

Vikram University, Ujjain (M.P.)

01

B.Sc I, II & III yrs
2017-18-19-20

Annual Examination Pattern.

Pages
01-15

PROPOSED SYLLABUS FOR B.Sc. BIOTECHNOLOGY

CENTRAL BOARD OF STUDIES

(Held On 27-28 April 2017)

H.S. Rathore

Prof Dr. H.S.RATHORE
DEAN
Faculty of Life Sciences
Vikram University,
UJJAIN, 456 010. India

B.Sc I Year	Title of the Paper	Theory	Internals	Total
BT-101	Cell Structure & Biology	(42.5) 40	(7.5) 10	50
BT-102	Microbiology	(42.5) 40	(7.5) 10	50
BT-103	Laboratory			50
				150

B.Sc II Year	Title of the Paper	Theory	Internals	Total
BT-201	Biophysics & Biochemistry	(42.5) 40	(7.5) 10	50
BT-202	Bioinstrumentation, Biostatistics & Bioinformatics	(42.5) 40	(7.5) 10	50
BT-203	Laboratory			50
				150

B.Sc III Year	Title of the Paper	Theory	Internals	Total
BT-301	Molecular Biology & Genetic Engineering	40 (42.5)	(7.5) 10	50
BT-302	Applied Biotechnology	(42.5) 40	(7.5) 10	50
BT-303	Laboratory			50

GRAND TOTAL- 450

S. Shukla
Prof. S. Shukla Shukla

Professor & Head
Department of Zoology
Cent. Madhya Vigyan Mahavidyalaya Ujjain

P.K. Singh
P.K. Singh

Dr. Anil Kumar
Dr. Anil Kumar

H.S. Rathore
H.S. Rathore

B.Sc. Biotechnology
Annual Examination Pattern
2017 - 2018

✓
B.Sc First Year

(2)

Paper I : Cell Structure and Biology

Unit-I:

Cell Structure & Theory, Structure of prokaryotic cell, Eubacteria and Archaeobacteria. Size, shape and arrangement of bacterial cells. Gram's positive and Gram's negative cells.

Structure of Eukaryotic cell, plant cells, animal cells. Difference between prokaryotic and eukaryotic cells.

Unit-II:

Structure and function of bacterial cell – flagella, pili, Cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic granules, spores and cysts.

Structure and function of eukaryotic cell – Cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, Centriole, Lysosome.

Unit-III:

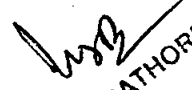
Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, Cell-cell interactions, Cell locomotion, Cell differentiation.


Unit-IV:

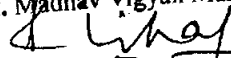
Transport Process: Cell Membrane: Models of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their roles. Transport across membranes – active and passive diffusion, mechanisms.

Unit-V:

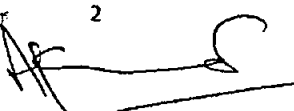
Introduction to Necrosis, Senescence, Apoptosis – Programmed cell death, Mechanism of Apoptosis, Intrinsic & Extrinsic pathways of cell death, Apoptosis in relation to Cancer, Oncogenes – Types of cancer.

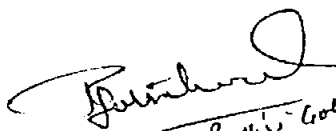
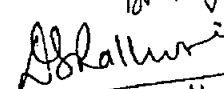


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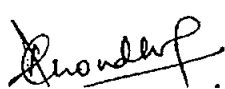

Professor & Head
Department of Zoology
Govt. Madhav Vigyan Mahavidyalaya Ujjain


P.K. Singh

A.S.P


Dr. Anil Kumar


Dr. Rajiv Kumar

Dr. S. Rathore

Deepa Kather


Dr. Anand

B.Sc. Biotechnology Ist yr
Annual Examination Pattern.

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Paper-II: Microbiology

2017 - 2018

Unit-I:

Introduction of Microbiology - History, Applications & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification. Microbial Taxonomy, Classification and identification of Bacteria, Bergey's manual.

Unit-II:

Structure and Diversity of Bacteria & Virus, Microbes in extreme environment. Nutritional requirement of microbes.

Bacteriology: Morphology and ultra structure of bacteriomorphological types, Archaeobacteria. Structure and function of cell organelles.

