**ಅನುಮೋದನೆ**

ವಿದ್ಯಾರ್ಥಿ: ಎಂ.ನ್ಯ. ರಾಜೇಶ್ ಶ್ರೀವಾಸ್ತ್ವ ಇಂಗ್ಲಿಷ್ ಸಂಸ್ಥಾನದ ವಿದ್ಯಾರ್ಥಿಯಾಗಿದ್ದಾರೆ, ಇತರೆ ವಿಭಾಗಗಳನ್ನು ಸಂಕ್ಷೇಪದಾಂತ್ರಿಕವಾಗಿ ನಡೆಸಬಹುದು, ಹೊಸ ಶ್ರೇಣಿಯಲ್ಲಿಯೇ ಸಂಗ್ರಹಿಸಲು ಅಬ್ಜನವಾಡಲಾಗಿದೆ.

ಇತ್ಯೇ 1) ಇಸ್ಲಾಮ್ ವಿಭಾಗದ ವಿದ್ಯಾರ್ಥಿ ಹೆಸರಿನಂತೆ: 12.06.2018.
2) ಇಸ್ಲಾಮ್ ವಿಭಾಗದ ವಿದ್ಯಾರ್ಥಿ ಹೆಸರಿನಂತೆ: 14.06.2018.
3) ರಾಜೇಶ್ ಶ್ರೀವಾಸ್ತ್ವ ವಿದ್ಯಾರ್ಥಿ ಹೆಸರಿನಂತೆ: 26.06.2018.

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ಇತ್ಯೇ 3) ಇನ್ನೊಂದು ವಿಭಾಗದ ಸಂಖ್ಯೆಯಿಂದ ಕ್ರಮಾತ್ಮಕವಾಗಿ, ವಿದ್ಯಾರ್ಥಿಯು II ವಿಭಾಗದ, VI ಶ್ರೇಣಿಯಿಂದ ಸಂಬಂಧಿಸಿದ ವಿವರಣೆಗಳನ್ನು ಸಂಗ್ರಹಿಸಿದ್ದಾಗಿದೆ, ಹೊಸ ಶ್ರೇಣಿಯಲ್ಲಿ ಸಂಜೋತಳಿಸಿದ್ದಾಗಿದೆ. ನಂತರ 14.06.2018. ತಿಳಾತಿಗೆ ಹೊಸ ಶ್ರೇಣಿಯಲ್ಲಿ ರಾಜೇಶ್ ಶ್ರೀವಾಸ್ತ್ವ ಹೆಸರಿನಂತೆ ತೆರೆಯಲಾಗಿದೆ. ಇದು ಸಂಬಂಧವಿದ್ದ ವಿಭಾಗದ ಶ್ರೇಣಿಯು 2018-19ರ ಸಂದರ್ಭದಲ್ಲಿ ಸಂಜೋತಳಿಸಿದ್ದಾಗಿದೆ, ಹೊಸ ಶ್ರೇಣಿಯಲ್ಲಿ ಸಂಜೋತಳಿಸಿದ್ದಾಗಿದೆ.


**ಒಬ್ಬರು**

1. ದಿಸ್ನೇಯ ವಿಭಾಗದ ವಿದ್ಯಾರ್ಥಿ ಅನುಮೋದಿಸಿದ್ದಾರೆ, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ.
2. ವಿದ್ಯಾರ್ಥಿ ವಿಧಾನಪ್ರದತ್ತಿಯುಳ್ಳ ಸಂಖ್ಯೆ.

