

NEP-2020 based Curricula and Examination Scheme,
University of Kota, Kota 2025

B.Sc. Biotechnology programme

(Six Semesters Scheme)

CBCS pattern (with effect from 2025-2026)



DEPARTMENT OF BIOTECHNOLOGY

UNIVERSITY OF KOTA

MBS Marg, KOTA (Rajasthan)-324005

INDIA

Course Code: BBT 5600P

Type of the Course: Professional

Title of the Course: B.Sc Biotechnology

Level of the Course: UG level

Credit of the Course: 120

Delivery subtype of the Course: Practical

Pre requisites and co requisites of the Course

For admission, students from Science Biology stream with 10+2 (HS exam) or equivalent, ISC, CBSE exam will be eligible.

Duration: Six Semesters (Three Years)

Course Structure

In view of the increasing demand for training manpower in the area of Biotechnology, Genetic Engineering and Microbiology, it was consensus of the committee (Faculties & experts) that this course should be broad based and should be able to give a good insight into modern biology and important component of hands-on training to the students.

Objectives of The Course

To convey scientific and technological knowledge and information with modern age orientation. To help young learners and realize that science and technology, both hand in hand can enrich and develop a personality, thus promising a life of success and achievement.

Hyperlinks of suggested e resources on University website and on web

<https://link.springer.com/>

<https://www.tandfonline.com/>

<https://onlinelibrary.wiley.com/>

NPTEL and UGC epathsala, SWAYAM, MH Education, GeoGebra and MS Excel toolbox

<https://ghr.nlm.nih.gov/resources#inheritance>

<https://opentextbc.ca/biology/chapter/10-1-cloning-and-genetic-engineering/>

<http://www.hoajonline.com/molbiolgeneteng>

<https://www.yourgenome.org/facts/what-is-genetic-engineering>

<https://www.immunology.org/>

<https://onlinelearning.hms.harvard.edu/hmx/courses/hmximmunology>

<https://www.rcsb.org/>

<http://jgi.doe.gov/our-science/>

<https://www.genengnews.com/>

<http://biosafety.icgeb.org/in>

<https://iop.vast.ac.vn/theor/conferences/smp/1st/kaminuma/SWISSPROT/index.html>

<http://www.ipindia.nic.in/>

<http://www.nbaindia.org>

<http://www.envfor.nic.in/divisions/csurv/geac/annex-5.pdf>

<https://www.hhs.gov/vaccines/about/resources/smart-vaccinetooll/index.html>

<https://www.cdc.gov/vaccines/pubs/pinkbook/index.html>

<https://www.embl.org/>

<https://www.cathdb.info/>

Environmental biotechnology latest research and news

Biotechnology news, Science Daily, Nature News, Science News

Nature Biotechnology, Journal of Applied Biology & Biotechnology

Visual Media

1. The Inner Life of the Cell 2. Mitosis World Movies 3. Davidson College Biology Videos 4. Borisy Lab Movie Page 5. The Biology Project Meiosis I and II Movies

Course learning outcome

Understand concepts of Biotechnology and demonstrate interdisciplinary skills acquired in different subjects like cell biology, genetics, biochemistry, microbiology, immunology and molecular biology.

Assessment Pattern:

The assessment of the students shall be divided into two parts in which first part is continuous assessment or internal assessment or mid-term assessment (30% weightage of the maximum marks) and second part is semester assessment or external assessment or end-term assessment (70% weightage of the maximum marks). Assessment pattern and distribution of maximum marks is summarized as given below:

(i) Continuous or Internal or Mid Term Assessment:

- (a) The continuous or internal or mid-term assessment (30% weightage of the maximum marks) for each theory paper shall be taken by the faculty members of the respective Departments during each semester. There will be three internal assessment tests (*i.e.* first internal assessment test or first mid-term test and second internal assessment test or second mid-term test and third internal assessment test) each of 10% weightage of maximum marks of each theory paper. Each internal assessment shall be of one hour duration for theory paper and shall be taken according to academic calendar which will be notified by the Department / University.

- (b) For practical papers, there will be no continuous or internal or mid-term assessment. There will be only one external or semester or end-term assessment (100% weightage of maximum marks).

(ii) Semester or External or End Term Assessment:

- (a) The semester or external or end-term assessment (70% weightage of the maximum marks) shall be three hours duration to each theory paper and twelve hours duration (spread over two days with 6 hours per day) for each practical paper and shall be taken by the University at the end of each semester.

- (b) The syllabus for each theory paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

***Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.*

***Section-B** will carry 50 marks with equally divided into five long answer type questions . Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.*

- (c) The syllabus of practical paper is divided according to main streams of Biotechnology. Marks shall be awarded on the basis of major & minor experiments, spotting, viva-voce, practical record, regularity factor, lab skills, maintain cleanness of workplace, etc.

Question Paper Pattern:

(A) Continuous or Internal or Mid Term Assessment:

30% weightage of Maximum Marks (30 Marks out of 100 Maximum Marks).

(i) Continuous or Internal or Mid Term Assessment:

Format

Department of

College / University

Address.....

First Internal Assessment Test 20... - 20....

Class	:	Max. Marks	: 10 Marks
Semester	:	Duration of Exam.	:
Subject	:	Date of Examination	:
Paper	:	Name of Teacher	:

Note: All questions are compulsory and marks are given at the end of the each question. Two or three sub-divisions may be given in the question.

