**Sant Gadge Baba Amravati University, Amravati**

**Faculty :** Science and Technology

**Programme :** B.Sc. (Microbiology)

**Course** : B.Sc II Semester III

## POs:

Students of undergraduate general degree programme at the time of graduation would be able to

- **PO1.** Critical Thinking : Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- **PO2**.Effective Communication : Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- **PO3**.Social Interaction : Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- **PO4**.: Effective Citizenship : Demonstrate empathetic social concern and equity centre national development ,and the ability to act with an informed awareness of issues and participate in civil life through volunteering
- **PO5.** Ethics : Recognize different value systems including your own, understand the moral dimensions of yourdecisions, and accept responsibility for them.
- **PO6**. Environment and Sustainability : Understand the issues of environmental contexts and sustainabledevelopment.
- **PO7.** Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in thebroadest contexts socio-technological changes.

**PSOs:**

Upon completion of the program me successfully, The students would be able to

- **PSO 1** Gain insight of Microbiology starting from history and fundamental knowledge about themicroorganisms.
- **PSO 2** Acquire the skill in the use and care of basic microbiological equipment and can perform basiclaboratory procedures in microbiology.
- **PSO 3** Be well-informative about the integral role of microorganisms and different branches of Microbiology.
- **PSO 4** Be acquainted with the basic concept of prokaryotes, their taxonomy, their differentiation from eukaryotes.

- **Employability Potential of the Programme:**

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

Medical Microbiology refers to the use of Microbiology in the Healthcare Industry. Microbiology firms are at the heart of the Healthcare Industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as Molecular Biology, Cell Biology, Recombinant Technology, and immune therapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in Research and Development, Pharmaceutical Companies, Hospitals, Diagnostic Centers, Manufacturing Sector of Microbiology, and Academic Sector. Many of our students have joined as Microbiologist at renowned pharmaceutical companies. Our students have also joined COVID-19 diagnostic laboratories across various districts, thus helping the society. Beside these students has also joined vaccine manufacturing institutions.

Previously, this field only focused with the discovery and development of small molecules

(drugs), but the industry has evolved throughout time. This industry's horizon has widened. Biopharmaceutics has added a new dimension to the industry. The use of Microbiology in drug research and discovery has always been a component of the process, but the addition of biologics as therapeutic elements has resulted in a rise of biotech businesses in the pharmaceutical sector. To begin, consider cell-based treatments, monoclonal antibodies, vaccinations, and other medicines. In this regard our students has got jobs in various pharmaceutical industries.

Low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are just a few of the issues that have plagued agriculture. Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly.

Food Microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. Almost all food industries need pure water. The bacterial quality of water is tested by Microbiologist. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environmental Microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of Microbiology. All these issues are now being addressed by using Biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories.

- **Transferable Skills:**

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas. These are:

• Analytical skill
• Report writing skill
• Presentation skill
• Time management
• Creative thinking
• Problem solving
• Planning
• Observational skill

- **Job Opportunities:** After successful completion of B.Sc. in Microbiology student may continue further studies like M.Sc. in Microbiology and then Ph.D. in Microbiology and make career in research field. Students have opportunities in private as well as public sectors.
- **Private Sector:** Biochemist can work in quality control, quality assurance and R & D divisions of companies like- Biotech companies, pharmaceutical companies, Chemical manufacturing companies, Food and Drink (includes brewing), Health and Beauty Care, Medical Instrument companies, Agricultural companies, Research Companies and Laboratories etc**.**
- **Public Sectors:** Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.
- **Government Sector** : Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug

administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary Inspectors for schools etc.

