genetics, evolution and genetic engineering. Understanding the latest developments in the fields of genetics and genetic engineering are an essential aspect of their future in academics in zoology.

UTILITY OF THE COURSE:

Learning of such areas of zoology as Physiology, Biochemistry, Cytology, Genetics, Evolution & Genetic Engineering equips students with necessary skills to pursue further study in a wide range of subjects. It also prepares the students for future research in any of the related fields. Such a broad coverage of topics in the second year also helps them widen their perspective of biological sciences. These courses would induce understanding of the subject so that the student could later take up specialized post-graduate courses and also pursue research in the relevant field. The students could also explore possibilities in developing themselves in such specialized fields to fit in the competitive environment.

Chairman,
Board of Studies in Zoology,
Faculty of Science & Technology,
Swami Ramanand Teerth
Marathwada University
Nanded- 431 606

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science & Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
Semester- III

Paper: CCZ- III: Physiology and Biochemistry
Section- A **Title of Paper: Paper- VI:** Physiology
Periods: 45 **Credits: 02 (Marks: 50)**

Objectives:

1. To understand the internal physical and chemical functions of animals and their parts.
2. To study the process of digestion, assimilation and excretion
3. To understand working of blood and circulatory system.
4. To understand the respiration and nervous coordination.
5. To study the endocrine function of Human reproductive organs.
6. To study the nature, function and classification of hormones.
7. To acquire knowledge on the structure of Pituitary, Thyroid, Adrenal, and Islets of Langerhans.

UNIT- I **11**

1. **Digestion:**
   Kinds of digestion-Intracellular and Extracellular Digestion.
   Physiology of digestion in the alimentary canal.
   Absorption of Carbohydrates, Proteins, Lipids.
2. **Vitamins:**
   Sources and deficiency diseases of Fat soluble and Water soluble vitamins.
3. **Respiration:**
   Kinds of Respiration- Direct and Indirect Respiration.
   Respiratory organs in man.
   Mechanism of Respiration in man.
   Transport of O_2 and CO_2

UNIT- II **11**

1. **Excretion:**
   Structure of Kidney, Structure of nephron.
   Mechanism of Urine formation (Ultra-filtration and tubular re-absorption).
   Counter-current Mechanism.
2. **Cardiovascular system:**
   Composition and functions of blood
   Types of heart in vertebrates: Neurogenic and Myogenic heart.
   Structure and working of Human Heart.
   Origin and conduction of the cardiac impulse, Cardiac cycle.
   E.C.G. and Blood Pressure

UNIT – III **11**

1. **Nerve Physiology:**
   Structure of generalized neuron

Types of neurons
Structure of synapse
Major Neurotransmitters- Acetyl choline, adrenaline & dopamine.
Conduction of nerve impulse

2. **Muscle Physiology:**
   Types of muscles- smooth muscles, skeletal muscles and cardiac muscles.
   Ultra structure of skeletal muscles

UNIT – IV **12**

1. **Reproduction:**
   Histological structure of human testes and ovaries.
   Physiology of male reproduction: hormonal control of spermatogenesis
   Physiology of female reproduction: hormonal control of oogenesis, menstrual cycle and pregnancy.

2. **Endocrine Glands:**
   Structure, functions and hormonal disorders of –
   Pituitary gland, Thyroid gland, Adrenal gland, Islet's of Langerhans (Pancreas)

Outcome of the Course:

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

1. Monitor their blood pressure and identify blood groups.
2. Understand function and types of heart & circulatory system.
3. Appreciate the basic function of kidney, main function of nerves.
4. Acquire knowledge on the nature and functions of hormones and learn the mechanism of hormone action.
5. Learn the structure and functions of Endocrine glands.
6. Understand the structure, development and function of reproductive organs in human.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
Semester- III

Paper: CCZ- III: Physiology and Biochemistry
Section- B **Title of Paper: Paper- VII :** Biochemistry
Periods: 45 **Credits: 02 (Marks: 50)**

Objectives:
1. To provide students with a deep knowledge in biochemistry.
2. To study the function and structure of Biomolecules.
3. To understand the role of biomolecules in cell membrane
4. To establish correlation between metabolism of different types of biomolecules.

UNIT – I **12**

1. **Biomolecules**:
   Classification, Structure and Properties of Carbohydrates.
   Classification, Structure and Properties of Proteins.
   Classification, Structure and Properties of Lipids.

UNIT – II **11**

Electrochemical properties of Water, pH and Colligative properties
Enzymes: Nomenclature and Classification
Mechanism of Enzyme Action- E-S Complex Formation, Lock and Key Model, Induced Fit Theory.
Factors affecting Enzyme Activity- Temperature, pH, Concentration of Enzyme, Concentration of Substrate.

UNIT – III **11**

1. **Carbohydrate Metabolism:**
   Glycolysis (EMP Pathway)
   Glycogenesis, Glycogenolysis and Glyconeogenesis
   Citric Acid Cycle (Krebs Cycle)
   Pentose Phosphate Pathway (HMP shunt).