Unit-III:

Structure and Diversity of Algae, Fungi, Protozoans, Mycoplasmas and Extremophiles. General characteristics. Various methods of staining - simple, Gram, endospore, capsule, flagella and negative staining, Fungal stains, Algal stains.

Unit-IV: Microbial Growth

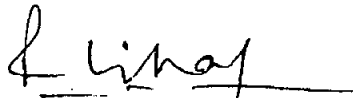
Microbial growth - mathematical expression of growth, growth curve, factors affecting growth. Batch, continuous, synchronous and diauxic growth. Quantification of microbial growth.

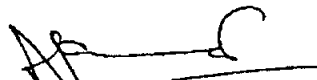
Control of micro organisms - physical & chemical, Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol - coefficient.

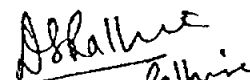
Unit-V:

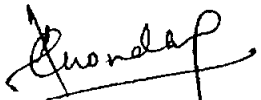
Microbial Nutrition and metabolism - Microbial Metabolism - Concept of Anabolism & catabolism processes. Nitrogen Fixation - Types and mechanisms, Microbial disease in plants & Animals (Only General concept).


Fermentation Process - Fermenter & its microbes of industrial importance.

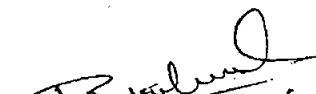

P.K. Singh



Dr. Anil Kumar


Dr. D.S. Rathore


Dr. Anjali Choudhary


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Dr. Pooja


Dr. H.S. Rathore

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B.Sc. Biotechnology - Ist yr
Annual Examination Pattern (9)
2017-2018

BT-103 Laboratory

List of Practicals

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells. Muscles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization of flagellin.
8. Viable cell counting using haemocytometer.
9. Measurement of cell by light microscope:-
Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, Cleaning of glassware, Preparation of cotton plugging and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by Pour plate, Spread Plate Methods.
16. Staining Method—Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining, shape and size.
18. Antibiotic Sensitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterisation of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note: 70% of the above list should be compulsorily performed.

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Dr. Anil Kumar

Dr. D.S. Rathore
Dr. D.S. Rathore

Dr. Anjali Choudhary
Dr. Anjali Choudhary

4

Dr. Rajini Choudhary
Dr. Rajini Choudhary

Dr. Deepa Rathi
Dr. Deepa Rathi

I * yr

B.Sc. Biotechnology 2017-2018
Annual Examination Pattern

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Scheme of Practical Examination


MM: 50


Duration: 3 Hrs

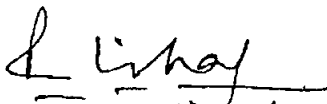
1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)


Suggested Reading


1. Cell and molecular. Biology: P.K.Gupta
2. Cell & Molecular biology: S.C.Rastogy
3. Molecular Biology of Cells, (2002), Alberts's et. al.
4. Cell Biology, P.S. Verma & Agarwal.
5. Text book of Microbiology by R.C.Dubey
6. A Text book of Microbiology -Dubey and Maheshwari
7. Essentials of Microbiology -K.S.Bilgrami /R.K.Sinha
8. Microbiology P.D.Sharma
9. General Microbiology Vol I & II Pawar & Dagniwala.
10. Applied Microbiology P.D.Sharma
11. Microbiology Fundamentals & Applications -S.S.Purohit
12. Experiments in Microbiology ,Plant Pathology & Biotechnology -K.R.Ancja
13. Fundamentals of Microbiology & Immunology By A.K.Banerjee.
Banerjee
14. Modern Concept of Microbiology H.D.Kumar & Swati Kumar


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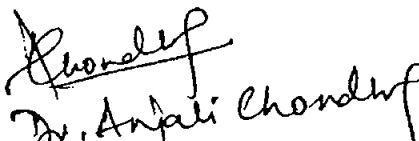

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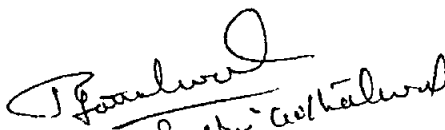

P.K. Singh


Dr. Anil Kumar


Dr. D.S. Rathore


Deepa Rathi


Dr. Anjali Choudhary


Dr. Raghav Choudhary

B.Sc. Biotechnology
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✓
B.Sc II Year

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Paper-I: Biophysics and Biochemistry

Unit-I:

Thermodynamics: Thermodynamic System, Equilibrium, Thermodynamic laws and their applications. Different types of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and relations, Maxwell's Equations, Fundamental equation of heat flow.