- **Job profiles:** Biochemist, Biologist, Biomedical Scientist, Biotechnologist, Chemical Examiners, Chemist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Microbiologist, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Microbiology students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Microbiology discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 10 / 07 /2023 resolved to accept the revised syllabus for B. Sc. II Sem. III and IV (Microbiology) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

**Sant Gadge Baba Amravati University Amravati**
**Scheme of teaching, learning &Examination leading to the Degree Bachelors of Science (Choice Based Credit System)C (Three Years Six Semesters Degree Programme- C.B.C.S)**

**(B.Sc. Part-II) (Semester-III) MICROBIOLOGY**

| SN | Subjects | Subject Code | Teaching & Learning Scheme | | | | | | | Duration of Exam Hrs. | Examination and Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Teaching Period Per week | | | | Credits | | | | Maximum Marks | | | | | Minimum Passing | |
| | | | L | T | P | Total | Theory | Practical | Total | | Theory + MCQ External | Skill Enhancement module Internal | Practical | | Total Marks | Marks | Grade |
| 1 | MCB (3S) Medical Microbiology (Theory ) | MCB (3S)T | 6 | | | 6 | 4.5 | | 4.5 | 3 hours | 80 | 20 | Internal | External | 100 | 40 | p |
| 2 | MCB (3S) Practical | MCB (3S) Pr. | | | 6 | 6 | | 2.25 | 2.25 | 3 Hours | | | 25 | 25 | 50 | 25 | p |
| 3 | Total | | 6 | | 6 | 12 | 4.5 | 2.25 | 6.75 | 6 hours | 80 | 20 | 25 | 25 | 150 | 65 | P |

# Syllabus Prescribed for 2023-2024

## UG Programme

**Programme : UG in Microbiology**

**Semester-III**

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|---|---|---|
| **MCB-(3S) T** | **Medical Microbiology** | **90** |

## Cos

Upon completion of course successfully, students would be able to

- **CO 1** Evaluate the prevalent communicable diseases of National importance and of the newer emerging pathogens.
- **CO 2** Understand the concept of Immunity, Antigen, Antibody and Immune system.
- **CO 3** Differentiate the structure and Classes of Immunoglobulins and their diversity.
- **CO 4** Understand the principles of immunology and its application in the diagnosis and prevention of infectious diseases.
- **CO 5** Apply the diagnostic techniques of Serology
- **CO 6** Determine the mode of entry and transmission of pathogen, symptoms, Laboratory diagnosis, and treatment for infectious diseases.
- **CO 7** Evaluate the antibiotic susceptibility of bacterial pathogens

| COURSE MODULE | UNIT | CONTENT |
|---|---|---|
| **DSC** | **Unit-I**<br>**Principles of Epidemiology** | **a)** Definition, Scope & Application of epidemiology.<br>**b)** Incidence & prevalence rates, Mortality & Morbidity rates<br>**c)** Infection- Types of infection<br>Epidemiology of infectious diseases: |

| | | |
|---|---|---|
| | | 1) Sources & reservoir of infection<br>2) modes of transmission<br>**d)** Measures for prevention of epidemics with Global health consideration<br>**e)** Epidemiological aspects of AIDS & COVID 19<br>**f)** Outline of Infection process - pathogenicity and virulence, Microbial virulence factors: toxins, enzymes<br>**(15 Periods)** |
| | **Unit-II**<br>**Immunology** | **a)** Organs and cells of immune system<br>**b)** Outline of Specific and Nonspecific factors in defense mechanism<br>**c)** Immunity- Definition and classification<br>**d)** Immune response: Antibody Mediated & Cell mediated Immune Response, Primary & Secondary Immune response<br>**e)** Autoimmunity & auto-immune diseases (Ex. Rheumatoid Arthritis and Myasthenia Gravis)<br>**(15 Periods)** |
| | **Unit-III**<br>**Serology** | **a)** Antigens- Definition, types and factors determining antigenicity, Bacterial antigens.<br>**b)** Antibodies (Immunoglobulins)- Definition, Structure, classification, Properties and differences<br>**c)** Monoclonal antibodies definition and applications<br>**d)** Antigen Antibody reactions- Agglutination-Blood grouping and WIDAL test, Precipitation - VDRL Test, Types of Immunodiffusion, Complement Fixation Test, ELISA and RIA.<br>**(15 Periods)** |
| | **Unit-IV**<br>**Pathogenic**<br>**Microorganisms** | **A) Bacteria :** Study of following bacteria with respect to their morphology, cultural and biochemical properties, pathogenesis, laboratory diagnosis and prophylaxis<br>a. *Staphylococcus aureus.*<br>*b. Clostridium tetani.*<br>*c. Salmonella typhi.*<br>*d. Mycobacterium tuberculosis.*<br>**B) Viruses-**<br>a) Rabies.<br>b) Dengue |

