



**B.Sc, (MICROBIOLOGY)**

**Undergraduate Programme)**

**(Effective from the Academic Year 2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)**

**Narsapur. Andhra Pradesh**



# **1 B.Sc, MICROBIOLOGY**

## **SEMESTER -I**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)  
Narsapur. Andhra Pradesh.**



## **SRI Y.N COLLEGE(AUTONOMOUS) NARSAPUR**

(Affiliated to Adikavi Nannayya University)

Thrice Accredited by NAAC at 'A' Grade with a CGPA of 3.40

Recognized by UGC as 'College with Potential for Excellence'

### **I B.Sc; MICROBIOLOGY**

#### **FIRST SEMESTER- PAPER –I**

#### **INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY**

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##### **Aim and objectives of Course:**

To understand History & Development of Microbiology, Microscopy, staining and sterilization techniques, Ultra-structure of cell, Different methods of microbial characterization To study nature of viruses, viral classification, cultivation of viruses and Type study of TMV & HIV.

##### **Learning outcomes of course:**

1. Explain relationship and apply appropriate terminology relating to the structure, Genetics, metabolism and ecology of prokaryotic microorganisms, Algae, viruses and Fungi.
2. Students will get basics and importance of Microbiology.
3. Demonstrate appropriate laboratory skill and techniques related to isolation, staining, identification and control of microorganism.

#### **UNIT-I**

**History of Microbiology & Place of Microorganisms in the living world:** History of Microbiology in the context of contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanovsky, Martinus Beijerinck and Sergei Winogradsky. Importance and applications of microbiology, Place of Microorganisms in the Living World Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese

#### **UNIT II**

**Prokaryotic microorganisms and Viruses:** Ultra-structure of Prokaryotic cell- Cell Wall, Cell Membrane, Cytoplasm, Nucleoid, Plasmid, Inclusion Bodies, Flagella, Pili, Capsule, Endospore General characteristics of Bacteria (Size, shape, arrangement, reproduction) General characteristics of Rickettsia, Mycoplasmas, Cyanobacteria, Archaea General characteristics of viruses, Cultivation of Viruses (in brief) Morphology, Structure and replication of TMV and Lambda Bacteriophage.

#### **UNIT III**

**Eukaryotic microorganisms:** Fungi - Habitat, nutrition, vegetative structure and modes of reproduction; outline classification, Algae - Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.. Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification.

#### **UNIT IV**

**Isolation and Culture of Bacteria and Fungi:** Growth media- Natural, synthetic and semi synthetic media. Selective, Enrichment, and Differential media Pure culture techniques - dilution- plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Preservation of microbial cultures - sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

## UNIT V

**Principles of Microscopy, Sterilization and Disinfection:** Principles of microscopy - Bright field and Electron microscopy (SEM and TEM). Staining Techniques - Simple and Differential staining techniques (Gram staining, Spore staining). Sterilization and disinfection techniques - Physical methods - autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods - UV rays, Gamma rays. Chemical methods - alcohols, aldehydes, fumigants, phenols, halogens and hypochlorite's.

**ADDITIONAL INPUT:** Bacterial motility - hanging drop technique, cultivation of aerobes & anerobes.

### RECOMMENDED TEXT BOOKS:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, TataMcGraw Hill Publishing Co., Ltd., New Delhi.
2. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3. Power, C.B. and Dagainawala, H.F. (1986). General Microbiology Vol I & II
4. Prescott, M.J., Harley, J.P. and Klein, D.A. (2012). Microbiology. 5th Edition, WCBMcGrawHill, New York.
5. Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, SriPadmavathi Publications, Hyderabad

### REFERENCE BOOKS:

1. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
2. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
3. Microbiology Edited by Prescott
4. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
5. Gopal Reddy *et al.*, Laboratory Experiments in Microbiology.

### BLUE PRINT

	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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**I B.Sc; MICROBIOLOGY**  
**FIRST SEMESTER- PAPER -I**

**INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY LAB**

**Practical syllabus :**

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Cyanobacteria, Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method.
11. Isolation of pure cultures of bacteria by streaking method.
12. Preservation of bacterial cultures by various techniques.

**SUGGESTED READING:**

- Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
- Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition, Himalaya Publishing House, Mumbai.
- Power, C.B. and Dagainawala, H.F. (1986). General Microbiology Vol I & II
- Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). Microbiology. 5th Edition, WCB McGrawHill, New York.
- Reddy, S.M. and Reddy, S.R. (1998). Microbiology Practical Manual, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.
- Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
- Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
- Microbiology Edited by Prescott
- Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi. Gopal Reddy *et al.*, Laboratory Experiments in Microbiology.