Unit-II:

General Biophysical methods: Measurement of pH, Radioactive labeling & counting. Autoradiography. Diffusion, Sedimentation, Osmosis, Viscosity- definitions, factors influencing them and their applications in biology.

Bragg's equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure.

Unit-III:

Fundamentals of Biochemistry: Biochemistry as molecular logic of living beings. Axioms of living matter, Major organic compounds of animate objects a general view. Chemical elements, structure of atoms, molecules and chemical bonds. Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water, Water as universal solvent, Acids, bases and salts, pH and buffers.

Unit-IV:

Biomolecules: Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.

Unit-V:

Enzymes: Structure, classification and function -Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km- Michaelis-Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot. Introduction to Allosteric Enzymes. Definition of holoenzyme: apoenzyme, coenzyme, cofactor, prosthetic group and their examples. Concept of ribozyme, multiple forms, isozymes and abzymes.

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P.K. Singh
P.K. Singh

D. Anil Kumar
D. Anil Kumar

D.D.S. Rathore
D.D.S. Rathore

Anita Choudhary
Anita Choudhary

Shobhit Choudhary
Shobhit Choudhary

Deepa Rattan
Deepa Rattan

^{II yr}
B.Sc Biotechnology
Annual Examination Pattern.

2018-2019
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Paper-II: Bioinstrumentation, Biostatistics and Bioinformatics

Unit-I:

Microscopy – Light, Phase contrast, fluorescence and Electron microscopy
Centrifugation technique. Principles types & separation of biological molecules.

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Unit-II:

Chromatography and Electrophoresis
Chromatography: Principles and applications, Principle and application of electrophoresis.
Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.

Unit-III:

Spectrophotometry.
Colorimetry (UV and Visible), Radio and Non radio labelling, Autoradiography

Unit-IV:

Biostatistics- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability, definition. Random variable and its distribution. Binomial probability distribution.

Unit-V:

Computers: General introduction (characteristics, capabilities, generations), hardware: organization of hardware (input devices, memory, control unit arithmetic logic unit, output devices): software : (System software; application software, languages -low level, high level), internet application.

Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc)

Biological Databases: Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc)

Cluster databases-An Introduction, Specialised databases (KEGG, etc). Database technologies (Flat-file), Structural databases (PDB)

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Amit Choudhary

Dr. Anil Kumar


Dr. H.S. Rathore
Deepa Rathore

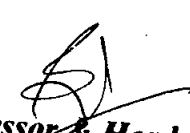
B.Sc. Biotechnology II yr
Annual Examination Pattern 2018-2019. (8)

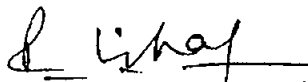
BT-203 Laboratory

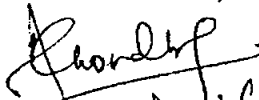
List of Practicals


1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Quantitative estimation of Protein by Folin-Lowry method.
4. Quantitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of pH on enzyme activity.
7. Study the effect of temperature on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and Output devices
20. Prepare a Marksheet of your class Subjects
21. Design your class timetable.
22. Prepare a bar chart, pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures, word art & clip art
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability.
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.


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P.K. Singh


Anand Choudhary

8

Dr. Anil Kumar


Dr. D.S. Rathore


Datta
2019 Rathore

II yr

B.Sc. Biotechnology

Annual Examination Pattern 2018-2019 ⑨

31. Introduction to NCBI.
32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
33. Analyzing Protein Sequences.
34. Analyzing DNA sequence.

Scheme of Practical Examination

MM: 50

Duration: 3 Hrs

1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)

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Dr. Anjali Choudhary

Dr. Rajini Choudhary
Dr. Rajini Choudhary

Dr. Deepa Rathi
Dr. Deepa Rathi

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II yr
B.Sc. Biotechnology
Annual Examination Pattern 2018-2019.