Q. No. 1.

or.....4 Marks

Q. No. 2.

or.....3 Marks

Q. No. 3.

or.....3 Marks

(B) Semester or External or End Term Assessment:

70% weightage of Max Marks (i.e.70 Marks out of 100 Max Marks).

Duration of Examination: 3 Hours

Max. Marks: 70

Note: The syllabus is divided into five independent units and question paper will be divided into three sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of one mark.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions . Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

SECTION-A

Q. 1.

Unit-I

(i) 2 Mark

(ii) 2 Mark

Unit-II

(iii) 2 Mark

(iv) 2 Mark

Unit-II

(v) 2 Mark

(vi) 2 Mark

Unit-IV

(vii) 2 Mark

(viii) 2 Mark

Unit-V

(ix) **2 Mark**

(x) **2 Mark**

SECTION-B

Unit-I

Q. 2. **10 Marks**

or **10Marks**

Unit-II

Q. 3. **10 Marks**

or **10 Marks**

Unit-III

Q. 4. **10 Marks**

or **10 Marks**

Unit-IV

Q. 5. **10 Marks**

or **10Marks**

Unit-V

Q. 6. **10Marks**

or **10 Marks**

Practical Examinations:

Continuous or Internal or Mid Term Assessment: *Not applicable in practical.*

External or Semester or End Term Assessment:

Duration of Exam : 6 Hours

Maximum Marks : 150 Marks*

Distribution of Maximum Marks:

S. No.	Name of Exercise	Marks
1.	Exercise No. 1 : Major Experiment	12
2.	Exercise No. 2 : Major Experiment	12
3.	Exercise No. 3 : Major Experiment	12
4.	Exercise No. 4 : Minor Experiment	10
5.	Exercise No. 5 : Minor Experiment	10
6.	Exercise No. 6 : Minor Experiment	10
7.	Exercise No. 7: Preparation	8
8.	Exercise No. 8: Preparation	8
9.	Exercise No. 9: Preparation	8
10.	Exercise No. 10 : Spotting Experiment(5 x 3= 15spots)	30
11.	Record (5x3)	15
12.	Viva-voce	15
Total Marks		150

Semester-wise Details

First Year

Semester I & II

Year / Semester		Serial Number, Code & Nomenclature of Paper			Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks		
	Number	Code		Nomenclature		L	P	C	Internal Assess.	Sem. Assess.	Total Marks	Internal Assess.	Sem. Assess.	
I Year I Semester	1.1	BBT01	DCC	Plant Diversity	3 Hrs	4	--	4	30	70	100	12	28	
	1.2	BBT 02	DCC	Fundamentals of Biochemistry	3 Hrs	4	--	4	30	70	100	12	28	
	1.3	BBT 03	DCC	Animal Diversity	3 Hrs	4	--	4	30	70	100	12	28	
	1.4	BBT 04	DCC	Practical-I	6 Hrs	--	12	6	--	150	150	--	75	
	1.9 & 1.10	AEC	AEC	Hindi/English	1.5 Hrs	2	---	2	---	50	50	--	20	
		Semester Total					14	12	20	90	410	500	--	
I Year II Semester	2.1	BBT 05	DCC	Cell Biology and Genetics	3 Hrs	4	--	4	30	70	100	12	28	
	2.2	BBT 06	DCC	Basics of Biostatistics	3 Hrs	4	--	4	30	70	100	12	28	
	2.3	BBT 07	DCC	Principles of Microbiology	3 Hrs	4	--	4	30	70	100	12	28	
	2.4	BBT 08	DCC	Practical-II	6 Hrs	--	12	6	--	150	150	--	75	
	1.9 & 1.10	AEC	AEC	English/Hindi	1.5 Hrs	2	---	2	---	50	50	--	20	
		Semester Total					14	12	20	90	410	500	--	
		First Year TOTAL					28	24	40	180	820	1000	--	
	Option for exit with Certificate in Biotechnology (40 credits score)													

SEMESTER FIRST
Paper 1.1BBT-01 PLANT DIVERSITY

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-I

Biodiversity of plant kingdom. Salient features and classification up to the level of order of different plant groups ; Algae (*Volvox*, *Oscillatoria*, *Chara*, , Fungi (*Saccharomyces*, *Puccinia*, *Alternaria*). Lichens.

UNIT-II

Salient features and classification up to the level of classes of different plant groups; Bryophytes (*Riccia*, *Anthoceros*, . Pteridophytes (*Lycopodium*, *Equisetum*, *Marsilea*). Gymnosperm (*Cycas*, *Pinus*,). Paleobotany: Definition and Importance, Geological time scale.

UNIT-III

Angiosperm – monocot (Wheat), dicot (Sunflower)
Anatomy-Internal structure of stem, leaf and root of Angiosperm .Modular type of growth. Anatomical differences in dicot and monocot root ,stem, leaf.

UNIT-IV

The concept of annual and perennials. Secondary growth, annual ring and wood formation. Morphology of seed plants, General organization of plant body such as aerial and underground parts.

UNIT-V

Flower and function of each part of flower. Fruit – Types of fruits, formation of fruits, parthenocarpy. Seed - Formation of seed, seed germination and dormancy.