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1. *[Signature]*  
2. *M. G. L.*  
3. *K. Venkatesh Reddy*

4. *Shen*  
5. *Zanti*  
6. *Pratishtha*



# **1 B.Sc, MICROBIOLOGY**

## **SEMESTER -II**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)**  
**Narsapur. Andhra Pradesh.**



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**I B.Sc; MICROBIOLOGY**

**SECOND SEMESTER- PAPER -II**

**MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY**

**Aim and objectives of Course:**

To understand DNA, RNA, Protein structure and synthesis. DNA damage, mutations and repair. Genetransfer methods.

**Learning outcomes of Course:**

1. This Course provides Understanding of biomolecular synthesis and control will help in further study.
2. Develop knowledge on microbial genetics and molecular biology.

**UNIT-I**

**Biomolecules:** General characters and outline classification of Carbohydrates (Monosaccharides- Glucose, Fructose, Ribose, Disaccharides- Sucrose, Lactose, Polysaccharides- Starch, glycogen, Cellulose) General characters and outline classification of fatty acids (Saturated & Unsaturated FattyAcids) Lipids (Simple & complex lipids) General characteristics of Amino Acids and Proteins. Structure of Nucleic acids.

**UNIT II**

**Enzymes:** Properties and classification of Enzymes. Biocatalysis- induced fit and lock and key models. Coenzymes and Cofactors. Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric. Factors effecting enzyme activity

**UNIT III**

**Analytical Techniques:** Principle and applications of – Colorimetry, Chromatography (paper, thin-layer, and column), Spectrophotometry (UV & visible), Centrifugation and Gel Electrophoresis (Agarose and SDS).

**UNIT IV**

**Microbial Nutrition and growth:** Nutritional requirements of Microorganisms Nutritional groups of microorganisms- autotrophs, heterotrophs, lithotrophs, organotrophs, phototrophs, chemotrophs Microbial Growth- different phases of growth in batch cultures; Synchronous, continuous, biphasic growth. Factors influencing microbial growth, Methods for measuring microbial growth - Direct microscopy, viable count estimates, turbidometry and biomass.

**UNIT V**

**Microbial metabolism:** Aerobic respiration - Glycolysis, TCA cycle, ED Pathway, Electron transport Oxidative and substrate level phosphorylations. Anaerobic respiration (Nitrate and sulphate respiration) Fermentation- lactic acid and ethanol fermentations Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

**ADDITIONAL INPUT:** Structural polymorphism of DNA , HP-TLC



**RECOMMENDED TEXT BOOKS:**

1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H. Freeman and Company, Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA.
2. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
3. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
4. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
5. Voet, D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
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UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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2. *M. G. J.*  
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3. *K. Venkatesh Babu*  
4. *S. S. S.*

5. *S. S. S.*  
6. *Pratyusha*





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**I B.Sc; MICROBIOLOGY**  
**SECOND SEMESTER—PAPER-II**  
**MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY**

Time: 3Hrs

Max.Marks:75M

**SECTION-A**

**I. Answer any five questions. Each carries five marks.**

**5X5=25M**

**Draw labeled diagrams wherever necessary.**

1. General characteristics of amino acids.
2. Coenzymes.
3. Cofactors.
4. Centrifugation.
5. Glycolysis.
6. Electron transport
7. Induced fit theory.
8. ED pathway.

**II. Answer any five of the following questions atleast Two from each section B & C.**  
**draw a labeled wherever necessary. Each answer carries 10 marks.**

**5X10M=50M**

**SECTION-B**

9. Write about general characteristics and classification of carbohydrates.
10. Write the properties and classification of enzymes.
11. Write about the principle and applications of calorimeter.
12. Write an essay on nutritional requirements of bacteria.
13. Explain the aerobic respiration of TCA cycle with flow chart.

**SECTION-C**

14. Write about the structure of nucleic acids.
15. Describe the factors that affect analytic activity of enzyme.
16. Write about the principle and applications of paper chromatography.
17. What are the factors affecting microbial growth.
18. Write about oxygenic and anoxygenic photosynthesis in bacteria.

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*P. Buncelle*  
*3/9/22*

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**I B.Sc; MICROBIOLOGY**

**SECOND SEMESTER—PAPER-II**

**MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY LAB**

**Practical syllabus:**

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation DNA by diphenylamine method.
4. Estimation of RNA by Orcinol method.
5. Colorimetric estimation of proteins by Biuret / Lowry method.
6. Estimation of reducing sugar-Anthrone method.
7. Estimation of sugar by titration method—Benedict's method.
8. Determination of pKa and pI values of amino acids.
9. Assay of amylase activity
10. Effect of temperature / pH on enzyme activity
11. demonstration of immobilization of enzyme activity.

**SUGGESTED READING:**

- Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
- Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA.
- Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
- Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H.Freeman
- Voet, D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
- White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.