(10)

Suggested Reading

1. A text book of Bioinformatics by Sharma & Munjal & Shankar.
2. Bioinformatics by CSV Murthy
3. Basic Bioinformatics by S. Ignacimuthu, S.J
4. Bioinformatics: Concepts, Skills and Application By S.C. Rastogi, N. Mendiratta & Parag Rastogi
5. Practical Guide for basic Bioinformatics & Biostatistics By P. Tiwari & P. Pandey
6. Biostatistics by B. Prasad
7. Statistical Methods By S.P. Gupta
8. Fundamentals of Statistics By S.C. Gupta
9. Biostatistics by P.N. Arora
10. Principles of Biochemistry, Lehninger
11. Fundamentals of Biochemistry, J.L. Jain
12. Biochemistry, Voet and Voet.
13. Textbook of Biochemistry - S.P. Singh.
14. Biophysics : Mohan P. Arora
15. Biophysics : Pattabh & Gautham
16. Biochemistry: A.C. Deb
17. Biomolecule: Mohan P. Arora
18. Principles of Biochemistry (2005), Nelson & Cox

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Dr. Anil Kumar
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Dr. D.S. Rathor

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Dr. Anjali Choudhary
Dr. Anjali Choudhary

Dr. Poojini Gultwal
Dr. Poojini Gultwal

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B.Sc. Biotechnology
Annual Examination Pattern - 2019-2020 (II)

B.Sc III Year

Paper-I: Molecular Biology and Genetic Engineering

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Unit-I:

DNA and RNA, Chemical Structure, Types and Properties, Experimental Proof of DNA as genetic material, Genome- Concept, Plant, Animal, Bacterial and Viral Genome, DNA Replication. Types, Experimental proof of semi conservative replication, Replicon- Concept. proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication. Y shaped. θ mode. rolling circle mechanism.

Unit-II:

Eukaryotic chromosomal organization. Euchromatin, Heterochromatin, chromatin structure, nucleosomes, histone and non histone proteins, Histone modifications. Introduction to epigenetics.

Unit-III:

Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules, Evolution of early forms, Mendelian genetics: Mendel's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.

Unit-IV:

Introduction to Recombinant DNA technology, Scope & importance. Gene Cloning, PCR, Introduction to Restriction endonuclease, Vectors for DNA transfer and their types: Plasmids, Phagemids, Cosmids, BAC. Gene amplification.

Unit-V:

Plasmids Types Properties and cloning vectors. Recombinant DNA technology with Restriction endonuclease and recombinant DNA.

Mutation, Types of mutations; Point mutation (Base pair change, frame shift, deletion).

Transcription, translation and gene expression in eukaryotes (yeast), Alternate splicing.

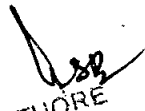
HSR
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Maharaja Pratap Singh
Mahavidyalaya Ujjain

P. K. Singh
Dr. Anjali Choudhary

Dr. Ail Kumar

Dr. S. Rathore
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III yr
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Paper-II: Applied Biotechnology

Unit-I: Microbial Biotechnology

Food Microbiology-Microbial contamination & Spoilage, Food preservation, Industrial Production of Ethyl Alcohol, Penicillin, Cyanocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.

Unit-II: Plant Biotechnology-

Introduction to plant tissue culture, Nutritional requirements, In vitro culture. Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis. Protoplast culture. Somatic hybridization, Genetic manipulation of plants using *Agrobacterium tumefaciens*.

Unit-III: Immunology and Animal Biotechnology

Immunity- Innate and Acquired, Host defense mechanism- Infection and its types, Organs and Cells of Immune system, Vaccines and its types. Antigens- Properties and types, Adjuvants, Immunoglobulins- Structure, types and functions, Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions.


History, Equipment and materials for animal cell culture technology. Physical requirement for animal cell and their growth curve in culture.

Commonly used cell lines - their organization and characteristics, Differentiation of cells. Organ culture - techniques, advantage and applications.

Applications of animal biotechnology: Methods of Transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals, Stem cell culture, Transplantation of cultured cells, Bioreactors for large scale production of animal cells.

Unit-IV: Fermentation Technology

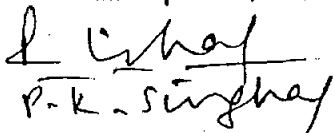
Fermentation Technology, Primary and Secondary Screening, Strain Improvement, Inoculum Development, Industrial Sterilisation process, Scale-up and Harvest and Recovery.