Reference Books:

1. Singh, Pande-Jain, A Text Book of Botany, Rastogi Publication
2. Dube H.C. Text of fungi, Bacteria and Viruses.
3. Bold H.C. The Plant Kingdom, Prentice - Hall India
4. Singh, Pandey and Jain. Diversity of microbes and cryptogams-Rastogi Publisher

SEMESTER FIRST

Paper 1.2BBT-02 FUNDAMENTALS OF BIOCHEMISTRY

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment
Semester Assessment

: 30 Marks
: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions (answer about in 400 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-1

Bioenergetics : principles of bioenergetics. First and second laws of Thermodynamics. Definition of Gibbs's Free Energy, Enthalpy and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant.
Energy rich compounds: Phosphoenolpyruvate, 1,3- Bisphosphoglycerate.

UNIT-II

Carbohydrate: Definition, classification, stereochemistry, cyclic structures Monosaccharide, Disaccharides, Polysaccharides: storage and structural.

UNIT-III

Protein Structure (Primary, Secondary, Tertiary and Quaternary). Purification (chromatographic and electrophoresis). Properties of amino acids their nature and peptide bond.

UNIT-IV

Lipids: classification and structure of fatty acids (Palmitic and stearic acid), Properties of oils and fats. Biological functions of lipids.

Structures, characteristics and functions of nucleotides; Three dimensional structure of nucleic acids, DNA as a double helical structure;

UNIT-V

Enzymes: - General properties, Classification. Nomenclature of enzymes. Coenzymes and Cofactors. Allosteric Enzymes and Isoenzymes.

References:

1. Lehninger. Principles of Biochemistry, Nelson & Cox, 4th Edition.
2. Voet & Voet Donald. 3rd Edition. Fundamentals of Biochemistry, J/W.
3. U Satyanarayan, Biochemistry, 3rd Edn, Books and Allied Pvt. Ltd.
4. Stryer – Biochemistry. W.H. Freeman & Co.
5. Price & Steven, Fundamentals of Enzymology, 3rd Edition
6. Geoffrey Cooper. The cell with CD- Rom. Sinauer Assoc. Incorp.
7. Elliott & Elliot. 3rd Edition Biochemistry and molecular biology.
8. Boyer, Concepts in biochemistry. Thomson
9. Plummer. An introduction to practical Biochemistry, 3rd Edition
10. J. Jayaraman. Lab Manual in Biochemistry.

SEMESTER FIRST
Paper 1.3BBT-03 ANIMAL DIVERSITY

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

***Note:** The syllabus is divided into five independent units and question paper will be divided into two sections.*

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions (answer about in 400 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT –I

Taxonomy: - Definition and meaning of Taxonomy, Bases and importance of taxonomy. Outline classification of Invertebrates. Fundamentals of body organization emphasizing symmetry, metamerism, coelome and levels of structural organization. Classification of Protozoa, Porifera, Coelenterata, Platyhelminthes, Nematoda and Annelida (up to class with examples).

UNIT –II

Protozoa: - Study of structural organization and life history of Trypanosoma and Paramecium. Study of locomotion, osmoregulation, nutrition and reproduction in protozoa. Parasitism, pathogenecity and its control in protozoans with special reference to Entamoeba, Leishmania and Trichomonas.

UNIT-III

Porifera: - Habit, habitat, structure and physiology of Scypha. Types of canal system in the phylum Porifera.

Coelenterata: - Habit, habitat, structure, function and life history of Aurelia. Polymorphism in coelenterata, coral reef.

UNIT IV

Platyhelminthes: - Structure, physiology and life history of Dugesia and Fasciola. Parasitic adaptation in Helminthes.

Nematyhelminthes: - Study of structure and life history of Dracunculus medinensis. Nematode parasites and human diseases.

UNIT-V

Annelida:- General Charecteristics of Annelida. Metamerism and coelom. Structure, physiology and life history of Pheretima and Hirudinaria. Trochophore larva.

References:

1. Ganguli, B.B., Sinha, A.K. and Adhikari, S. 2001. Biology of Animals. (Vol. I and III). New Central Book Agency, Calcutta.
2. Jordan, E.L. and Verma, P.S. 2001. Invertebrate Zoology. S. Chand and Co., New Delhi.

Paper 1.4 BBT PRACTICALS I

Practical Exercises

1. Study of examples of each type: Algae, Fungi, Bryophytes, Pteridophytes, Angiosperm, and Gymnosperm.
2. Study of different parts of the plant (T.S. of monocot and dicot, examples of each type) : root, stem and leaves, flower, Inflorescence.
3. Analysis of Sugars
 - a. Monosaccharide-Glucose, Fructose, Galactose, Mannose, Pentose.
 - b. Disaccharides-Sucrose, Maltose And Lactose. C) Polysaccharides-Starch And Dextrin.
4. Analysis of Amino Acids
5. Lipid Analysis [Group Experiments]
 - a. Determination Of Saponification Number.
 - b. Determination Of Acid Number.
 - c. Determination Of Iodine Number
6. Demonstration Experiments
 - a. Separation of Amino Acids By TLC.
7. Study of Paramecium: W.M., Binary fission, conjugation
8. Earthworm ovary, Nervous system and Spermatheca,
9. Drosophila characters, sexual dimorphism, eye and wing mutation.
10. Microscopic slides of VS skin, oesophagus, stomach, liver, pancreas, lung, kidney, testis, ovary.
11. Identifications and systemic positions upto order of important non chordate and chordate specimens.
12. Permanent mounting.