**ಬಿಧಿವಾರಿ**

1. ವಿಶ್ವಾಸ, ಸಂಕ್ಷೇಪದಾಂತ್ರಿಕ ವಿವರಣೆಗಳನ್ನು, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ.
2. ಪ್ರತ್ಯೇಕಿಸಿದರೆ (ತನ್ನೂತ್ತರದ), ಶ್ರೀವಾಸ್ತ್ವ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ.
3. ವಿಶ್ವಾಸವಿ, ವಿವರಣೆಗಳನ್ನು ಹೆಸರಿನಂತೆ ವಿಧಾನಾಂತ್ರಿಕ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ.
4. ಪ್ರತ್ಯೇಕಿಸಿದರೆ, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ.
5. ಮೈಲಿಸಿದರೆ, ವಿದ್ಯಾರ್ಥಿಗಳು, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ.
6. ವಿಶ್ವಾಸವಿ, ವಿಧಾನಪ್ರದತ್ತಿಯುಳ್ಳ ಸಂಖ್ಯೆಯಿಂದ ಸಂಜೋತಳಿಸಿದ್ದಾರೆ, ಎ.ತೆ.ಶ್ರೀವಾಸ್ತ್ವ.
7. ಆಧುನಿಕ ವಿದ್ಯಾರ್ಥಿಗಳು / ಮೈಲಿಸಿದರೆ ವಿದ್ಯಾರ್ಥಿಗಳು ಸಂಜೋತಳಿಸಿದ್ದಾರೆ.
GULBARGA UNIVERSITY
DEPARTMENT OF STUDIES IN MICROBIOLOGY

Faculty of Science and Technology

Syllabus for
B.Sc Course with Microbiology
Choice Based Credit System (CBCS)

(With effect from Academic Year 2018-19)

Department of Post Graduate Studies and Research in Microbiology
Gulbarga University, Kalaburagi - 585106,
Karnataka, India
2018
## THE COURSE STRUCTURE OFFERED FOR B.SC. COURSE WITH MICROBIOLOGY AT GULBARGA UNIVERSITY, KALABURAGI EFFECTIVE FROM THE ACADEMIC YEAR 2018-19.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Course code</th>
<th>Course title</th>
<th>Credits L+P</th>
<th>Teaching hours/week L+P=Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Core courses</td>
<td>CCM-1</td>
<td>Introduction to Microbiology and Microbial Diversity</td>
<td>4+2=6</td>
<td>4+2=6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCM-2</td>
<td>Instrumentation &amp; Biotechniques</td>
<td>4+2=6</td>
<td>4+2=6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CCM-3</td>
<td>Bacteriology &amp; Virology</td>
<td>4+2=6</td>
<td>4+2=6</td>
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<tr>
<td></td>
<td></td>
<td>CCM-4</td>
<td>Microbial Physiology, Metabolism and Biochemistry</td>
<td>4+2=6</td>
<td>4+2=6</td>
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<tr>
<td>V</td>
<td>Discipline Specific Elective Course</td>
<td>DSEM-1</td>
<td>Food &amp; Dairy Microbiology</td>
<td>1+1=2</td>
<td>1+1=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DSEM-2</td>
<td>Microbial Genetics &amp; Recombinant DNA Technology</td>
<td>1+1=2</td>
<td>1+1=2</td>
</tr>
<tr>
<td></td>
<td>Skill Enhancement Courses</td>
<td>SECM-1</td>
<td>Microbes in Sustainable Agricultural and Development</td>
<td>4+2=6</td>
<td>8+4=10</td>
</tr>
<tr>
<td>VI</td>
<td>Skill Enhancement Courses</td>
<td>SECM-2</td>
<td>Medical Microbiology &amp; Immunology</td>
<td>1+1=2</td>
<td>1+1=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SECM-3</td>
<td>Industrial Microbiology</td>
<td>1+1=2</td>
<td>1+1=2</td>
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<tr>
<td></td>
<td></td>
<td>SECM--4</td>
<td>Environmental Microbiology</td>
<td>4+2=6</td>
<td>8+4=10</td>
</tr>
</tbody>
</table>

**Total credits for Botany Courses**: 44

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**CHAIRMAN**

*Department of Microbiology*

*Gulbarga University, Kalaburagi-585106*
SEMESTER-I
CCM-I: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

CREDITS: 06
Total Hrs: 60

Preamble:
- Microbiology is an exceptionally broad discipline, encompassing diversified Microbial world. One of the most fascinating and attractive aspects of microbial world is its extraordinary bewildering diversity of living organisms.
- A microbiologist must be acquainted with various biological disciplines and with major group of microorganisms.
- A microbiologist when expose to the subject of microbiology needs an introduction to the whole before concentrating on those parts which are of great concern.