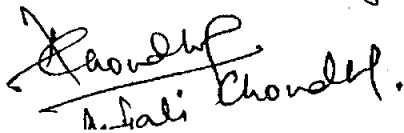

Professor & Head

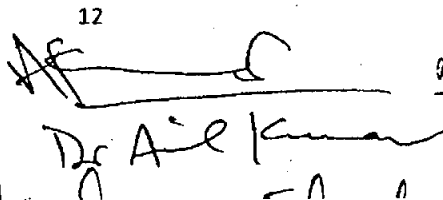
Department of Zoology

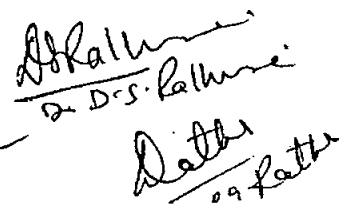
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Types of fermentation - batch, continuous, fed batch process: Submerged and Solid State fermentation process, Basic design of a fermentor and factors affecting fermentor design.


P.K. Singh


A. Sali Choudhary

12

Dr. Ail Kumar


Dr. D.S. Rathore

14 yrs

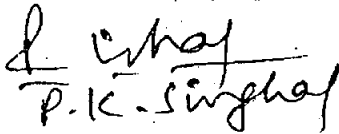
B.Sc. Biotechnology
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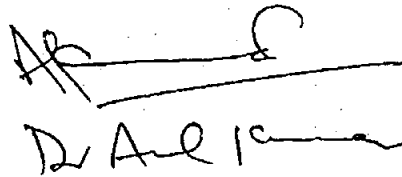
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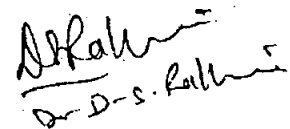
Types of fermentors- Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.

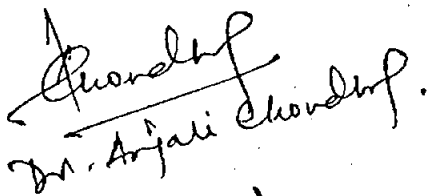
Unit-V: Environment Biotechnology

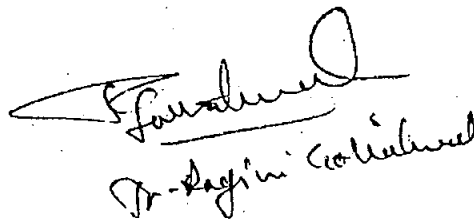
Environment: Basic concept, Significance, Public awareness, Environmental pollution, Assessment of water quality, Treatment of waste-water - Primary, secondary and tertiary treatment. Solid waste management (composting, vermi-composting, methane production). Biopesticides- Bacterial and Fungal, Genetically modified crops, Biofertilizers - Nitrogen fixers, PSB, Mycorrhiza and VAM, Microbial leaching, Microbial Enhanced Oil Recovery. Bioremediation and Biodeterioration. Modern fuels- Methanogenic bacteria and biogas, microbial hydrogen production.

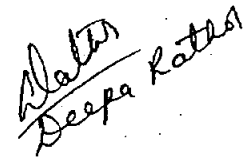

P.K. Singh

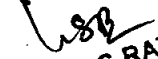

Dr. Anil Kumar



Dr. D.S. Rathi


Dr. Anjali Choudhary


Dr. Jagjivan Choudhary


Dr. Deepa Rathi


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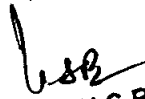

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III yr

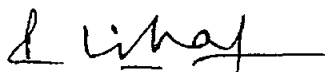
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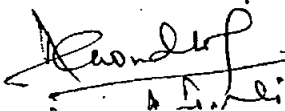
**BT-303 Laboratory
List of Practicals**


1. Chromosomal DNA isolation from Plant cells.
2. Chromosomal DNA isolation from Animal cells.
3. Genomic DNA isolation from Micro-Organisms.
4. Analysis of isolated DNA by Agarose gel electrophoresis.
5. Spectrophotometric analysis of DNA and DNA melting.
6. UV as a physical mutagen
7. Gradient Plate Technique
8. Estimation of DNA using diphenylamine method.
9. Estimation of RNA using orcinol method.
10. Isolation of RNA from Yeast..
11. Isolation of plasmid DNA from bacteria.
12. Effect of UV radiation on microbial cell
13. Demonstration of repair mechanism *in* microbes.
14. Bacteriophage and determination of latent period of infection
15. Isolation of total RNA from Plant tissue by SDS phenol method.
16. Elution of DNA from agarose gel band.
17. Transformation in E-coli cell.
18. Growth of plant tissue into undifferentiated mass of callus.
19. Preparation of animal cell culture media.
20. Separation and culture of lymphocyte from blood.
21. Demonstration of fermentor.
22. Preparation of wine.
23. Extraction of citric acid from *Aspergillus*.
24. Production of ethanol by yeast.
25. Demonstration of PCR.
26. Immobilization of microbial cells.
27. Extraction and preparation of lactic acid.
28. Extraction and preparation of citric acid.
29. Demonstration of Radial immuno diffusion analysis.
30. Isolation of microorganism from polluted site/ industrial waste.
31. Blood group analysis.