SEMESTER SECOND
Paper 2.1 BBT 05 - CELL BIOLOGY AND GENETICS

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment
Semester Assessment

: 30 Marks
: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions (answer about in 400 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-I

Ultra Structure of Prokaryotic and Eukaryotic Cell. Structure and Function of Cell components (Cell Wall, Plasma Membrane, Endoplasmic Reticulum, Golgi apparatus, , Ribosome.Chloroplast, Mitochondria, Nucleus

UNIT-II

Structure of chromosome –Prokaryotic and Eukaryotic Chromosome. euchromatin and heterochromatin, karyotype. Special types of Chromosomes (Polytene and Lampbrush Chromosome.)

UNIT-III

Cell Cycle: General strategy of cell cycle, Different stages of cell division ; -Mitosis and Meiosis. Importance of cell division.

UNIT-IV

Mendel's laws of inheritance, Monohybrid , Dihybrid Cross, Test cross, Back cross, Incomplete dominance , Cytoplasmic inheritance.

UNIT-V

Transformation, Conjugation, Generalised and specialised transduction. transposable elements, mechanism of transposition and genetic transposition.

References:

1. Molecular Biology of Cell- Bruce Alberts et al, Garland publications.
2. Cell Biology- Ambrose & Dorothy Mast, ELBS Publications.
3. Fundamentals of Cytology- Sharp, McGraw Hill Company.
4. Cytology- Wilson & Morrison, Reinhold Publications.
5. Cell Biology and Molecular Biology- EDP Roberts and EMF Roberts, Saunders College.
6. Cell Biology, Genetics and Evolution & Ecology P.S. Verma and Agarwal.
7. Cell Biology : A lab manual. Shanmugan. Mc Millan India Ltd.
8. Genetics- Strickberger, 2 nd.
9. Microbial Genetics – D. Frifielder.
10. Baltimore- Molecular Biology of the Cell.

SEMESTER SECOND

Paper2.2 BBT – 06 BASICS OF BIOSTATISTICS

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

***Note:** The syllabus is divided into five independent units and question paper will be divided into two sections.*

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions (answer about in 400 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-I

Introduction to biostatistics and its scope. Sampling techniques. Collection of data, Frequency distribution, tabulation, graphical representation of data by histogram, frequency polygon curve and cumulative frequency curve.

UNIT-II

Measure of central tendency : mean, median, mode .

Measure of dispersion, Mean deviation, Standard deviation and standard error, variance.

Analysis of variance.

UNIT-III

Correlation: Introduction, definition and types of correlation between two variables. Scatter diagram, Karl Pearson's coefficient of correlation and Spearman's rank correlation coefficient.

UNIT-IV

Regression analysis, multiple linear regression.

Hypothesis: null and alternate hypothesis. Test for significance, chi-square test, student t-test (single sample mean and two sample mean), F-test.

UNIT-V

Designing and methodology of an experiment: Introduction, Definition of the problem, Aims and Objectives, Review of Literature, Hypothesis, Plan of Action, Analysis of Data, Conclusion.

Probability: Concept, calculation and theories.

Reference Books:

1. Statistical Methods by S.P.Gupta, Publisher S.Chand & Co, New Delhi
2. Statistics by R.S.N. Pillai & V. Bagavathi, Publisher S.Chand & Co, New Delhi
3. S. C. Gupta and V. K. Kapoor: Mathematical Statistics, Sultan Chand & Sons
4. B. K. Mahajan: Bio Statistics, Jaypee Publications
5. G. C. Beri: Business Statistics

SEMESTER SECOND

Paper2.1 BBT – 07 PRINCIPLES OF MICROBIOLOGY

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

***Note:** The syllabus is divided into five independent units and question paper will be divided into two sections.*

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions (answer about in 400 words). Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-I

History of Microbiology with special reference to contribution of the following A. Leewenhock, L. Pasteur, R. Koch, J. Lister, J.Tyndall.

Biogenesis vs abiogenesis, Koch postulates, discovery of antibiotics.

Principle of microscopy: Bright field, dark field, phase contrast, fluorescent, electron microscopy.

UNIT-II

Microbial classification, Morphology of bacteria with major emphasis on bacterial structure and cell wall. Gram positive and Gram-negative bacteria.

General structure of viruses and mycoplasma.

UNIT-III

Classification and General characteristics of fungi and protozoa. Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rates Microbes in extreme environment .Physical and chemical factors affecting growth: temperature, light, pH, oxygen and saline requirements.

UNIT-IV

Sterilization – Physical and Chemical Methods of sterilization. Microbiology of soil ,air,food and water.

Microbiology of dairy and dairy products .

UNIT-V

Types of microbial pathogens and diseases caused by them. Human diseases (Tuberculosis, HIV, candidiasis, polio, malaria), Plant diseases (Root knot nematode galls, little leaf of brinjal, bacterial blight of rice, green ear disease of bajra, TMV).

Reference Books:

1. Microbiology, Authors- Pelczar, Chan and Kreig.
2. Microbiology- an Introduction- (8th Edn), Authors- Tortora, G.J., Funke, B.R., Case, C.L.
3. General Microbiology, Authors- Stainer, Inghram, Wheelis and Painter.
4. Microbial Physiology, Authors- Moat and Foster.
5. A Text book of Microbiology, Authors- P. Chakraborty.
6. Textbook of Microbiology, Authors- Dubey and Maheshwari.
7. Microbiology, A Practical Approach. Authors- Patel and Phanse
8. General Microbiology, Authors- Powar and Dagainawala.
9. Microbiology, Author- S.S. Purohit.
10. Microbiology, Authors- Prescott, Herley and Klein.
11. Bacteriology, Authors- Topley and Wilson.