| | | |
|---|---|---|
| | | c) Corona<br>**C) Fungi-**<br>a) *C. albicans*<br>**(15 Periods )** |
| | **Unit-V Antimicrobial chemotherapy** | **a)** Ideal characters of chemotherapeutic agents<br>**b)** Major antimicrobial agents and its clinical uses:<br>**i)Antibacterial agents**: Rifampicin, Chloramphenicol, Streptomycin and Ciprofloxacin<br>**ii) Antiviral agents**: Azidothymidine, Amantadine.<br>**iii) Antifungal agents**: Griseofulvin, Amphotericin B, Imidazole.<br>**c)** Basic mechanism of antibiotic action<br>**d)** Antimicrobial susceptibility testing: Introduction to CLSI (NCCLS), MIC. Disc diffusion, agar dilution, broth dilution (macro and micro).<br>**e)** Introduction to antibiotic Resistance<br>( **15 Periods)** |
| **SEM** | **Techniques of Diagnostic Microbiology Laboratory** | **1.** Collection, Transportation and Cultural examination of Urine, Blood, Sputum, Stool, Pus, CSF.<br>**2.** Sample collection techniques for diagnosis of Mycotic infections – Skin scrapping, Nails Clipping, Sputum, Hair plucking<br>**3.** To detect the fungi by direct microscopic method<br>**4**. Detection of fungal elements –<br>a) KOH preparation,<br>b) Iodine.<br>c) India Ink,<br>d) Lactophenol Cotton Blue Staining |

| | | |
|---|---|---|
| | | **5.** Disposal of clinical samples<br>**6.** Antimicrobial susceptibility testing and determination of MIC and MBC, Kirby- Bauer Disc diffusion Technique, Agar dilution, Broth dilution (Macro and Micro).<br>**7.** Antifungal susceptibility testing by Automation techniques in Diagnostic Microbiology<br>(**15 Periods)** |

## COs

**The student would be able to understand**

- **CO 1** proper methods of collection, storage & transport of clinical material for Microbiological investigations.
- **CO 2** methods of disinfection and sterilization and their application to control and prevent hospital and community acquired infections including universal biosafety precautions and waste disposal.
- **CO 3** Get Employment in Microbiological & Pathological Laboratories

**Activities for SEM**:
1. Class test (10 Marks)
2. Assignments (5Marks)
3. Project/Field visit /Study Tour / Innovative activity (5 Marks)

# Syllabus Prescribed for 2023-2024

## UG Programme

## Programme : UG in Microbiology

## Semester-III

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|---|---|---|
| MCB-(3S)Pr | MCB-(3S) Practical | 06 / per week /per batch |

**COs**

Upon completion of the course, the student would be able to:

- **CO 1** Isolate and identify the bacteria
- **CO 2** Analyse the Antibiotic Resistance
- **CO 3** Perform the different serological Tests