UNIT – IV **11**

1. **Lipid metabolism** :
   The ß-Oxidation (Beta Oxidation) Pathway
   Ketosis, Ketogenesis and Ketolysis.

2. **Protein metabolism:**
   Transamination, deamination and decarboxylation reactions of amino acids.
   Disposal of nitrogenous waste.
   Krebs-Henseleit Urea Cycle (Ornithine cycle).

Outcome of the Course:

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

1. Understand the chemical structure and functions of various biomolecules
2. Learn the signaling of biomolecules in cell membrane.
3. Understand the correlation between metabolism of different types of biomolecules.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
Semester- III

Paper: CCZP- II **Section- A & B**

Title of Paper: Practical Paper X: Physiology and Biochemistry (Practical based on P-VI & VII)

Practicals: 32 **Credits: 02 (Marks: 50)**

Objectives:

1. To improve the skills of students in microscopy, slide preparation, observations, drawings and laboratory techniques.
2. To acquaint the students with operations of the different laboratory equipment.
3. Ability to carry out routine clinical analysis of blood.
4. Understand the working principle and application of Sphygmo-manometer and Haemoglobinometer.
5. Learn clinical procedures for blood & urine analysis.

Section- A

1. Qualitative detection of digestive enzymes (Protease, Amylase and Lipase) in cockroach.
2. Detection of human salivary amylase.
3. Study of histological structure of following organs – Stomach, Intestine, Pancreas, Liver and Kidney.
4. Estimation of oxygen consumption in fish or any other suitable aquatic animal.
5. Qualitative detection of nitrogenous waste products (Ammonia, Urea, Uric acid) in bird's excreta and urine of Mammals.
6. Detection of Blood Groups- A, B, AB, O with Rh factor.
7. R.B.C. counting.
8. W.B.C. counting.
9. Estimation of Haemoglobin.
10. Measurement of B.P. by using B.P. apparatus (Demonstration only).
11. Preparation of Haematin crystals.
12. Structure of neurons (slide/chart); Types of nerve cells- Unipolar, Biopolar, Multipolar (Slides)
13. Structure of synapse
14. Temporary preparation of squamous epithelium, ciliated epithelium, skeletal muscle fiber and blood smear.
15. Study of histological structure of following organs- Testis, Ovary, Pituitary, Thyroid, Adrenal and islets of Langerhans.
16. Location of endocrine glands through charts or models.

Section- B

17. Qualitative detection of Carbohydrates.
18. Qualitative detection of Proteins
19. Qualitative detection of Lipids
20. Study of colligative properties of water.
21. Effect of different factors on Enzyme activity.
22. Estimation of an Enzyme – Amylase.
23. Estimation of an Enzyme – Protease.

24. Determination of Glycogen
25. Determination of Glucose.
26. Determination of Lipids.
27. Estimation of Protein by Lowry's method.
28. Estimation of free amino acids.
29. Estimation of Urea.
30. Estimation of Uric Acid
31. Routine examination of urine (physical examination of urine)
32. Chemical examination of urine.

Short excursion / study tour is compulsory.

Submission:

i) Practical record book duly signed by the teacher in charge/Head of the Department.

ii) Excursion report.

Outcomes:

1. Students able to improve the skills in microscopy, slide preparation, observations, drawings and laboratory techniques.
2. To acquaint the students with operations of the different laboratory equipment.
3. Ability to understand the detection of blood groups of humans.
4. Ability to Understand the estimation of blood cell counts, Haemoglobin content in humans.
5. To acquaint the students with operation of clinical procedures for blood & urine analysis.

(Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines.)

REFERENCE BOOKS BASED ON PAPER: CCZ-III (SECTION A (P-VI) & SECTION B (P-VI)), PAPER: CCZZP-II (P-X)

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2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill
3. Guyton, A.C. and Hall, J.E. (2011). T*extbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4. Eckert R.- Animal Physiology (W. H. Freeman)
5. K. A. Goel and K. V. Shastri- A Textbook of Animal Physiology. Rastogi Pub.
6. Animal Physiology – A. Maria Kyttikan and N. Armugam (Saras Pub.)
7. Biochemistry – Arumugam et.al, (Saras Pub.)
8. Clinical Pathology and Haematology – Nanda Baheti (Kanhaiya Pub.)
9. Comparative Animal Physiology - C. Ladd Prosser.
10. Human Physiology - Vander A. J., Sherman J. H. and Luciano D. S. (Mc Graw Hill London)
11. Principles of Anatomy and Physiology – Tortora G. H. and Grabowasky S. R. (Harper Collins College Publication)
12. Text book of Animal Physiology – A. K. Berry (Emkay Publications, Delhi)
13. Principles of Animal Physiology – D. W. Wood
14. Physiology – Guyton and Hall
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16. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
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18. Williams Text Book of Endocrinology – Tenth Edition, Saunders, 2003.
19. Endocrinology – Mac E. Hadley, Fifth Edition, Pearson Education, 2004
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21. Basic and Clinical Endocrinology – Greenspan, F.S., 3rd Ed., Appleton and Lange.
22. Basic Medical Endocrinology – Goodman, H.M., Raven, New York, 1988.
23. Hormones : From Molecules to Diseable, Bailiene, E.E. & P.A. Kelly, Herman, NewYork, 1991.
24. Bailey's Textbook of Histology – Williams and Wilkins (Baltmore and Scientific Book Agency, Culcutta Copenhaver W. M.).
25. Text book of Histology – Bloom W. and Fawcett D. W.
26. Histology of Mammals – Athavale M. V. and latey A. N.
27. Histology – Lippinocott, Han A. W.
28. Human Histology – Leslie Brainerd Arey (Khosla Pub. House, Delhi)
29. Tools of Biochemistry – T. G. Cooper.
30. Biochemistry – C. B. Power (Himalaya Pub.)
31. Outline of Biochemistry – Conn. E.E. and Stumpf P. V.
32. Biochemistry – Leninger A. L.