SEMESTER SECOND

Paper 2.4 BBT -08 PRACTICALS II

Practical Exercises

1. Genetic exercise based on mendelian laws.
2. Detection of blood groups and Rh factors.
3. Mitosis in onion root tip
4. Identification of giant chromosome in chironomous larvae
5. Observation of Barr bodies
6. Cell Counting and viability
7. Blood Smear Preparation.
8. Separation of cell organelles by sucrose gradient.
9. Preparation and study of various stages of mitosis and meiosis.
10. Quantitation of DNA by spectrophotometry.
11. Preparation of competent.
12. U.V. Induced Mutagenesis.
13. Bacterial transformation by CaCl_2 method)
14. Transduction in *E. coli*.
15. Conjugation in *E. coli*.

NEP-2020 based Curricula and Examination Scheme,
University of Kota, Kota 2024

B.Sc. Biotechnology programme

CBCS pattern (with effect from 2025-2026)

Second year

(Semester III & IV)



DEPARTMENT OF BIOTECHNOLOGY

UNIVERSITY OF KOTA

MBS Marg, KOTA (Rajasthan)-324005

B.Sc. Biotechnology Semester-III, IV

Semester-wise Details

SECOND Year

Year / Semester	Serial Number, Code & Nomenclature of Paper				Duration of Exam	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
	Number	Code		Nomenclature		L	P	C	Internal Assess.	Sem. Assess.	Total Marks	Internal Assess.	Sem. Assess.
II Year III Semester	3.1	BBT09		Fundamentals of Molecular Biology	3 Hrs	4	--	4	30	70	100	12	28
	3.2	BBT 10		Biophysics & Instrumentation	3 Hrs	4	--	4	30	70	100	12	28
	3.3	BBT 11		Basics of Plant Physiology	3 Hrs	4	--	4	30	70	100	12	28
	3.4	BBT 12		Practical-III	6 Hrs	--	12	6	--	150	150	--	75
	3.7	GEC		Computer Application	1.5 Hrs	2	---	2	---	50	50	--	20
				Semester Total		14	12	20	90	410	500	--	--
II Year IV Semester	4.1	BBT 13		Plant Cell, Tissue and Organ Culture	3 Hrs	4	--	4	30	70	100	12	28
	4.2	BBT 14		Basics of Animal Physiology	3 Hrs	4	--	4	30	70	100	12	28
	4.3	BBT 15		Fundamentals of Immunology & Animal Cell Culture	3 Hrs	4	--	4	30	70	100	12	28
	4.4	BBT 16		Practical-IV	6 Hrs	--	12	6	--	150	150	--	75
	4.7	GEC		Environment Science	1.5 Hrs	2	---	2	---	50	50	--	20
				Semester Total		14	12	20	90	410	500	--	--
				Second Year Total		28	24	40	180	820	1000	--	--
	Option for exit with Diploma in Biotechnology (80 credits score)												

Assessment Pattern:

The assessment of the students shall be divided into two parts in which first part is continuous assessment or internal assessment or mid-term assessment (30% weightage of the maximum marks) and second part is semester assessment or external assessment or end-term assessment (70% weightage of the maximum marks). Assessment pattern and distribution of maximum marks is summarized as given below:

(iii) Continuous or Internal or Mid Term Assessment:

- (c) The continuous or internal or mid-term assessment (30% weightage of the maximum marks) for each theory paper shall be taken by the faculty members of the respective Departments during each semester. There will be three internal assessment tests (*i.e.* first internal assessment test or first mid-term test and second internal assessment test or second mid-term test and third internal assessment test) each of 10% weightage of maximum marks of each theory paper. Each internal assessment shall be of one hour duration for theory paper and shall be taken according to academic calendar which will be notified by the Department / University.

- (d) For practical papers, there will be no continuous or internal or mid-term assessment. There will be only one external or semester or end-term assessment (100% weightage of maximum marks).

(iv) Semester or External or End Term Assessment:

- (d) The semester or external or end-term assessment (70% weightage of the maximum marks) shall be three hours duration to each theory paper and twelve hours duration (spread over two days with 6 hours per day) for each practical paper and shall be taken by the University at the end of each semester.

- (e) The syllabus for each theory paper is divided into five independent units and question paper for each theory will be divided into three sections as mentioned below:

***Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.*

***Section-B** will carry 50 marks with equally divided into five long answer type questions . Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.*

- (f) The syllabus of practical paper is divided according to main streams of Biotechnology. Marks shall be awarded on the basis of major & minor experiments, spotting, viva-voce, practical record, regularity factor, lab skills, maintain cleanness of workplace, etc.

Question Paper Pattern:

(C) Continuous or Internal or Mid Term Assessment:

30% weightage of Maximum Marks (30 Marks out of 100 Maximum Marks).

(ii) Continuous or Internal or Mid Term Assessment:

Format

Department of

College / University

Address.....

First Internal Assessment Test 20... - 20....

Class	:	Max. Marks	: 10 Marks
Semester	:	Duration of Exam.	:
Subject	:	Date of Examination	:
Paper	:	Name of Teacher	:

Note: All questions are compulsory and marks are given at the end of the each question. Two or three sub-divisions may be given in the question.

Q. No. 1.

or.....4 Marks

Q. No. 2.

or.....3 Marks

Q. No. 3.

or.....3 Marks

(D) Semester or External or End Term Assessment:

70% weightage of Max Marks (i.e.70 Marks out of 100 Max Marks).