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2. *M. S...*  
3/9/22

3. *K. Venkatesh Reddy*

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5. *S. Suresh*

6. *P. Suresh*



# **II B.Sc, MICROBIOLOGY**

## **SEMESTER -III**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)**  
**Narsapur. Andhra Pradesh.**





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**II B.Sc; MICROBIOLOGY**

**THIRD SEMESTER—PAPER-III**

**MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

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**Aim and objectives of Course:**

To understand different biomolecules, analytical techniques, bacterial nutrition, growth and metabolism

**Learning outcomes of Course:**

Up on completion of this course students should able to:

1. Explain working principle and applications of Colorimetry, Chromatography, Spectrophotometry, Centrifugation and Gel Electrophoresis.
2. Knowledge on Microbial nutrition, bacterial growth, metabolism and Respiration.
3. The student will get first-hand experience on separation methods

**UNIT I**

**Nucleic acids:** DNA and RNA - Role in heredity-The central dogma Watson and Crick model of DNA, Types of RNA, structure, and functions, Organization of DNA in prokaryotes

**UNIT II**

**Genetic material and replication:**Experiments which established DNA as genetic material RNA as genetic material, Mechanism of DNA Replication in Prokaryotes, Proof of semi conservative mechanism of replication (Meselson - Stahl Experiment)

**UNIT III**

**Gene expression and regulation:** Concept of gene - Mutton, recon and cistron. Genetic code Protein synthesis - Transcription and translation in Prokaryotes Regulation of gene expression in bacteria -*lac* operon

**UNIT IV**

**Mutations, damage and repair:** Outlines of DNA damage and repair mechanism Mutations - spontaneous and induced Chromosomal aberrations - deletions, inversions, tandem duplications, insertions Point mutations- base pair changes, frame shifts Mutagens - Physical and Chemical mutagens Bacterial recombination-Transformation, Conjugation, Transduction (Generalized and specialized transductions)

**UNIT V**

**Genetic engineering:** Basic principles of genetic engineering. Restriction endonucleases, DNA ligases. Vectors – plasmids (pBR322 & pUC8), Cosmids, Phagemids, lambda phage vector, M 13 vectors. Outlines of gene cloning methods. Polymerase chain reaction. Genomic and cDNA libraries. General account on application of genetic engineering in industry, agriculture, and medicine.

**ADDITIONAL INPUT:** Types of PCR and DNA fingerprinting.



**RECOMMENDED TEXT BOOKS:**

1. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
2. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
3. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
4. Lewin, B. (2000). Genes VIII. Oxford University Press, England.
5. Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
6. Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) A text Book of Molecular Biotechnology. Himalaya Publishers, Hyderabad.
7. Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5th Edition. McGraw Hill, New York.
8. Smith, J.E. (1996). Biotechnology, Cambridge University Press.

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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*P. Sunil*  
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**II B.Sc; MICROBIOLOGY**

**THIRD SEMESTER—PAPER-III**

**MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

Time 3Hrs

Max.Marks:75M

**SECTION-A**

**I. Answer any 5 questions. Each question carries 5 marks.**

**5X5M=25M**

1. Central dogma
2. RNA as genetic material
3. Mutoon, Recon, Cistron
4. Genetic code
5. UV rays as mutagens
6. Conjugation in bacteria
7. PCR
8. Plasmid vectors

**II. Answer any five of the following questions atleast Two from each section B & C. draw a labeled wherever necessary. Each answer carries 10 marks.**

**5X10M=50M**

**SECTION-B**

9. Explain Watson and Crick model of DNA with a neat labeled diagram?
10. Explain DNA as a genetic material with an experimental proof?
11. Explain the important steps in protein synthesis with a diagram?
12. Explain different types of chromosomal mutations and point mutations?
13. Write the basic steps involved in gene cloning?

**SECTION-C**

14. Write different types of RNA and its functions?
15. Explain the proof of semi conservative replication of DNA (Meselson & Stahl experiment)?
16. Explain the functioning of lac operon concept?
17. Explain the generalized & specialized transduction?
18. What are the application of genetic engineering in agriculture, medicine and industry?