33. Biochemistry – Das.
34. Textbook of Biochemistry – Rao K. R.
35. Textbook of Biochemistry West E. S., Todd W. R. Mason H. S. and VanBruggen J. T.
36. Experimental Physiology – S. C. Rastogi (Wiley Eastern Ltd. London)
37. A Textbook of Practical Physiology – V.G. Ranade (P. V. G. Prakashan Pune.)
38. Manual of Practical Zoology – P. K. G. Nair and K. P. Achar (Himalaya Pub.)
39. Medical Laboratory Techniques – Ramni Sood (Jaypee Brothers medical Pub. Pvt. Ltd. New Delhi).

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science & Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
SRTM UNIVERSITY PRACTICAL EXAMINATION SUMMER / WINTER
QUESTION PAPER
Zoology
Semester- III

Paper: CCZP- II **Section- A & B**

Title of Paper: Practical Paper X: Physiology and Biochemistry (Practical based on P- VI & VII)

Centre:	**Date:**
Batch No.:	**Session:**
Marks: 40	**Time: 04 Hrs.**

Q.1 Qualitative detection of digestive enzymes (Protease, Amylase and Lipase) in Cockroach (**Any Two**)/ Detection of human salivary amylase./ Estimation of O2 consumption in fish or any suitable aquatic animal. **10**

OR

Detect any two Nitrogenous Waste Products from Sample Provided/
Detection of Blood Groups from given sample/ Counting of R.B.C./ W.B.C. in blood sample provided./
Estimate the Haemoglobin percentage in a given sample of blood/
Prepare Haematin Crystals from blood sample provided./
Measurement of Blood Pressure in Man.

Q.2 Identify and describe Nerve Cells and synapse from Slide Provided (Any Four)./ **08**
Identify and describe the histological slides of Endocrine glands (Any Four).

OR

To locate, Identify and comment on endocrine glands in charts or models provided (Any Four)/ Temporary preparation of squamous/ ciliated epithelium / skeletal muscle fiber/ blood smear

Q.3 Qualitative detection of Carbohydrates/ Proteins/Lipids **or** Demonstrate any one colligative property of water **10**

OR

Effect of different factors on Enzyme activity/Estimation of an Enzyme – Amylase or Protease

Q.4 Determination of Glycogen/ Glucose **or** Determination of Lipids./ Estimation of Protein by Lowry's method/ Estimation of free amino acids / Urea/Uric Acid **08**

OR

Routine examination of urine (physical examination of urine)/ Chemical examination of urine

Q.5 Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.
a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And
b) Internal Test on Practicals=05 Marks.
2. Demonstration of animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C Guidelines.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

PRACTICAL PAPER

CONTINUOUS ASSESSMENT (CA)

Zoology

Semester- III

Paper: CCZP- II **Sections- A & B**

Title of Paper Practical Paper X: Physiology and Biochemistry (Practical based on P-VI & VII)

Centre: **Date:**

Marks:10

SEAT NUMBER: ……..

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	**10**	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

Zoology

Semester- IV

Paper: CCZ-IV: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering

Section- A **Title of Paper: Paper- VIII:** Cell Biology and Genetics

Periods: 45 **Credits: 02 (Marks: 50)**

Objectives:

1. To provide students with relevant knowledge, skills and values in contemporary cell biology.
2. To understand the structure and function of the cell as the fundamentals for understanding the functioning of all living organisms.
3. To acquire knowledge of prokaryotic, eukaryotic cells.
4. To make aware of different cell organelles, their structure and role in living organisms.
5. To acquire knowledge of Mendelian Genetics and its Extension.
6. To emphasize the central role of genes and their inheritance in the life of all organisms.