Duration of Examination: 3 Hours

Max. Marks: 70

Note: The syllabus is divided into five independent units and question paper will be divided into three sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of one mark.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions . Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

SECTION-A

Q. 1.

Unit-I

(i) 2 Mark

(ii) 2 Mark

Unit-II

(iii) 2 Mark

(iv) 2 Mark

Unit-II

(v) 2 Mark

(vi) 2 Mark

Unit-IV

(vii) 2 Mark

(viii) 2 Mark

Unit-V

(ix) 2 Mark

(x) 2 Mark

SECTION-B

Unit-I

Q. 2. 10 Marks

or 10Marks

Unit-II

Q. 3. 10 Marks

or 10 Marks

Unit-III

Q. 4. 10 Marks

or 10 Marks

Unit-IV

Q. 5. 10 Marks

or 10Marks

Unit-V

Q. 6. 10Marks

or 10 Marks

Practical Examinations:

Continuous or Internal or Mid Term Assessment: *Not applicable in practical.*

External or Semester or End Term Assessment:

Duration of Exam : 6 Hours

Maximum Marks : 150 Marks*

Distribution of Maximum Marks:

S. No.	Name of Exercise	Marks
13.	Exercise No. 1 : Major Experiment	12
14.	Exercise No. 2 : Major Experiment	12

15.	Exercise No. 3 : Major Experiment	12
16.	Exercise No. 4 : Minor Experiment	10
17.	Exercise No. 5 : Minor Experiment	10
18.	Exercise No. 6 : Minor Experiment	10
19.	Exercise No. 7: Preparation	8
20.	Exercise No. 8: Preparation	8
21.	Exercise No. 9: Preparation	8
22.	Exercise No. 10 : Spotting Experiment(5 x 3= 15spots)	30
23.	Record (5x3)	15
24.	Viva-voce	15
Total Marks		150

SEMESTER THIRD

Paper 3.1 BBT-09 Fundamentals of Molecular Biology

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

***Note:** The syllabus is divided into five independent units and question paper will be divided into two sections.*

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT -I

Introduction to molecular biology – historical background, nature of genetic material, experimental proof for DNA as genetic material, types of nucleic acids (DNA and RNA). Watson Crick model of DNA, other forms of DNA (A-form, Bform and Z-form), properties of DNA, DNA denaturation and renaturation, concept of central dogma, satellite DNA and tandem repeats.

UNIT -II

DNA replication : mechanisms of prokaryotic DNA replication, semi-conservative model of replication, mechanism of DNA replication – discontinuous synthesis of DNA, RNA primer of DNA synthesis, DNA polymerases I, II, III and their role in DNA replication; eukaryotic DNA replication, DNA damage and repair.

UNIT -III

Regulation of gene expression in prokaryotes : Transcriptional control; enzyme induction and repression, constitutive. Synthesis of enzymes, the operon hypothesis : genes involved in regulation – regulatory genes, promoter gene, operator gene, and structural gene. Lac operon, Arg operon. Brief account of eukaryotic gene regulation.

UNIT – IV

Transcription control by termination and anti-termination, mRNA splicing, genetic code, types of RNA, wobble hypothesis, translation initiation and termination in prokaryotes.

UNIT – V

Post translational modification in prokaryotes and eukaryotes, protein sorting/ trafficking and protein localization and translocation: and signal transduction: channels and ion uptake.

References:

1. Molecular Cell Biology, 7th Edition. Lodish, et. al.
2. Biochemistry, 4th edition. Donald Voet and Voet J
3. Harpers review of Biochemistry, 25th Edition. Murray RK, Rodwell VW.
4. Lehninger's Principles of Biochemistry, 5th Edition. Nelson DL and Cox MM
5. Biochemistry, 5th Edition. Garrett and Grisham
6. Molecular Biology of the Cell, 5th Edition, Bruce Alberts et. al.
7. Cytology, P.S. Verma, V.K. Agarwal, S. Chand Publications

SEMESTER THIRD

Paper 3.2 BBT- 10 Biophysics and Instrumentation

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.

- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT -1

Bioenergetics: Energy and its various forms, principle of Thermodynamics, energy exchange, conservation of energy.

Photobiology: Nature of light, Primary photochemical reactions, Photosynthesis, flowering, Solarization, Photo dynamism, Strategies in light reception, Photoreceptor in microbes, Plants and animals.

UNIT -II

Biophysics of vision, vision fault and correlations, Bio luminance. Biophysics of sound vibration, Phono-receptor, Auditory function, Location and origin of sound, Hearing aids.

Membrane conductivity, Diffusion, Active transport, Osmosis, Diffusion pressure, deficit, Biosorption, Electrical properties of biological compartments, Electrochemical gradients, membrane potentials.

UNIT-III

Molecular interaction: Intra- molecular and Inter- molecular interaction, Attractive and repulsive forces operating within molecules and their overall effects on molecular interactions.

Radiations and their interaction with matter, Electromagnetic radiation, Ultraviolet and visible spectroscopy, Raman spectra, Nuclear magnetic Resonance, Electrophoresis, Radioactive tracer techniques, Autoradiography.

UNIT-IV

Instruments, basic principle and usage: colorimeter, spectrophotometry, Centrifuges, Analytical and differential pH meters, GM counter.