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3. *K. Venkatesh Babu*

4. *Shani*  
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**THIRD SEMESTER—PAPER-III**  
**MOLECULAR BIOLOGY AND MICROBIAL GENETICS lab**

**PRACTICAL SYLLABUS**

1. Study of different types of DNA and RNA using micrographs and model / schematic representations.
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer.
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS -PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology - Ultra centrifuge, Transilluminator, PCR

**REFERENCE BOOKS:**

1. Smith, J.E. (1996). Biotechnology, Cambridge University Press.
2. Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press,
3. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
4. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi

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2. *M. Srinivas*  
3/9/22
3. *K. Venkatesh Reddy*
4. *S. Srinivas*
5. *S. Srinivas*

*6. P. Srinivas*



# **II B.Sc, MICROBIOLOGY**

## **SEMESTER -IV**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)  
Narsapur. Andhra Pradesh.**





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### **II B.Sc; MICROBIOLOGY**

#### **FOURTH SEMESTER—PAPER-IV**

#### **IMMUNOLOGY AND MEDICAL MICROBIOLOGY**

##### **Aim and objectives of Course:**

- To study types of immunity, immune organs, cells, antibodies and antigenantibodyinteractions.
- To learn diagnostic and pathogenesis of various diseases. Antimicrobial defense anddifferent toxins and vaccines.

##### **Learning outcomes of Course:** Up on completion of the course students able to

1. Explain No-specific body defence and the immune response
2. Develop knowledge on disease transmission and control
3. Demonstrate on collection and handling of laboratory specimens
4. Develop an information making personal health decision in regard to infectious diseases.
5. Student can safeguard himself & society and can work diagnostics and hospitals.

#### **UNIT I**

**Immune System:** Concept of Innate and Adaptive immunity Primary and secondary organs of immune system - thymus, bursa fabricus, bone marrow, spleen, lymph nodes. Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and esinophils Complement system (in brief)

#### **UNIT II**

**Immune response:** Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) Haptens. Antibodies - basic structure and types and functions (Immune complex formation and elimination - Agglutination, Precipitation, Neutralization, Complement fixation, Phagocytosis) Generation of Humoral Immune Response (Plasma and Memory cells) Generation of Cell Mediated Immune Response MHC- Functions of MHC I & II molecules Hypersensitivity-definition and types (in brief) Autoimmunity (in brief)

#### **UNIT III**

**Microbes in Health and Disease:** Normal flora of human body. Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Opportunistic infections, Nosocomial infections. General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention, and control of the following Bacterial diseases - Tuberculosis, Typhoid. Fungal diseases - Candidiasis. Protozoal diseases - Malaria. Viral Diseases –Corona virus and AIDS

#### **UNIT IV**

**Principles of Diagnosis:** General principles of diagnostic microbiology- Collection, transport of clinical samples, Identification by Culturing & Biochemical characteristics (IMViC), Identification by molecular assays (PCR, RT-PCR, DNA probes), Identification by serological tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation)

## UNIT V

**Prevention and Treatment:** Vaccines Monoclonal antibodies- Production and application Antimicrobial agents- General modes of action of antibacterial (Penicillin), antifungal (Amphotericin), antiviral (Amantadine)agents Interferons Tests for antimicrobial susceptibility (Disc diffusion) Antibiotic resistance in bacteria.

**ADDITIONAL INPUT:** SARS & MARS, COVID-19 – Treatment & prevention.

### RECOMMENDED TEXT BOOKS:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

### REFERENCE BOOKS:

1. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
2. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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2. *M. S. J.*  
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4. *S. L. S.*

5. *S. Sath*  
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Recognized by UGC as 'College with Potential for Excellence'

**II B.Sc; MICROBIOLOGY**

**FOURTH SEMESTER—PAPER-IV**

**IMMUNOLOGY AND MEDICAL MICROBIOLOGY LAB**

Time: 3Hrs

Max.Marks:75M

**SECTION-A**

**I. Answer any five of the following. Each question carries 5 marks. 5X5=25M**

1. Thymus
2. Macrophage
3. Hypersensitivity reactions
4. MHC molecules
5. Nosocomial infection
6. ELISA
7. Corona virus
8. Interferons

**II. Answer any five of the following questions, atleast 2 from each section A&B  
Draw a labeled diagrams wherever necessary**

**5X10=50M**

**SECTION-B**

1. Explain types of immunity?
2. Explain antibody structure and its types?
3. Explain causal organism, pathogenesis, epidemiology, prevention and control of tuberculosis?
4. Write a note on collection and transportation of clinical samples?
5. Write about a vaccines?

**SECTION-C**

6. Write structure and functions of cells of immune system?
7. Write a cell mediated immune response?
8. Explain normal flora of human body?
9. Explain methods for identification of clinical samples by serological tests?
10. Explain the tests for antimicrobial susceptibility?