**Practical: 3S Microbiology**

**List of Practical/Laboratory Experiments/Activities etc.**

**1.** Studies of microbial enzymes

**a)** Urease **b)** Coagulase **c)** Oxidase

**1** Study of Sugar Fermentation Test

**2.** Study of Indole Test

**3**. Study of Methyl Red Test

**4.** Study of Voges Proskauer Test

**5**. Study of Citrate Test

**6.** Isolation and Identification of *Staphylococcus aureus* and its Antibiotic sensitivity.

**7.** Isolation and Identification of *E. coli* and its Antibiotic sensitivity.

**8.** To perform Widal Test

**9.** To perform RPR Test

**10.** To perform Blood Grouping Test

**11.** Study of human pathogenic Fungi using permeant slides

**The distribution of marks for the practical examination shall be as follows:**

| **External Examination** | | **Internal Examination** | |
|---|---|---|---|
| Performance of any two experiments | 20 marks | Attendance & students performance | 10 Marks |
| Viva-voce | 05 marks | Practical Record book | 10 Marks |
| | | MCQ/ Spotting | 05 Marks |
| **Total** | 25 Marks | **Total** | 25 Marks |

**Course Material/Learning Resources**

1.Medical Bacteriology : Dey N.C. & Day T.K.

2. Medical Microbiology Vol. I & II : Cruickshank K.R.

3. Text Book of Microbiology : Ananthanarayan R. & C.E. Panikar

4. Medical Parasitology : Dey N.C. & Dey T.K.

5. Dorland's Pocket Medical Dictionary

6. Microbiology : Zinsser W.

7. Preventive & Social Medicine : Park & Park

8. General Microbiology & Immunity : S.G.Wilson. Vol. I & II

9. Medical Microbiology : R. Anantnarayan

10. Fundamental Priciples of Bacteriology : A.J.Salle.

11. Microbes & Diseases of Man : W.C.Deb. (Helminthology)

12. Microbiology : B.D.Davis, R.Dulbecoco, H.N.Eisen, H.S.Ginsburg.

13. Parasitology : K.D.Chatterjee

14.Text Book of Medical Microbiology: H.L.Chopra.

**PRACTICALS :**

1. Microbes in Action : Saley, Wandermark, Tarporewala, Bombay.

2. Medical Microbiology Vol.II : R.Cruickshank.

3. A manual of Microbiological Methods. : A.J.Salle

4. Microbiological Methods : Collins

5. Difco mannual

6. A Textbook of Practical Microbiology (Ist Edition) B. Sc. Part II :Dnyanpath Publication R. R. Pachori, P.S. Sadar, A.M. Pande Edited by: N.S. Kulkarni

7. A Textbook of Practical Microbiology (IInd Edition) B. Sc. Part II :Dnyanpath Publication P.S. Sadar, A.M. Pande Edited by: R. R. Pachori

# Sant Gadge Baba Amravati University, Amravati

**Faculty** : Science and Technology

**Programme** : B.Sc. (Microbiology)

**Course** : B.Sc II Semester IV

**POs:**

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- **PO1.**Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

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**PSOs:**

Upon completion of the programme successfully, The students would be able to

- **PSO 1** Gain insight of Microbiology starting from history and fundamental knowledge about themicroorganisms.
- **PSO 2** Acquire the skill in the use and care of basic microbiological equipment and can perform basiclaboratory procedures in microbiology.
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**Employability Potential of the Programme:**

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

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molecules (drugs), but the industry has evolved throughout time. This industry's horizon has widened. Biopharmaceutics has added a new dimension to the industry. The use of microbiology in drug research and discovery has always been a component of the process, but the addition of biologics as therapeutic elements has resulted in a rise of biotech businesses in the pharmaceutical sector. To begin, consider cell-based treatments, monoclonal antibodies, vaccinations, and other medicines. In this regard our students has got jobs in various pharmaceutical industries.

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Food Microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. Almost all food industries need pure water. The bacterial quality of water is tested by Microbiologist. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

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Beside job opportunities in the sector of Agriculture, pharmaceutical and Food Industries, our students are working as Research Fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and Private Pathological Laboratories.