Microscopy: Compound microscope, Phase contrast, Dark field, Fluorescent and Electron microscopy

UNIT-V

Elucidation of intact biological structures in living organisms: Ultrasound. Optical filters, X-ray, X-ray diffraction, Computerized Axial Tomography, Electrocardiography, Electro-encephalography.

References:

- 1) Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
- 2) Wilson K. and Walker J. (Eds.) (1995). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
- 3) Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd. , Chichester, England.
- 4) Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

SEMESTER THIRD
Paper 3.3 BBT 11: Basics of Plant Physiology

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

***Note:** The syllabus is divided into five independent units and question paper will be divided into two sections.*

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT – 1

Plant water relations : importance of water to plant life, physical properties of water diffusion and osmosis, absorption & ascent of sap. Transport of water and transpiration. Mineral nutrition: Essential macro and micro elements and their role. Transport of organic substances.

UNIT – II

Photosynthesis Significance, historical aspects, photosynthetic pigments, action spectra and enhancement effects, concept of two photo systems (Cyclic & Non cyclic) z-scheme. Photophosphorylation, C-3, C-4 and CAM pathway, photorespiration.

UNIT – III

Respiration: ATP the biological energy currency, aerobic and anaerobic respiration, kreb's cycle, electron transport mechanism (chemi-osmotic theory), redox potential, oxidative phosphorylation, pentose phosphate pathway.

UNIT – IV

Nitrogen and lipid metabolism: Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid 21 biosynthesis, α & β oxidation, saturated and un saturated fatty acids, storage and mobilization of fatty acids.

UNIT – V

Growth and Development : Definitions, phases of growth and development, kinetics of growth, seed dormancy Seed germination and factors of their regulation plant movements the concept of photoperiodism, plants hormones auxins, gibberellins, cytokinins, abscissic acid, ethylene, history of their discovery, biosynthesis and mechanism of actions photomorphogenesis, phytochromes and cytochromes.

References:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications

SEMESTER THIRD

Paper 3.4 BBT -12 PRACTICALS III

1. Preparation of genomic DNA from bacteria.
2. Isolation of genomic DNA from Blood.
3. Absorption
4. Adsorption
5. Osmosis: Potato osmoscope
6. Transport across membrane
7. Study of DNA melting
8. Photosynthesis: Demonstration of Oxygen evolution.
9. Light/Carbon dioxide necessary for photosynthesis.
10. To study the permeability of plasma membrane using different concentration of organic solvents.
11. To demonstrate the phenomenon of the osmosis by the use of potato osmometer.
12. To study the phenomenon of plasmolysis and deplasmolysis.
13. To demonstrate the rate of transpiration by use of potometers (Ganong's/Farmers)
14. To study the relative rate of transpiration from the leaf surfaces of the different plants using cobalt chloride paper.
15. To demonstrate that light is necessary for photosynthesis.
16. To demonstrate the effect of different wavelengths of light during the photosynthesis.
17. To demonstrate the carbon-dioxide, light, water and chlorophyll are essential for photosynthesis by Moll's experiment.
18. To compare the rate of photosynthesis under different condition by using Wilkott's bubbler.
19. Comparison of the rate of respiration (R.Q.) of various plant parts or substrates with the help of Ganong's respirometer.
20. Separation of chlorophyll pigments by the paper chromatography
21. Principles and application of instruments:
 - a. PH meters (digital).
 - b. Light and phase contrast microscope.
 - c. Colorimeter.
 - d. Spectrophotometer (Visible and UV).
 - e. Sound level meter.
 - f. Audiometer.
 - g. GM counter and Scintillation counter
 - h. Incubator

- i. Shaker
- j. Laminar flow bench
- k. Hearing aids

SEMESTER FOURTH

Paper 4.1 BBT-13 Plant Cell, Tissue and Organ Culture

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT -I

History, scope and applications of plant tissue culture – contribution of Indian Scientists. Concept of asepsis and methods of sterilization, Nutrient media, their composition and methods of preparation.

UNIT -II

Basic Concepts in cell culture and cellular totipotency. Callus organogenesis – dedifferentiation. Somatic embryogenesis – induction of embryogeny *in vitro*, indirect and direct somatic embryogenesis.

UNIT-III

Selection and preparation of explants for adventitious shoot bud induction and axillary bud proliferation. Steps of micropropagation-management of donor plants, culture establishment, shoot multiplication, rooting and hardening and acclimatization. Protoplast isolation, culture and differentiation.

UNIT-IV

Anther and pollen culture – production of haploids. *In vitro* fertilization, embryo, endosperm, ovary and ovule culture. Embryo rescue. Methods of cryopreservation for germplasm conservation. Somaclonal and gametoclonal variation. Meristem tip culture for elimination of viruses in plants.

Organ culture- Types, Techniques and process.

UNIT-V

Cell culture and *in vitro* production of secondary metabolites. Important alkaloids and factors affecting their production. Hairy root culture, elicitation and biotransformation.

References:

1. Bhajwani, S.S, & Razdan, M.K. (1996). Plant Tissue Culture. Theory and Practice, Elsevier.
2. Razdan, M.K. (2003) Introduction to Plant tissue culture, Science Publishers
3. Singh, B.D. (2004). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

SEMESTER FOURTH

Paper 4.2 BBT 14: Basics of Animal Physiology

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT-I

Digestion: Nutrients: Carbohydrates, lipids, proteins, vitamins, Digestive enzymes and hormones of GIT. Digestive mechanism: Mechanical and chemical digestion. Absorption and assimilation of end products of digestion. Balanced diet, malnutrition (PEM), obesity; endoscopy.