UNIT – I **11**

1. **Overview of Cells:**
   Structure of Prokaryotic and Eukaryotic cells. Microscopy for cell study.
2. **Cell Organelles:**
   Structure and functions of Cell Organelles- Plasma membrane, Endoplasmic reticulum, Golgi complex, Mitochondria, Ribosomes, Lysosomes and Nucleus.
3. Cell Cycle and its regulation

UNIT – II **11**

1. **Introduction to Genetics:**
   Mendel's work on transmission of traits, Genetic Variation.
2. **Mendelian Genetics and its Extension:**
   Mendel's law of inheritance- Law of Dominance, Law of Segregation, Law of independent Assortment.
   Interaction of genes and modifying genes- Complementary factor (9:7); Supplementary factor (9:3:4); Inhibitory factor (13:3); Duplicate genes (15:1); Lethal genes (1:2:1)

UNIT – III **11**

1. **Multiple Alleles and Genes:**
   i) Inheritance of ABO Blood groups in Man.
   ii) Rh factor and Erythroblastosis foetalis in man.
   iii) Polygenic characters- skin pigmentation in man.
2. **Linkage and Crossing over:**
   i) Linkage- Types and significance
   ii) Crossing over- a) Mechanism of crossing over, b) Factor affecting crossing over, c) Significance of crossing over.

3. **Mutation**
   i) Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy.
   ii) Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations.

UNIT – IV **12**

1. **Sex determination**
   i) Chromosomal methods of sex determination.
   ii) Bridge's ratio theory of genic balance.
2. **Sex linked inheritance**
   i) Sex linked inheritance in Drosophila.
   ii) Sex linked inheritance in man – colourblindness, haemophilia, Hypertrichosis
3. **Cytoplasmic Inheritance-** Mitochondrial inheritance (in human being)
4. **Human Genetics**
   i) Syndromes – *Turner, Klinefelter, Down, Cat-Cry, Patau syndrome*
   ii) Inborn errors of metabolism – Phenylketonuria (PKU), Alkaptonuria, Albinism.
   iii) Human pedigree analysis with symbols.

Outcome of the Course:

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

1. Understand the structure and function of the cell as the fundamentals for understanding the functioning of all living organisms.
2. Understand structures and various cellular functions associated with the macromolecules found in cells.
3. Acquire knowledge of Mendelian Genetics and its Extension.
4. Graduates will be able to explain and interpret various processes, phenomena, states and evolutionary tendencies at a biological system level.

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Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

Zoology

Semester- IV

Paper: CCZ- IV: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering

Section- B **Title of Paper: Paper- IX:** Evolutionary Biology and Genetic Engineering

Periods: 45 **Credits: 02 (Marks: 50)**

Objectives:

1. To know the history and concept of evolution.
2. To understand the mechanisms and factors involving in evolution process
3. To acquire increased theoretical and practical knowledge of various processes of Molecular Genetics
4. To study the techniques for obtaining genetically modified organisms

UNIT – I **12**

1. **Introduction to theories of Evolution:**
   Lamarckism, Darwinism, Neo-Darwinism, Hugo De Vries theory.
2. **Evidences of organic Evolution**:
   i) **Morphological and Anatomical evidences**: Homologous, analogous and vestigial structures and their evolution.
   ii) **Physiological and Biochemical evidences**: examples.
   iii**) Embryological Evidences**: examples, Biogenetic Law.
   iv) **Palaeontological Evidences**: Distribution of fossils in rocks, dating of rocks and fossils, conclusion drawn from fossil records (brief account).
   v) **Taxonomical evidences**: evolution based principles of classification, phylogenetic tree.
3. **Processes of Evolutionary Change:**
   Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection.

UNIT – II **11**

1. **Species Concept:**
Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric).

2. **Extinction:**
Mass extinctions in history of earth, Mass extinction- Causes, Role of extinction in evolution.

3. **Adaptive radiation**- Causes and significance, Adaptive radiation in Darwin's finches

4. **Hardy-Weinberg Principle-** Hardy-Weinberg Equilibrium, Factors that upset Hardy-Weinberg Equilibrium

UNIT – III **11**

1. **Nature and functions of genetic materials**.
   i) DNA – Structure, types and functions.
   ii) RNA – Structure, types and functions.
   iii) Genetic code

2. **Introduction to Genetic Engineering**
3. **Recombinant DNA Technology**

   i) Tools: - A) Enzymes: - a) Lysing b) Ligases c) Nucleases (Exonucleases, Endonucleases, Restriction Endonucleases) d) Synthetases (DNA polymerase, Reverse transcriptase)

   B) Vectors: - Cloning vectors (Plasmid -psBR322, Bacteriophage-Lambda phage, Virus-SV40, Cosmid vectors)

UNIT – IV **11**

1. **Techniques:**
   - i) Gel-Electrophoresis
   - ii) PCR (Polymerase Chain Reaction)
   - iii) Southern, Northern and Western Blotting**.**
2. Construction of rDNA
3. c-DNA libraries and Genomic libraries
4. Transgenesis and Transgenic animals (Transgenic cattle, sheep, pig and fish)
5. Cloning and cloned animals (Dolly sheep)
6. DNA fingerprinting.

Outcome of the Course:

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

1. Understand the theories and concepts of evolution.
2. Learn the process of evolution in animals.
3. Understand the patterns of evolutionary changes in animals.
4. Understand the organization and functions of genetic material in the living world.
5. Understand the Recombinant DNA Technology.