**Transferable Skills:**

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas. These are:

• Analytical skill
• Report writing skill
• Presentation skill
• Time management
• Creative thinking
• Problem solving
• Planning
• Observational skill

- **Job Opportunities:** After successful completion of B.Sc. in Microbiology, student may continue further studies like M.Sc. in Microbiology and then Ph.D. in Microbiology and make career in research field. Students have opportunities in private as well as public sectors.
- **Private Sector:** Biochemist can work in quality control, quality assurance and R & D divisions of companies like- Biotech companies, pharmaceutical companies, Chemical manufacturing companies, Food and Drink (includes brewing), Health and Beauty Care, Medical Instrument companies, Agricultural companies, Research Companies and Laboratories etc**.**
- **Public Sectors:** Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.
- **Government Sector** : Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug

administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary inspectors for schools etc.

- **Job profiles:** Biochemist, Biologist, Biomedical Scientist, Biotechnologist, Chemical Examiners, Chemist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Microbiologist, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Microbiology students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Microbiology discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 10 /07 /2023 resolved to accept the revised syllabus for B. Sc. II Sem. III and IV (Microbiology) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

**Sant Gadge Baba Amravati University Amravati**
**Scheme of teaching, learning &Examination leading to the Degree Bachelors of Science (Choice Based Credit System) (Three Years Six Semesters Degree Programme- C.B.C.S)**

**(B.Sc. Part-II) (Semester-IV) MICROBIOLOGY**

| SN | Subjects | Subject Code | Teaching & Learning Scheme | | | | | | | Duration of Exam Hrs. | Examination and Evaluation Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Teaching Period Per week | | | | Credits | | | | Maximum Marks | | | | | Minimum Passing | |
| | | | L | T | P | Total | Theory | Practical | Total | | Theory + MCQ External | Skill Enhancement module Internal | Practical | | Total Marks | Marks | Grade |
| 1 | MCB (4S) Biochemistry and Molecular Biology (Theory ) | MCB (4S)T | 6 | | | 6 | 4.5 | | 4.5 | 3 hours | 80 | 20 | Internal | External | 100 | 40 | p |
| 2 | MCB (4S) Practical | MCB (4S) Pr. | | | 6 | 6 | | 2.25 | 2.25 | 3 Hours | | | 25 | 25 | 50 | 25 | p |
| 3 | Total | | 6 | | 6 | 12 | 4.5 | 2.25 | 6.75 | 6 hours | 80 | 20 | 25 | 25 | 150 | 65 | P |

**Syllabus Prescribed for 2023-2024 UG Programme**

**Programme : UG in Microbiology**

**Semester-IV**

| Code of the Course /Subject | Title of the Course/Subject | Total Number of Periods |
|---|---|---|
| **MCB-(4S) T** | **Biochemistry and Molecular Biology** | **90** |

**COs**

After the completion of this course, the student will have knowledge about

- **CO 1** structure and function of biomolecules
- **CO 2** the classes of enzymes
- **CO 3** concepts and terminologies of enzymes
- **CO 4** importance and applications of various enzymes in the processes viz.
- **CO 5** Replication transcription and translations etc
- **CO 6** mutation, its types, and related effects.
- **CO 7** recombination- transduction, conjugation and transformation
- **CO 8** techniques used for DNA transformation in host cells, design of various vectors used for plants, animals and microorganisms and their modification strategies.
- **CO 9** different types of Vectors and enzymes used in r DNA technology

| COURSE MODULE | UNIT | CONTENT |
|---|---|---|
| **DSC** | **Unit-I**<br>**Biomolecules** | **A)** Structure and function of biomolecules<br>a. Carbohydrates<br>b. Proteins<br>c. Nucleic acid (DNA & RNA)<br>d. Lipids<br>**B)** Biosynthesis of DNA and RNA<br>**a)** Replication of DNA- Mechanism of replication with enzymes involved, models of replication: Knife and fork, |