UNIT-II

Respiration: Aerobic and anaerobic respiration. Structure of respiratory organs. Mechanism and regulation of breathing. Transport of O₂ and CO₂. Respiratory disorders: Emphysema, asthma, occupational disorders, spirometry.

UNIT-III

Circulation: Circulatory fluids: Blood, lymph; blood cells; structure of haemoglobin. Blood circulation through heart, arteries, arterioles, capillaries, venules and veins. Cardiac cycle and its

regulation. Blood clotting mechanism, blood pressure. Cardiac disorders, ECG, heart transplantation (an introductory idea).

UNIT-IV

Excretion: Excretory products: NH_3 , urea, uric acids, amino acids. Structure of kidney, nephron; mechanism of urine formation; micturition. Autoregulation, counter-current mechanism, renin-angiotensin system. Accessory excretory organs: Skin, liver, lungs etc. Excretory disorders, dialysis, Kidney transplant.

UNIT-V

Muscle and Neural Physiology: Structure of smooth, skeletal and cardiac muscles; myofibrils. Isotonic and isometric contraction of muscles, sliding-filament theory of muscle contraction; relaxation of muscle fibres; Properties of muscles, myopathy. Kinds of neuron, structure of myelinated and nonmyelinated nerve fibres. Reflex action, types. Sensory Physiology: Tactile receptors, pain receptors, thermoreceptors, chemoreceptors.

References:

1. Berry, A.K. Animal physiology.
2. Guyton, A.C. and Hall, J.E. A Text Book of Medical Physiology (10th Edition).
3. W.B. Saunders company.
4. Ganong, H. Review of Medical physiology. McGraw Hill.

SEMESTER FOURTH

Paper 4.3BBT 15 Fundamentals of Immunology and Animal Cell Culture

Course Type : Core

Credits:4

Duration :3 hrs

Continuous/Internal/Assessment

: 30 Marks

Semester Assessment

: 70 Marks

Note: The syllabus is divided into five independent units and question paper will be divided into two sections.

- **Section-A** will carry 20 marks with one compulsory question comprising ten short answer type questions taking two questions from each unit. Each question shall be of two marks.
- **Section-B** will carry 50 marks with equally divided into five long answer type questions. Paper setter shall be advised to set two questions from each unit and students are instructed to attempt five questions by selecting one question from each unit.

UNIT- I

Concept of Innate and Adaptive immunity. Structure, Functions and Properties of Immune Cells and Immune Organs. Antigens, Haptens, Adjuvants. Structure, Types, Functions and Properties of antibodies.

UNIT- II

Characteristics of an antigen; Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. Principles of Precipitation, Agglutination, Immunodiffusion,

Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, Immunoelectronmicroscopy. Structure and Functions of MHC.

UNIT- III

Complement- Components and biological activities.

Primary and Secondary Immune Response; Generation of Humoral and Cell Mediated Immune Response. Hypersensitivity, Autoimmune diseases.

UNIT-IV

History of development of animal cell culture and methods of animal cell culture: culture media composition and preparation. Growth factors promoting proliferation of animal cell. Animal cell lines – their culture and maintenance. Stem cell cultures, embryonic stem cells and their applications.

UNIT-V

Organ culture, whole embryo culture, transfection of animal cells: selectable markers, HAT selection, antibiotic resistance etc. Somatic cell fusion, transplantation of cultured cells. Differentiation of cells, culture of animal mycoplasma. Growth kinetics of cells in culture,

References:

1. Roitt, Brostoff, Male and Mosby. Immunology.
2. Kuby et al. Immunology. W.H. Freeman and Company.
3. Rao, C.V. An Introduction to Immunology. Narosa Pub. House.
4. Coleman, R.M. Fundamental Immunology. McGraw Hill.
5. Paul, W.E. Fundamentals of Immunology. Raven Press New York
6. Masters, J. Animal Cell Culture. Panima.
7. Freshney, I. Culture of Animal Cell. John Wiley.
8. Martin, C. (Ed). Animal Cell Culture Techniques. Springer.
9. Mather and Barnes. (Ed). Methods in Cell Biology. Vol. 5-7, Animal Cell Culture Method. Academic Press.
10. Paul, J. Animal Tissue Culture. Butler, M. and Dawson, M. Lab Fax : Cell Culture. Bios Scientific Publications

SEMESTER FOURTH

Paper 4.4 BBT -16 PRACTICALS IV

1. Sterilization techniques for non-living, plant material.
2. Tissue culture media preparation.
3. Slant preparation.
4. Excision of embryo / ovule / Anther and their inoculation.
5. Preparation of aseptic plant. Aseptic techniques.
6. Inoculation of culture. Root culture. Leaf culture. Shoot tip and meristem culture. Flower bud and flower culture.
7. Isolated ovary culture.
8. Callus induction and regeneration.

1. Demonstration of catalase and ptyalin enzyme activity.
2. Haematocrit value.
3. Haemoglobin percentage.
4. RBC counting.
5. WBC counting.
6. Differential counting.
7. Blood group detection
8. Preparation of Blood film.
9. Preparation of smooth, skeletal (striated & non striated), cardiac muscle fibres.
10. Structure of Myelinated and non myelinated nerve fibre.
11. Sterilization techniques for animal material.
12. Media preparation.
13. Slant preparation.