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3. *K. Venkatesh Reddy* 3/9/22  
4. *Sheri*

5. *Santi*  
6. *P. Sathy Kumar*



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**II B.Sc; MICROBIOLOGY**  
**FOURTH SEMESTER- PAPER-IV**  
**IMMUNOLOGY AND MEDICAL MICROBIOLOGY LAB**

**PRACTICAL SYLLABUS:**

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (*E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar
6. Antibacterial sensitivity by Kirby-Bauer method
7. Determination of Minimal Inhibitory Concentration (MIC) of an antibiotic
8. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatormycoses (ring worms)
9. Study of various stages of malarial parasite in RBCs using permanent mounts.
10. Phenol coefficient test
11. Isolation of Normal flora of human body (Hands, Feet, Nostrils, Teeth Surface) by swab method.
12. Evaluation of Hand Sanitizer Effectiveness by Filter Paper Disc Method & thumb impression method.

**RECOMMENDED TEXT BOOKS & REFERENCE BOOKS:**

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
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4. Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
5. Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication.
6. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott,

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2. M. S. *3/9/21*  
3. K. Venkatesh Babu

4. Sleni  
5. Sath  
6. Pratyush

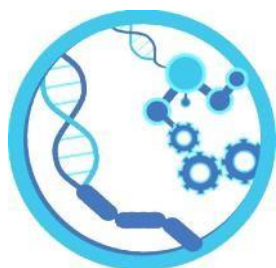




# **II B.Sc, MICROBIOLOGY**

## **SEMESTER -IV**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)  
Narsapur. Andhra Pradesh.**



## **SRI Y.N COLLEGE(AUTONOMOUS) NARSAPUR**

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### **II B.Sc; MICROBIOLOGY**

#### **FOURTH SEMESTER—PAPER-V**

#### **MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY**

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##### **Aim and objectives of Course:**

- To study role of microorganisms in nutrient cycling, microorganism in waste treatment and degradation of xenobiotics
- To determine the potability of drinking water
- To study concepts of screening and strain improvement, media, Fermentation, assays with examples of industrially important processes

##### **Learning outcomes of Course:**

Up on completion of the course students able to

- Understand fundamental concept in soil microbial diversity, basic concept of biogeochemical cycles and plant growth promotion and plant diseases
- Understands the role of microorganisms in treatment of solid and liquid waste.
- Acquire knowledge on application of microorganisms in agro – environmental fields.
- Get basic information design of fermenter, fermentation processes and Single cell proteins.
- Self-reliance in the industrial application of Microbiology in life and industry.
- Entrepreneurship can be established with the gained knowledge.

#### **UNIT I**

**Microbial Ecology:** Role of microorganisms in Biogeochemical cycles (Carbon, nitrogen, phosphorus) Microbe-microbe interactions - Synergism, mutualism, commensalism, antagonism, competition, parasitism, predation Plant- Microbe interactions - Plant growth promoting Microorganisms, Plant pathogens

#### **UNIT II**

**Microorganisms in Environment:** Microbes in waste management- solid and liquid waste (aerobic and anaerobic) Microbes in degradation of Xenobiotics Microbes in drinking water- detection of potability by (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coli forms (b) Membrane filter technique Microbes in food - intrinsic and extrinsic parameters that affect microbial growth in food.

#### **UNIT III**

**Industrial Microbiology:** Industrial important Microorganisms- Yeasts & Moulds, Bacteria , Actinomycetes . Screening techniques. Strain improvement techniques.

#### **UNIT IV**

**Fermentation processes:** Design of fermented (for control of pH, temperature, dissolved oxygen, foaming and aeration) Types of fermentation processes - solid state, liquid state, batch, fed-batch, continuous. Fermentation media (Carbon source, nitrogen source, minerals, vitamins & growth factors, Buffers, Precursors, Antifoam agents, water, oxygen) Examples of Crude media; molasses, corn- steep liquor, sulphite waste liquor, whey. Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

## UNIT V

Microbial Productions: Microbial production of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic acid, vitamin B12, Amylase, Yogurt Microbial cells as food- SCP.

**ADDITIONAL-INPUT:** Techniques involved in selection of industrially importance of Metabolites from-microbes. Production of therapeutic enzyme.

### RECOMMENDED TEXT BOOKS:

- Atlas RM and Bartha R. (2000). **Microbial Ecology: Fundamentals & Applications**. 4th edition. Benjamin/Cummings Science Publishing, USA
- Barton LL & Northup DE (2011). **Microbial Ecology**. 1st edition, Wiley Blackwell, USA
- Campbell RE. (1983). **Microbial Ecology**. Blackwell Scientific Publication, Oxford, England
- Coyne MS. (2001). **Soil Microbiology: An Exploratory Approach**. Delmar Thomson Learning
- Lynch JM & Hobbie JE. (1988). **Microorganisms in Action: Concepts & Application in Microbial Ecology**. Blackwell Scientific Publication, U.K
- Madigan MT, Martinko JM and Parker J. (2014). **Brock Biology of Microorganisms**. 14th edition. Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). **Environmental Microbiology**. 2nd edition, Academic Press

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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3. K. Venkatesh Reddy  
4. Sleni