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Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
Semester –IV

Paper: CCZP- III **Section –A & B**

Title of Paper: Practical Paper XI: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering (Practical based on P-VIII & IX)

Practicals: 32 **Credits: 02 (Marks: 50)**

Objectives:

1. To provide basic practical skills and experience in using laboratory techniques in experimentation.
2. To understand how to prepare mitotic chromosomes.
3. To Demonstrate the Mendalian traits in Man.
4. To be able to mounting of salivary glands of Drosophila larvae
5. To understand the outline of Genetic Engineering
6. To Learn the role of Genetic Engineering in biology

Section- A

1. Staining of eukaryotic cells: Temporary mount of buccal epithelial cells to study their structure.
2. Identification of cell organelles (based on chart / photo-micrographs)
3. Operation and maintenance of compound microscope.
4. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
5. Study of various stages of meiosis.
6. Problems based on Monohybrid & Dihybrid cross.
7. Problems based on interaction of genes (Complementary, Supplementary, Inhibitory Duplicate factors, Lethal genes).
8. Problems based on blood group inheritance & sex linked inheritance (haemophilia and colour blindness) in man.
9. Culture of Drosophila.
10. Observation of genetic characters likes eyes and wings in drosophila.
11. Preparation of temporary slides of salivary gland chromosomes from drosophila/chironomous larva.
12. Study of permanent slide of sickle cell anaemia.
13. Study of normal male and female human karyotype (use photographs or prints) and abnormal (chromosomal abnormalities) human karyotypes.
14. Study of genetic syndromes:
    a) Down's syndrome
    b) Klinfelter's syndrome
    c) Turner's syndrome.
15. Human pedigree analysis- various symbols used.
16. Study of human genetic traits (PTC (phenyl thio carbamate) tasters, ear lobes)

Section- B

Study of evidences by using photograph/charts and models-

17. Study of homologous organs (limbs of 5 different groups of vertebrates).
18. Study of analogous organs (wings of bird, insect and bat).
19. Study of connecting links (*Archeopteryx* and *Peripatus*).
20. Study of any four vestigial organs in humans.
21. Study of adaptive radiation in feet of birds.
22. Study of adaptive radiation in mouth parts of insects.
23. **Charts/Diagrams/Cut-outs:**
    a) Study of evolution of man based on three hominid fossils.
    b) Phylogeny of horse limbs and teeth of horse ancestors.
    c) Darwin's Finches- beaks of different species.
24. Calculation of frequencies of recessive and dominant gene in a population by using Hardy Weinberg Principle.
25. Calculation of heterozygotes and homozygotes in population by using Hardy Weinberg's principle.
26. Estimation of DNA by Diphenyl amine (DPA method).
27. Study of the principle and applications of Electrophoresis apparatus
28. PCR- Principle and applications.
29. ELISA- Demonstration.
30. Study of transgenic animals.
31. Study of the principle and applications of DNA finger printing.
32. Sequence Similarity Search using BLAST- Demonstration

Visit to Natural History Museum and submission of report.

Submission:

i) Practical record book duly signed by the teacher in charge/Head of the Department.
ii) Excursion report.

Outcomes:

1. Students would be able to prepare temporary squash preparations of onion root tips for mitosis.
2. Demonstrate the genetic traits in Man.
3. Ability to culture Drosophila flies in the laboratory.
4. Ability for mounting of salivary glands of Drosophila larvae.
5. Students are able to understand the outline of Genetic Engineering.
6. Ability to Learn the role of Genetic Engineering in biology.

(Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines.)

REFERENCE BOOKS BASED ON PAPER: CCZ-IV (SECTION A (P-VIII) & SECTION B (P-IX)), PAPER: CCZZP-III (P-XI)

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
4. Russell, P. J. (2009). *Genetics- A Molecular Approach.* III Edition. Benjamin Cummings.
5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
6. Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
7. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
8. Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
9. Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
10. Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.
11. Dr.S.S.Nanware, Dr.D.B.Bhure & M.U.Barshe (2015). Text Book-Cell Biology. Aruna Prakashan Latur, M.S. ISBN: 978-93-5240-012-6,Publication12th June, 2015
12. Dr.D.B.Bhure, Dr.S.S.Nanware & M.U.Barshe (2016). Text Book of Fundamental Genetics. Aruna Prakashan Latur, M.S. ISBN: 978-93-5240-035-5,Publication16th June, 2016
13. Gupta, P. K (2002) *Cell and Molecular Biology*, (2ed), , Rastogi Publications., Meerut
14. Gardner, J.E., Simmons, J.M and Snustad D.P..(2007). *Principles of Genetics* (8th edn.).John Wiley and Sons, India.
15. Sarada K & Mathew Joseph (Editors) (1999) *Cell Biology, Genetics and Biotechnology*,
16. Thomas A. P (Editor), (2012). *Genetics and Biotechnology- The Fundamentals. Green Leaf Publications*, TIES, Kottayam.
17. Heinemann, 1993, Techniques for Engineering Genes, Butterworth. Open Universiteit Nederland.
18. J.D. Watson, M. Gilman, J. Witkowski & M. Zoller, (1992). Recombinant DNA Technology, (2nd Edn.). Scientific Americans books, Newyork.
19. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). Evolution.- Cold Spring, Harbour Laboratory Press
20. Bendall, D. S. (ed.) (1983). Evolution from Molecules to Man. Cambridge University Press, U.K
21. Chattopadhyay Sajib. (2002). Life Origin, Evolution and Adaptation.Books and Allied (P) Ltd. Kolkata, India.
22. Douglas, J. F (1997). Evolutionary Biology.Sinauer Associates.
23. Hall, B. K. and Hallgrimsson, B. (2008), Evolution. 4th Edition; Jones and Bartlett Publishers.
24. Verma P.S. and Agarwal V.K. (1974). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand Publications, Delhi. Multicolour Reprint 2005