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P.K. Singh


S. S. Choudhary

14

Dr. A. K. Kumar


Dr. S. K. Rathore


Dr. S. K. Rathore

111 yr

(15)

B.Sc. Biotechnology

Annual Examination Pattern - 2019-2020

32. Differential count of WBC.
33. To examine flocculation reaction using VDRL test.
34. To observe the agglutination reaction using WIDAL test
35. Determine the concentration of unknown antigen using Radial Immuno Diffusion technique.

Note: 70% of the above list should be compulsorily performed.

Scheme of Practical Examination

MM: 50

Duration: 3 Hrs

1. Major (10)
2. Major (10)
3. Minor (5)
5. Minor (5)
4. Spotting (10)
5. Viva- Voce. (05)
6. Practical Record. (05)

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Suggested Reading

1. Industrial Microbiology By A. H. Patel
2. Microbial Biotechnology By Hazarre
3. Molecular biology: Avinash & Kakoli Upadhyay
4. Gene Biotechnology: Jogdand
5. Essential of Biotechnology: S.N.Das
6. Text book of Biotechnology: R.C. Dubey
7. Biotechnology & genomics : P.K. Gupta
8. Modern concept of Biotech: H.D. Menon
9. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee

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Banerjee

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Dr. Anjali Choudhary
Dr. Anjali Choudhary

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Dr. Ail Kumar
Dr. Ail Kumar

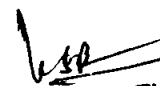
D.S. Rathore
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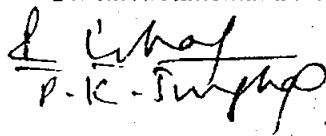
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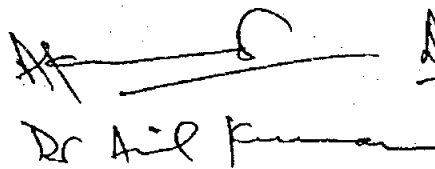
B.Sc. Biotechnology IIIrd yr
Annual Examination Pattern - 2019-2020

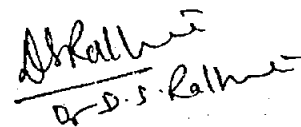
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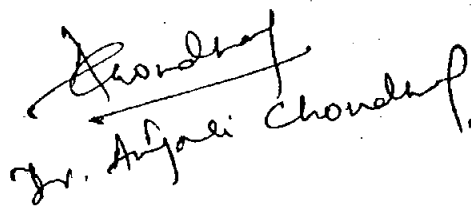
10. Fundamentals of Microbiology & Immunology : Banerjee & Banerjee
11. Immunology : Rao
12. Biotechnology & Genomics : P.K.Gupta
13. Biotechnology : Satyanarayan
14. Plant tissue culture: Bhajwan
15. Introduction to plant tissue culture: Razadan
16. Introduction to Biotech: Chawla
17. Animal Biotechnology: Srivastava, Singh & Yadav.
18. Text book of Animal Biotechnology, Ramdas and Mecraya,
19. Biotechnology Animal cell, Satish M.K.
20. Animal Biotechnology, Ranga M.M.
21. Text Book of Biotechnology, B.D. Singh. Culture of Animal cell, Freshney.
22. Plant Biotechnology, Jitendra Parkash.
23. Biotechnology in plant science. Kumar N C.
24. Environmental Biotechnology Agrawal S.K.

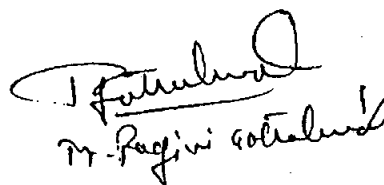

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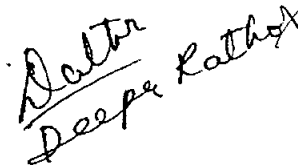

P.K. Gupta



Dr. Anil Kumar


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Dr. Anjali Choudhary


M. Rajini Sathish


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