5. Gauth  
6. Potyur





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**II B.Sc; MICROBIOLOGY**  
**FOURTH SEMESTER—PAPER-V**  
**MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY**  
Time: 3Hrs Max.Marks:75M

**SECTION A**

**I. Answer any five of the following. Each question carries 5 marks. 5x5=25M**

1. Mutualism
2. Azotobacter
3. Xenobiotics
4. Cell emplacement
5. Crowded plate
6. Centrifugation
7. SCP
8. Yogurt

**II. Answer any five of the following questions, atleast 2 from each section A&B**  
**Draw labeled diagrams wherever necessary**

**5X10=50M**

**SECTION-B**

9. Explain role of microorganism in nitrogen cycle?
10. Explain municipal waste treatment process?
11. Write a note on industrially important microorganisms?
12. Write types of fermentation process?
13. Write a note on industrial production of ethanol and its applications?

**SECTION-C**

14. Explain plant growth promoting microorganisms?
15. Write intrinsic and extrinsic factors that affect the microbial growth in food?
16. Explain methods for strain improvement?
17. Explain techniques involved in downstream processing?
18. Write a note on industrial production of vitamin B12?

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2. *H. S...*  
3/9/21  
3. *H. Venkatesh Reddy*  
4. *Sleni*

5. *Sant*  
6. *Deetya*





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**II B.Sc; MICROBIOLOGY**

**FOURTH SEMESTER- PAPER-V**

**MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY LAB**

**PRACTICAL SYLLABUS**

1. Microbial fermentation for the production and estimation of ethanol
2. Isolation of amylase producing microorganisms from soil
3. Isolation of food spoilage microorganisms from spoiled food sample.
4. MPN test
5. Demonstration of fermenter
6. Production of wine from grapes
7. Growth curve and kinetics of any two industrially important microorganisms.
8. Microbial fermentation for the production and estimation of citric acid
9. Preparation of yoghurt.
10. Crowded plate technique
11. Isolation of microorganism from soil
12. Isolation of microorganism from different water samples

**REFERENCE BOOKS:**

1. Martin A. (1977). **An Introduction to Soil Microbiology**. 2nd edition. John Wiley & Sons Inc. New York & London. Adams MR and Moss MO. (1995). **Food Microbiology**. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). **Basic Food Microbiology**. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Casida LE. (1991). **Industrial Microbiology**. 1st edition. Wiley Eastern Limited.
4. Crueger W and Crueger A. (2000). **Biotechnology: A textbook of Industrial Microbiology**. 2nd Edition. Panima Publishing Company, New Delhi
5. Frazier WC and Westhoff DC. (1992). **Food Microbiology**. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Jay JM, Loessner MJ and Golden DA. (2005). **Modern Food Microbiology**. 7th edition. CBS Publishers and Distributors, Delhi, India

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3/9/22

3. *K. Venant Reddy*

4. *S. S. S.*

5. *S. S.*

6. *P. Suresh*



# **III B.Sc, MICROBIOLOGY**

## **SEMESTER -V**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)**  
**Narsapur. Andhra Pradesh.**



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**III B.Sc; MICROBIOLOGY**

**FIFTH SEMESTER PAPER-VI**

**MICROBIAL BIOTECHNOLOGY AND r - DNA TECHNOLOGY**

**Aim and objectives of Course**

To study applications of microbial biotechnology and r DNA technology.

**Learning outcomes of Course**

Up on completion of the course students able to

1. Students should be able to demonstrate with the wide diversity of microbes and their potential use in medicine, agriculture and industry biotechnology regulation and ethics.
2. Students will get knowledge on restriction endonuclease in r DNA technology and selection of transformed cells
3. Students will get knowledge on cloning vehicles in r DNA technology
4. Student will be able to understand gene sequencing methods
5. Students will get knowledge on of genetically modified crops. And role of microorganisms in creation of transgenic animals and plants.

**UNIT- I**

Introduction to microbial biotechnology, Bacterial genes, genomes and genetics. Recombinant microbial biotechnology products, biotechnology regulation and ethics. Restriction and Modification: Classification of restriction endonucleases. Enzymes used in molecular cloning; Polymerases, ligases, phosphatases, kinases and nucleases; Advanced Molecular biology techniques, Electrophoresis and Blotting techniques.

**UNIT- II**

**Cutting and joining DNA:** (cohesive end ligation, methods of blunt end ligation). Transfection and transformation. Selection of transformed cells. Screening methods (Genetic marker and blue white screening).

Cloning vehicles - Plasmid, Bacteriophage, Construction of genomic and cDNA libraries. Advantages of cDNA libraries.