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Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
SRTM UNIVERSITY PRACTICAL EXAMINATION SUMMER / WINTER
QUESTION PAPER
Zoology
Semester –IV

Paper: CCZP-III **Section –A&B**

Title of Paper: Practical Paper XI: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering (Practical based on P-VIII & IX)

Centre: **Date:**
Batch No.: **Session:**
Marks: 40 **Time: 04 Hrs.**

Q.1 Temporary mount of buccal epithelial cells to study their structure / Identify any two cell organelles and comment on their structure and functions / Demonstrate operation of compound microscope and comment on it / Preparation of temporary stained squash of onion root tip to study stages of mitosis / Study of various stages of meiosis. **10**

OR

Solve One problem based on Monohybrid Cross & One problem based on Dihybrid Cross / Solve any two problems on Interaction of Genes.
(Complementary, Supplementary, Inhibitory Factors, Duplicate genes, Lethal genes)

Q.2 Solve Problems based on blood group inheritance in man/ Sex-Linked Inheritance **08**
Identification of Human Syndromes (any two)/ Preparation of Temporary Mount of Salivary Gland Chromosomes of Drosophila / Chironomous Larvae

OR

PTC tasting test in a group of individuals and reporting of results

OR

Identify and Comment on as per instructions. a) Sickle cell anemia –slide/photograph/ charts.
b) Humans pedigree analysis (Any Four symbols)

Q.3 Identify and comment on as per the instructions (Any Four) {homologous organs, analogous organs, connecting links, vestigial organs, adaptive radiation} **10**

OR

Problems (**Any Two**) based on Hardy- Weinberg Principle.

Q.4 Estimation of DNA by Diphenyl amine (DPA method)./ Study of the principle and applications of Electrophoresis apparatus/PCR/DNA Finger printing/ ELISA-Demonstration/ Sequence Similarity Search using BLAST –Demonstration/ Study of transgenic animals **08**

Q.5 Viva-Voce **04**

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = Total 10 Marks.
a) Submission of Record book & Submission of Report on a Field Visit = 05 Marks And
b) Internal Test on Practicals=05 Marks.
2. Demonstration of animal Dissections through Models, Charts and Computer Aided Techniques as per U.G.C Guidelines.

Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
PRACTICAL PAPER
CONTINUOUS ASSESSMENT (CA)
Zoology
Semester- IV

Paper: CCZP- III **Sections- A & B**

Practical Paper XI: Cell Biology, Genetics, Evolutionary Biology and Genetic Engineering (Practical based on P- VIII & IX)

Centre: **Date:**

Marks: 10

SEAT NUMBER: ……..

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Submission of Record book & Submission of Report on a Field Visit	05	
2.	Internal Test on Practicals	05	
	Total Marks	**10**	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
B.Sc. Second Year, Semester – III

Skill Enhancement Course (SEC)

SECZ –I (A): HAEMATOLOGY

Periods: 45 **Credits:02 (Marks:50)**

Objectives

1. To understand the composition and functions of human blood.
2. To appreciate different types of compounds used in processing and storage of blood.
3. To learn different techniques used in study of blood cells.
4. To develop skill of collecting, preserving and analyzing blood samples.
5. To learn about changes in blood composition in disease.

UNIT – I

1. Introduction- Definition, Components, Cells – Structure and Functions of cells, Lymph. Collection of Blood- Collection of capillary blood by skin puncture, Collection of blood by Venipuncture, Collection of arterial blood, Criteria for sample collection.

- Practical- Collection of blood by Venipuncture and arterial blood. Determination of blood group of provided blood sample.

UNIT – II

2. Anticoagulants - Definition, Action of EDTA, Oxalates, double oxalates, fluorides, acid citrate, detxtrose-trisodium citrate, heparin - Effect of anticoagulants on blood cell morphology.
3. Haemoglobin - Normal structure and various haemoglobin, Determination of haemoglobin by various methods - Anaemia.

- Practical - Determination of haemoglobin from given blood sample, Clotting and bleeding time of blood.

UNIT – III

4. Study of Blood Cell Count - Total WBC Count, Total RBC Count, Platelets Count, Absolute Eosinophil Count, Reticulocyte Count.

