

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

B.Sc. Biotechnology programme

CBCS pattern (with effect from 2024-2025)



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-geneticengineering/>

<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-vaccinetoold/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. Boris 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

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, Vaucheria*), Fungi (*Saccharomyces, Puccinia, Alternaria*). Lichens.

UNIT-II

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

UNIT-III

Angiosperm – monocot (Wheat), dicot (Sunflower)
Anatomy-Internal structure of stem, leaf and root of Angiosperm and Gymnosperm. Differences in Angiosperm and Gymnosperm. Differences in dicot and monocot.
Tissue system, structure and function of different cells (parenchyma, collenchyma, sclerenchyma). Xylem and phloem.

UNIT-IV

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

UNIT-V

Inflorescence. 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

: 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-1

Bioenergetics : principles of bioenergetics. First and second laws of Thermodynamics. Definition of Gibb'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 and anomeric forms, Haworth projections. Monosaccharide, Disaccharides, Polysaccharides: storage and structural.

UNIT-III

Protein Structure (Primary, Secondary, Tertiary and Quaternary).
Purification(chromatographic and electrophoresis). Protein Folding. Protein Sequencing.
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; Unusual nucleotides and unusual structures of nucleic acids.

UNIT-V

Enzymes: - General properties, Classification. Role in metabolism, Anabolism and catabolism. Coenzymes and Cofactors. Catalytic Mechanism. Enzyme Kinetics (derivation of Michaelis-Menten constant, linear transformation of the equation). Enzyme Inhibition. Allosteric Enzymes and Isoenzymes. Mechanism of Enzyme Regulation.

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 Asso. 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.Jayraman. 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, pathogenicity 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 Characteristics 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.
- Jordan, E.L. and Verma, P.S. 2001. Invertebrate Zoology. S. Chand and Co., New Delhi.

Paper 1.4 PRACTICALS I

Practical Exercises

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

SEMESTER SECOND
Paper 2.1BBT 04- CELL BIOLOGY AND GENETICS

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

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

UNIT-II

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

UNIT-III

Cell Cycle: General strategy of cell cycle, Interphase (Different stages) and Mitosis; Generation

time; Cell cycle regulation.

The Mechanics of Cell division; Introduction, An overview of different stages in Mitosis, meiosis and cytokinesis; Cell differentiation and its implications

Cell Senescence: Difference between aging and necrosis; Programmed Cell Death

UNIT-IV

Mendelian Laws and physical basis of inheritance, dominance and its molecular basis Basics of gene interaction. lethal genes, polygenic traits, linkage and gene maps. Sex linked inheritance . Determination of sex. cytoplasmic inheritance, pleiotrophy(multiple alleles), Hardy Weinberg law (population genetics).

UNIT-V

Transformation, Conjugation, Transduction: generalized transduction, specialized transduction.

Site specific recombination: transposable elements- classes of transposable elements, element insertion sequences (IS element), mechanism of transposition and genetic transposition.

References:

1. Molecular Biology of Cell- Bruce Alberts et al, Grand publications.
2. Cell Biology- Ambrose & Dorothy Masty, ELBS Publications.
3. Fundamentals of Cytology- Sharp, Mc Graw Hill Company.
4. Cytology- Wilson & Marrison, Reinform Publications.
5. Cell Biology and Molecular Biology- EDP Robertis and EMF robertis, Sauder College.
6. Cell Biology, Genetics and Evolution & Ecology P.S. Verma and Agarwal.
7. Cell Biology : A lab manual. Shanmucan. 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 - 05 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, TM

SEMESTER SECOND
Paper2.3 BBT – 06 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 cells wall. Gram positive and Gram-negative bacteria. Microbial spores, sporulation/ germination process.

Structure, growth, nutrition, metabolism, physiology, genetics of viruses. Mycoplasma.

UNIT-III

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

UNIT-IV

Sterilization – Principle and methods: Physical and Chemical Methods.

Microbiology of soil and bio geo-chemical cycles. Microbiology of air. Microbiology of food. Microbiology of water.

Microbiology of dairy and dairy products. Industrial microbiology

UNIT-V

Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis *etc.* Host defense mechanism against pathogens.

Symptoms, Etiology and control measures: 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, Ingharam, 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 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 CaCl₂ method)
14. Transduction in *E. coli*.
15. Conjugation in *E. coli*.