**UNIT- III**

**Microbial production of fuels:** alcohols, hydrogen and methane. Microbial production of polymers: xanthanes gums.

**Biomass and bio fuels:** plant biomass (cellulose, starch, pectin, gum materials). Animal biomass (chitin, milk, whey, slaughter, house waste). Microbial biomass (algal blooms, in fresh and sea water), fungal mushrooms, fermentation waters by yeasts, and bacterial biomass. Concept of single cell proteins, probiotics and their applications.

**UNIT- IV**

**Methods of gene sequencing** –Maxam-Gilberts and Sanger's dideoxy chain termination methods; Polymerase chain reaction technique (Components in PCR and PCR conditions). Methods of gene transfer in fungi, yeast and higher plants using microinjection, microprojectile bombardment (gene gun method, Electroporation and *Agrobacterium* mediated transformation. Expression of cloned genes in bacteria, yeast, plant and animal cells. Basic principles and application of biosensors. Nucleic acid probe technology.



### UNIT- V

Concept of genetically modified microorganisms. Bt cotton: production, advantages and limitations. Probable advantages and disadvantages of genetically modified crops. Role of microorganisms in creation of transgenic animals and plants.

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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2) *M. S. S.*  
3/1/22

3) *K. Venkata Reddy*

4) *Sleni*

5) *Sat*

6) *P. Sathya*



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**II.B.Sc; MICROBIOLOGY**

**FIFTH SEMISTER—PAPER-VI**

**MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY**

**Time: 3Hrs**

**Max.Marks:75**

**SECTION- A**

**I. Answer any FIVE questions. Each question carries 5 marks. 5×5=25 Marks**

1. Yeast
2. Bio- fuels
3. Polymerases
4. Genetic markers
5. c-DNA libraries
6. Microbial production of Hydrogen
7. Biosensors
8. Transgenic animals

**II. Answer any five of the following questions atleast Two from each section B & C. draw a labeled wherever necessary. Each answer carries 10 marks.**

**5×10=50 Marks**

**SECTION- B**

9. Write Recombinant microbial biotechnology products for human therapeutics.
10. Discuss bio fuel production from plant biomass.
11. Discuss various restriction endonucleases.
12. Write any two blotting techniques.
13. Describe various cloning vehicles.

**SECTION- C**

14. Explain microbial production of alcohol.
15. Explain gene sequencing methods.
16. Write gene transfer methods.
17. Discuss production, advantages and limitations of Bt. Cotton.
18. Explain Role of microorganisms in creation of transgenic plants.

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2 *M. Sridhar*  
3/9/22

4 *Sheri*

5 *Sathish*

3 *K. Venkata Reddy*

6 *Roathub*



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**III B.Sc; MICROBIOLOGY**

**FIFTH SEMISTER—PAPER-VI**

**MICROBIAL BIOTECHNOLOGY AND r – DNA TECHNOLOGY LAB**

**Skills Outcomes:**

On successful completion of this practical course student shall be able to

1. Students learn the practical skill about the crude extraction of DNA from plant and animal sources.
2. Learn invitro amplification of DNA and its applications.
3. To understand the mechanism of gene transfer, expression and regulation.
4. Students will able to understand the commercial production of wine, alcohol and mushrooms.

**Practical syllabus**

1. Culturing of mushrooms
2. Isolation of yeast from grapes.
3. Production of wine
4. Production of ethyl alcohol
5. Isolation of Plasmid DNA from E.coli
6. Tissue culture: callus cultivation
7. Fermentative production of ethyl alcohol
8. Transformation in Bacteria using plasmid.
9. Restriction digestion of DNA and its electrophoretic separation.
10. Ligation of DNA molecules and their testing using electrophoresis.
11. Activity of DNAase and RNAse on DNA and RNA.
12. Isolation of Plasmid DNA.
13. Demonstration of PCR.

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2. *M. S.*  
3/9/22

4. *Sheri*

3. *K. Venkata Reddy*

5. *Gath*

6. *Prateek*





# **III B.Sc, MICROBIOLOGY**

## **SEMESTER -V**

### **2022-2023**



**Department of Microbiology**

**Sri Y.N.College (Autonomous)**  
**Narsapur. Andhra Pradesh.**



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**III B.Sc; MICROBIOLOGY**  
**FIFTH SEMESTER- PAPER-VII**  
**BIOSTATISTICS AND BIOINFORMATICS**

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**Learning outcomes:**

Student after successful completion of the course will be able to

1. Understand biological data bases.
2. Summarize Searching sequence data bases.
3. students able to use appropriate tests for bio variable analysis.
4. Able to understand analytical tests and Construction of phylogenetic trees by clustering methods.
5. Able to understand protein modelling methods .