- Practical – Determination of Total Count of RBC, WBC.

UNIT – IV

5. Study of Blood Smear for differential WBC Count - Preparation and Staining of smears, Counting Methods, Morphology of White cells, Types of White Cells, Abnormalities in morphology of blood cells and related diseases.

- Practical – Determination of differential WBC Count by blood Smear.

Outcomes

1. Ability to explain composition and functions of blood.
2. Knowledge about compounds used in processing and storage of blood.

3. Skill to be able to use different techniques used in study of blood cells.
4. Ability to collect, preserve and analyze blood samples.
5. Knowledge of changes in blood composition in disease.

REFERENCE BOOKS:

1. Medical Laboratory Technology - Ramnik Sood
2. Medical Lab Technology Vol. I, II & III – Kanai Mukherjee
3. Hand Book of Medical Technology - Mrs. Chitra
4. Medical Laboratory Technology – A. Ananthanarayan
5. Manual for Laboratory Technician of Primary Health by Minister of Health
6. Human Physiology Vol. I & II – C. C. Chatterjee

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Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
B.Sc. Second Year, Semester – III

Skill Enhancement Course (SEC)

SECZ –I (B): URINOLOGY

Periods: 45 **Credits: 02 (Marks:50)**

Objectives

1. Understanding structure and function of human urinary system.
2. Learning about formation and composition of urine.
3. Appreciate importance of urine composition in detecting disease.
4. Instill skill to perform basic urinary system function tests.
5. Develop ability to handle and process urine samples.

UNIT - I

1. Definition, Structure and Functions of Urinary System, Physiology of Mechanism of Urine formation.

- Practical – Study of principle and procedure of renal function test in human.

UNIT - II

2. Constituents and composition of Urine
   i) Normal constituents and abnormal constituents of Urine- i) Qualitative tests for sugar, albumin, ketone bodies, bile salts and bile pigments.

- Practical – Study of normal and abnormal constituents of Urine.

UNIT - III

3. Renal Function Tests
   i. Definition, importance of tests like urea, creatinine, uric acid, proteins
   ii. Importance of Dialysis

- Practical- Biochemical Qualitative and Quantitative tests for urine from normal and diabetic persons.

UNIT - IV

4. Collection and preservation of Urine Sample
   i. Physical and Chemical Examinations of abnormal constituents.
   ii. Microscopic Examination of urine
   iii. Preparation of Urine Report
   iv. Urinometer.

- Practical- Study of Microscopic Examination of urine.

Outcomes

1. Ability to describe function of human urinary system.
2. Skill to collect, preserve, process and store urine samples.

3. Skill to perform physical, chemical and microscopic examination of urine samples.
4. Ability to document findings of urine examination/analysis.

REFERENCE BOOKS

7. Medical Laboratory Technology - Ramnik Sood
8. Medical Lab Technology Vol. I, II & III – Kanai Mukherjee
9. Hand Book of Medical Technology- Mrs. Chitra
10. Medical Laboratory Technology – A. Ananthanarayan
11. Manual for Laboratory Techniian of Primary Health by Minister of Health
12. Human Physiology Vol. I & II – C. C. Chatterjee

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science & Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

Zoology

B.Sc. Second Year, Semester – IV

Skill Enhancement Course (SEC)

SECZ –II (C): HISTO-TECHNOLOGY

Periods: 45 **Credits: 02 (Marks: 50)**

Objectives

1. Appreciation of structure of cells in various types of tissues.
2. Learning the methods in storage and histochemical processing of tissue samples.
3. Acquire the ability and skill to prepare histological slides of tissue samples.
4. Learn about tools used in histological study of tissues.

UNIT - I

1. Introduction – Definition of Histo-technology.
2. Methods of examination of tissues and cells, Collection and labeling of specimens, Methods of preparation and examination of tissues (fresh and fixed tissue).

- Practical – Study of different types of microtomes.

UNIT- II

3. Fixation of tissue - Definition, Criteria for an ideal fixative, types (Simple and Compound), Properties of Simple and Compounds fixatives (Microanatomical, cytological and histochemical)

- Practical – Isolation and collection of tissue, fixing and block preparation.

UNIT- III

4. Tissue processing - Manual and automatic tissue processing, Different embedding media, Steps of tissue processing (Dehydration, Clearing, Impregnation).
5. Embedding- Methods of Embedding, Embedding medium, names of media and moulds, Automatic Tissue Processes (Structure and Working, Advantages and Disadvantages).

- Practical – Tissue processing of prepared blocks.

UNIT- IV

6. Section Cutting - Types of Microtome, Rotary Microtome -Parts and their functions, Microtome Knives- Types, Care and Maintenance Techniques of sharpening; Technique of Section Cutting, Preparation of Adhesive Mixture, Mounting.
7. Staining - Definition and Significance of Staining, Stain and Staining Types, Theory of Staining, Methods of Staining.

- Practical – Section Cutting, fixing, alcohol grading, staining and preparation of permanent slide.