Unit 1: History of Development of Microbiology 15 hrs

Unit 2: Media preparation & Techniques 05 hrs
Microbiological media pure culture technique maintenance & preservation of cultures

Unit 3: Diversity of bacteria 10 hrs
Systems of classification Binomial Nomenclature, Whittaker’s five kingdom and Carl Woese’s three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms. General characteristics of bacteria, viruses and cell organelles with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.

Unit 4: Diversity of algae 10 hrs
Algae History of phycology with emphasis on contributions of Indian scientists; General characteristics of algae including occurrence, thallus organization, algae cell ultra structure, pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction. Applications of algae in agriculture, industry, environment and food.

Unit 5: Diversity of fungi 10hrs
Fungi Historical developments in the field of Mycology including significant contributions of eminent mycologists. General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, Economic importance of fungi with examples in agriculture, environment, Industry, medicine, food, and mycotoxins.

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Unit 6: Diversity of Protozoa  
Protozoa General characteristics with special reference to Amoeba, Paramecium, Plasmodium, Leishmania and Giardia

PRACTICALS:

- Microbiology Good Laboratory Practices and Biosafety.
- To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
- Preparation of culture media for bacterial cultivation.
- Sterilization of medium using Autoclave and assessment for sterility
- Sterilization of glassware using Hot Air Oven and assessment for sterility
- Sterilization of heat sensitive material by membrane filtration and assessment for sterility
- Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
- Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
- Study of Spirogyra and Chlamydomonas, Volvox using temporary Mounts
- Study of the following protozoans using permanent mounts/photographs: Amoeba, Entamoeba, Paramecium and Plasmodium

Suggested reading

SEMESTER –II
CCM-II: Instrumentation & Biotechniques

CREDITS: 06

Total Hrs: 60

Preamble :
- This paper introduces various techniques and instrumentation methods required for the knowledge.
- The student should gain the knowledge of basic techniques through this paper.
- It provides understanding on the techniques and methods of microscopy, spectroscopy, chromatography, electrophoresis, HPLC, TLC, Centrifugation, etc

Unit 1: Microscopy

08 Hrs

Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope

Unit 2: Sterilization Principles types & techniques

12 Hrs

Moist Heat, Dry Heat, Hot Air Oven, Tyndallization, Filtration, Autoclave physical & chemical methods of sterilization

Unit 3: Chromatography

14 Hrs

Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography. Column packing and fraction collection. Gel filtration chromatography, ionexchange chromatography and affinity chromatography, GLC, HPLC.

Unit 4: Electrophoresis

08 Hrs

Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gel electrophoresis.

Unit 5: Spectrophotometry

10 Hrs


Unit 6: Centrifugation

12 Hrs

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.
PRACTICALS

- Study of fluorescent micrographs to visualize bacterial cells.
- Ray diagrams of phase contrast microscopy and Electron microscopy.
- Separation of mixtures by paper/thin layer chromatography.
- Demonstration of column packing in any form of column chromatography.
- Separation of protein mixtures by any form of chromatography.
- Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
- Determination of $\lambda_{max}$ for an unknown sample and calculation of extinction coefficient.
- Separation of components of a given mixture using a laboratory scale centrifuge.
- Understanding density gradient centrifugation with the help of pictures.

Suggested readings:
III SEMESTER  
CCM-III: Bacteriology & Virology  

CREDITS: 06  
Total Hrs: 60  

Preamble:  
- This paper gives an approach to discovery of bacteria, origin and evolution  
- It highlights on numerical taxonomy, ultrastructure of bacteria, bacterial systematics classification, and Morphology  
- It highlights on general structure of viruses Isolation, purification and their cultivation of viruses  

Unit 1: Introduction  
06 hrs  
Introduction: Discovery of bacteria and viruses their origin and evolution  

Unit 2: Morphology and ultrastructure of bacteria  
10 hrs  
Morphology and ultrastructure of bacteria: Size, shape and arrangement - structure, chemical composition of cell wall of archaeabacteria, gram-negative bacteria, gram-positive bacteria and acid fast bacteria; Fine structure, composition and function of cell membrane, capsule, flagella, pili, gas vesicles, ribosomes, mesosomes, reserve food materials, magnetosomes and phycobilisomes, bacterial nucleic acids and genome organization.  