**UNIT – I**

Definition, nature and scope of bioinformatics. Bioinformatics versus computational biology. Branches of bioinformatics. Basic concepts in bioinformatics. Introduction to Biological data bases: NCBI, EMBL, EXPASY, PIR, Pfam. Concept of World Wide Web: HTML, HTTP.

**UNIT – II**

Searching sequence data bases using BLAST. Multiple sequence alignment– progressive alignment–profiles–multi dimensional dynamic programming. Biostatistics: Measures of Central tendency and distribution–mean, median, mode, range, standard deviation, variance.

**UNIT – III**

Basic principles of probability theory, Bayes theorem, Normal distribution, statistical inference –Types of errors and levels of significance. Comparison of variance (F-test), small sample test, t- test for comparison of means, chi square test. Analysis of variance–one way and two way, multiple comprises.

**UNIT – IV**

Correlation and Linear regression. Sequence Analysis: Introduction to hidden Markov models. Genomics and proteomics: Molecular phylogenetics: Construction of Phytogenetic trees using parsimony method and branch & bound method. Clustering methods– UPGMA & neighbor-joining. Fragment assembly, peptide sequencing using mass and spectroscopy data. Comparative genomics.

**UNIT – V**

Modeling: Protein secondary structure prediction–Chou Fasman rules– Neural networks–discriminant analysis. Prediction of transmembrane segments in Membrane proteins. Protein 3D structure prediction– homology– threading – Potential energy functions–energy minimization–molecular dynamics–simulated annealing.

### SUGGESTED READINGS:

1. Daniel, 2006, Biostatistics, Eighth Edition. John Wiley and sons.
2. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.
3. T.A. Attwood and D.J. Parry-Smith, 2001, Introduction of Bioinformatics.
4. A.D. Baxevanis, 1998, Bioinformatics: A practical guide to the analysis of Genes and proteins, (Edited) B.F. Publication.
5. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2nd Edition By Mount CBS publishers.

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	ESSAY QUESTIONS	SHORT ANSWER QUESTIONS
UNIT -I	2	2
UNIT-II	2	1
UNIT-III	2	2
UNIT-VI	2	1
UNIT-V	2	2

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2) *M. G. Suresh*  
3/9/22

3) *K. Venkatesh Reddy*

4) *Sheri*

5) *Sathya*

6) *Pratishtha*





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**III B.Sc; MICROBIOLOGY**

**FIFTH SEMESTER- PAPER-VII**

**BIostatistics AND BIOinformatics**

Times: 3Hrs

Max.Marks:75M

**SECTION-A**

**I. Answer any FIVE questions. Each question carries 5 marks. 5×5=25 M**

1. NCBI
2. HTML
3. Standard deviation
4. BLAST
5. F- test
6. Chi square test
7. Proteomics
8. Simulated annealing

**II. Answer any five of the following questions atleast Two from each section B & C. draw a labeled wherever necessary. Each answer carries 10 marks.**

**5×10=50 M**

**SECTION- B**

9. What are the structural domain resources.
10. List three major DNA sequence databases.
11. Discuss the dynamic programming in sequence alignment.
12. Write Bayes thermo.
13. Discuss correlation and regression.

**SECTION -C**

14. Write on analysis of variance.
15. Describe peptide sequencing.
16. Write gene transfer methods.
17. Discuss protein secondary structure prediction methods.
18. Explain protein 3D secondary structure prediction methods.

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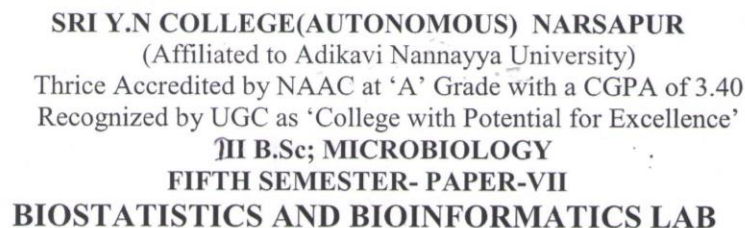
2 M. S. 3/9/22

3 K. Venkatesh Reddy

4 Sleni

5 Gath

6 Prathap



On successful completion of the practical course student shall be able to

- Practical syllabus:**

- ### SUGGESTED READINGS:

1. Daniel, 2006, Biostatistics, Eighth Edition. John Wiley and sons.
2. Durbin, Eddy, Krogh, Mithison, Biological sequence analysis.
3. T.A. Attwood and D.J. Parry-Smith, 2001, Introduction of Bioinformatics.
4. A.D. Baxevanis, 1998, Bioinformatics: A practical guide to the analysis of Genes and proteins, (Edited) B.F. Publication.
5. David W, 2005, Bio-informatics; sequence and Genome Analysis, 2nd Edition B. Morgan CB Publishers.

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