Outcomes

1. Ability to identify different types of tissues and distinguish between different components of cells.
2. Skill related to fixation of tissue samples and microtechnic processing of tissues.
3. Ability to identify, handle and catalogue slides of different tissues.
4. Students' skill in operating and maintaining different types of microtomes.

REFERENCE BOOKS:

1. Histochemical Techniques – J. D. Bancroft.
2. Handbook of Histopathological and Histochemical Techniques – C. F. A. Culling.
3. Histological and Histochemical Methods 4th Ed. – John Kiernan.

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B. Sc. Second Year Syllabus w.e.f. June, 2020
Zoology
B.Sc. Second Year, Semester – IV

Skill Enhancement Course (SEC)

SECZ- II (D): APICULTURE

Periods: 45 **Credits: 02 (Marks: 50)**

Objectives

1. To learn about life history and social structure of honey bee species.
2. To study bee rearing and farming methods and the equipment involved.
3. To learn about apiculture benefits and different byproducts & their economic scope.
4. To study the different bee diseases and predators and their control measures.

UNIT- I: BIOLOGY OF BEES

1. History, Classification and Biology of Honeybees.
2. Social Organization of Honey bees.

- Practical – Study of different species of locally available honey bees.

UNIT- II: REARING OF HONEY BEES

3. Artificial Bee Rearing (Apiary), Bee hives- Newton and Langstroth, Bee Pasturage, Selection of Bee Species for apiculture, Bee keeping equipment, Methods of extraction of honey (Indigenous and Modern).

- Practical- Visit to the Apiculture centers, Submission of report about different equipment and procedures used in keeping of artificial bee hives.

UNIT- III: DISEASES AND ENEMIES

4. Bee diseases and enemies, Control and preventive measures.

- Practical- Study of different parasites and predators of honey bees.

UNIT- IV: ECONOMY OF BEES AND ENTREPRENEURSHIP

5. Products of Apiculture industry and its uses (Honey, Bee wax, Propolis, Pollen etc.).
6. Bee keeping industry- Recent efforts, Modern methods in employing artificial believes for Cross pollination in horticulture gardens.

- Practical- Collection of natural bee hives, honey etc.
- Practical- Extraction of bees wax from bee hive.

Outcomes

1. Ability to understand and describe the life stages and social organization of honey bee species.
2. Ability to correctly explain and perform bee rearing, farming and harvesting practices.
3. Appreciate the economic importance of derivative benefits and byproducts of apiculture.
4. To identify and take remedial measures against the different bee diseases and predators.

REFERENCE BOOKS:

1. Apiculture - Prost, P. J. (1962), Oxford and IBH, New Delhi.
2. Apiculture - Bisht D. S., ICAR Publications.
3. Bee Keeping in India - Indian Council of Agricultural Research, New Delhi.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

CONTINUOUS ASSESSMENT (CA)

Zoology

Semester- III

SECZ- I (A): HAEMATOLOGY

Or

SECZ- I (B): URINOLOGY

Centre: **Date:**

Marks: 25

SEAT NUMBER: ……..

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Seminar Presentation	15	
2.	Test	10	
	Total Marks	**25**	

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Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

CONTINUOUS ASSESSMENT (CA)

Zoology

Semester- IV

SECZ- II (C): HISTOTECHNOLOGY

Or

SECZ- II (D): APICULTURE

Centre: **Date:**

Marks: 25

SEAT NUMBER: ……..

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1.	Seminar Presentation	15	
2.	Test	10	
	Total Marks	**25**	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
Choice Based Credit System (CBCS) Course Structure
Faculty of Science& Technology
B. Sc. Second Year Syllabus w.e.f. June, 2020
SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

END OF SEMESTER EXAMINATION (ESE)

Zoology
Semester- III
SECZ- I (A): HAEMATOLOGY
Or
SECZ- I (B): URINOLOGY

CENTRE: **DATE:**

Maximum Marks: 25

SEAT NUMBER: ……..

Sr. No.	End of Semester Examination (ESE)	Maximum Marks	Marks Obtained
1.	Skill Work Report Submission	10	
2.	Overall Skill Judgment	10	
3.	Skill Work Presentation	05	
	Total Marks	**25**	

Name & Signature
Examiner – 1

Name & Signature
Examiner – 2

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) Course Structure

Faculty of Science& Technology

B. Sc. Second Year Syllabus w.e.f. June, 2020

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

END OF SEMESTER EXAMINATION (ESE)

Zoology

Semester- IV

SECZ- II (C): HISTOTECHNOLOGY

Or

SECZ- II (D): APICULTURE

CENTRE: **DATE:**

Maximum Marks: 25

SEAT NUMBER: ……..

Sr. No.	End of Semester Examination (ESE)	Maximum Marks	Marks Obtained
1.	Skill Work Report Submission	10	
2.	Overall Skill Judgment	10	
3.	Skill Work Presentation	05	
	Total Marks	**25**	

Name & Signature
Examiner – 1

Name & Signature
Examiner – 2