| | | |
|---|---|---|
| | | rolling circle.<br>**b)** Transcription (RNA synthesis)<br>(**15 Periods)** |
| | **Unit-II**<br>**Gene expression and regulation** | **a)** Concept of gene – Definition of Gene, gene within gene, split gene.<br>**b)** Concept of Genetic code<br>**c)** Outline of Translation (Protein synthesis)<br>**d)** Gene regulation Mechanisms - *lac* operon ,Trp operon<br>**(15 Periods)** |
| | **Unit-III**<br>**Gene mutation and bacterial Recombination** | **A.** Mutation- Definition & types of mutations – Base pair substitution, frame-shift, point, missense, nonsense & silent mutations, Effect of Mutation on Phenotype (Sickle cell anemia<br>**B.** Molecular basis of spontaneous and induced mutations - Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogues, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays, U.V. light.<br>**Mechanism of recombination :**<br>Breakage and reunion<br>**Transfer of genetic material in prokaryotes:**<br>**a)** Transformation : Experiment of Griffith. Avery, MacLeod and McCarty experiment to prove Genetic Transformation. Mechanism of Transformation.<br>**b)** Transduction: Experiment of Zinder and Lederberg. General mechanism of Transduction. Types of Transduction: Generalized and Restricted,<br>**c)** Conjugation: Experiment of Lederberg and Tatum, Experiment of Davis, Nature and function of F Plasmid. Hfr formation. Various Mating types. Mechanism of conjugation: i) F+ x F ii) Hfr X F – .<br>**(15 Periods)** |

| | | |
|---|---|---|
| | **Unit-IV**<br>**Introduction and tools of genetic engineering** | **a)** Introduction to basic technique of genetic engineering.<br>**b)** Enzymes for splicing: Restriction endonucleases.<br>**c)** Range of DNA manipulating enzymes: Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases.<br>**d)** Vectors: Ideal characters and types: Plasmid ($pBR_{322}$, pUC19), Cosmid, Phagemid (p Bluescript) and Bacteriophage (M13, and Lambda gt 10,11), expression vectors.<br>**e)** Host Microorganisms for Genetic Engineering (*E. coli, S. cerevisiae*)<br>**(15 Periods)** |
| | **Unit-V**<br>**Enzymology and Metabolism** | **A) Enzymology**<br>**a)** Nature and Definition.<br>**b)** Classification and nomenclature of enzymes.<br>**c)** Terminologies used in enzymology - Enzyme, active site, substrate, co-enzyme , cofactors, prosthetic group, polo enzyme, apoenzyme, activation energy, isoenzyme, allosteric enzyme, inhibitors, immobilized enzymes.<br>**B) Metabolism :**<br>**a)** General strategies of metabolism.<br>**b)** EMP pathway, TCA cycle.<br>**c)** Oxidative phosphorylation and Electron transport chain.<br>**(15 Periods)** |
| **SEM** | **Skills for Molecular Biology and Genetic Engineering** | **Characterization techniques of biomolecules**<br>**a)** Electrophoresis (Agarose, Polyacrylamide)<br>**b)** Chromatography and its types<br>**c)** Isolation of Genomic DNA from bacteria<br>**d)** Isolation of Plasmid DNA.<br>**e)** Introducing DNA into host cell, competent cells, transformation of competent cells and identification of transformed cell (e.g., Antibiotic resistance gene, blue white selection) Selection |

| | | |
|---|---|---|
| | | of clones: Direct (colony hybridization) and Indirect method (southern blotting).<br>**f)** Definition, method and applications of DNA sequencing (by microarray) and PCR.<br>**g)** Construction of gene library (genomic and cDNA **(15 Periods)** |
| | **COs:**<br>By the end of this module, the students will have knowledge about<br>➢ **CO 1** Basic rDNA Technology and its applications<br>➢ **CO 2** DNA Sequencing and PCR<br>➢ **CO 3** construction of cDNA Libraries | |
| | ****Activities** 1. Class test (10M)<br>2. Assignment (5M)<br>3. Educational Visit /Group discussion /Seminars and projects /Any innovative activity (5M). | |

**Syllabus Prescribed for 2023-2024 UG Programme**

**Programme: UG in Microbiology**

**Semester-IV**

| **Code of the Course /Subject** | **Title of the Course/Subject** | **Total Number of Periods** |
|---|---|---|
| **MCB- (4S) Pr** | **MCB-(4S) Practical** | **6 periods /per week/per batch** |

**COs:**

By the end of this module, the students would be able to:

- **CO 1** acquire knowledge in the qualitative and quantitative estimation of biomolecules
- **CO 2** study the various analytical techniques that are routinely used for separation of biomolecules
- **CO 3** Demonstrate Enzyme activity and enzyme immobilization
- **CO 4** Isolate Genomic DNA from bacterial culture

**Practical: 4S Microbiology**

**List of Practical/Laboratory Experiments.**

1. To perform the Qualitative test for Carbohydrate
2. To perform the Qualitative test for Lipids
3. To perform the Qualitative test for Proteins
4. To perform the Estimation of Proteins
5. To perform the Estimation of DNA
6. To perform the Estimation of RNA
7. To perform the Paper Chromatography of amino acids
8. Demonstrate the activity of Enzyme Amylase
9. To study the Immobilization of enzymes
10. To perform the Bacterial Genomic DNA isolation
11. To perform the Agarose gel electrophoresis of DNA

**The distribution of marks for the practical examination shall be as follows:**

| **External Examination** | | **Internal Examination** | |
|---|---|---|---|
| Performance of any two experiments | 20 marks | Attendance & students performance | 10 Marks |
| Viva-voce | 05 marks | Practical Record book | 10 Marks |
| | | MCQ/ Spotting | 05 Marks |
| **Total** | 25 Marks | **Total** | 25 Marks |

**Course Material/Learning Resources**

1. Text Book of Biochemistry by Dr. O. P. Agrawal.
2. Essentials of Biochemistry by Dr. M. C. Pant.
3. Text book of Biochemistry by West and Todd.
4. Essentials of Food and Nutrition, Volume I & II by Swaminathan.
5. Text book of Biochemistry by Sucheta Dandekar.
6. Text book of Biochemistry by U. Satyanarayana

7. Fundamentals of Biochemistry by J. L. Jain

8. Lehninger, A I., (1982), Principles of Biochemistry, Butterworth Publishers, New York.

9. Palmer T., (1985). Understanding Enzymes. 2nd Ed., Ellis Horwood Ltd., Chichester

10. Price, N. C, Stevens, L, (1989), Fundamentals of Enzymology, 2"d Ed.,Oxford Sci. Publ., Oxford

11. Fundamentals of Biochemistry (1999) by Donald Voet, Judith Voet, Charlotte Pratt, John Wiley & Sons, N.Y. 145 146

12. Biochemistry 3rd edition (1994) by Lubert Stryer WH Freeman and Co. San Francisco.

13. General Enzymology by M.S. Deshpande and N. S. Kulkarni (Himalaya publication)

14. Molecular Biology of Cell : J.D. Watson, D.Bray

15. Genetic Engineering and its applications : Joshi P.

16. Cell Biology : C.B. Pawar

17. Genetics Vol. I &II : C.B. Pawar

**PRACTICALS :**

1. Practical Manual in Biochemistry by Jairaman

**2.** An Introduction to Practical Biochemistry by David T Plummer

3. A Textbook of Practical Microbiology (Ist Edition) B. Sc. Part II :Dnyanpath Publication R. R. Pachori, P.S. Sadar, A.M. Pande Edited by: N.S. Kulkarni

4. A Textbook of Practical Microbiology (IInd Edition) B. Sc. Part II :Dnyanpath Publication P.S. Sadar, A.M. Pande Edited by: R. R. Pachori