Unit 3: Bacterial systematic  
14hrs  

Unit 4: Introduction to Virology  
10hrs  
Introduction to Virology: History, origin, development and evolution of viruses, plant viruses, animal viruses, modes of transmission  

Unit 5: Bacteriophage  
10hrs  
General structure of viruses: configuration and symmetry- helical and icosahedra; Physical and chemical components - capsomere, capsid, matrix and envelop; Viral genome, nucleoprotein organization, multiplication of viral genomes.  

[Signature]  
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Unit 6: Isolation of viruses

10hrs


PRACTICAL

- Isolation & purification of bacteria from air soil & water
- Simple staining
- Gram’s staining
- Acid fast staining
- Capsule staining
- Flagellar staining
- Isolation purification & cultivation of viruses

Reference Books:

2. N. Woodford & A.P. Johnson 1996; Molecular Bacteriology, Human Press Inc.
3. J.K. Struthers & R.P. Westram, 200; Clinical Bacteriology, Manson Publ. Ltd.
6. S.H. Gillespie & P.M. Hawkey 2006; Principles and Practice of Clinical Bacteriology; John Wiley
7. G.G. Meynell & Elinor Meynell, 2000; Theory & Practice of Experimental Bacteriology, Cambridge
8. Peter Hawkey & Deidre Lewis 1990; Medical Bacteriology, Oxford University Press.
9. Bergey’s Manual of Systematic Bacteriology. 9th Edn. Lippincott Williams, Wilkin Bacteriology,
15. Cappuccino Sherman’s Microbiology- A Laboratory Manual, 7th Ed.,1994; Pearson Education India
SEMESTER- IV

CCM-IV: Microbial Physiology, Metabolism and Biochemistry

Preamble:
- Microbial Physiology and Biochemistry is the language of Biology which have tremendous metabolic diversity.
- The tools for research to the all branches of science are of mainly Biochemical in nature.
- The study of Biomolecules- Carbohydrates, Proteins, Lipids and Nucleic acids gives the information regarding the functioning of cells at molecular level.

Unit 1 Microbial Growth and Effect of Environment on Microbial Growth 10hrs
Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs, acidophiles, alkaliophiles, solute and water activity halophiles, xerophiles, osmophilic, aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe, barophilic. Autotroph/Phototroph, heterotrophy, Chemolithoautotroph, Chemolithoheterotroph, Chemo heterotroph, Chemolithotroph, photolithoautotroph, Photoorganoheterotroph.

Unit 2 Nutrient uptake and Transport 08hrs
Passive and facilitated diffusion Primary and secondary active transport, concept of uniport, symport and antiport. Group translocation

Unit 3 Chemoheterotrophic Metabolism - Aerobic & Anaerobic Respiration Hours:
Concept of aerobic respiration, anaerobic respiration (Denitrification; nitrate/nitrite and nitrate/ammonia respiration; fermentative nitrate reduction) and fermentation fermentation (Homofermentative and Hetero fermentative pathways).

Unit 4 Metabolism 14hrs
Carbohydrate metabolism - Glycolysis, ED, Pentose phosphate pathway TCA cycle, ETC and uncoupplers
Lipid Metabolism: Fatty acid oxidation (β oxidation), energetics of palmitic acid oxidation. Ketone bodies, Biosynthesis of long-chain fatty acids (palmitate).
Unit 5: Bioenergetics
First and second laws of Thermodynamics. Definitions of Gibb’s Free Energy, enthalpy, and Entropy. Standard free energy change and equilibrium constant, Energy rich compounds: Phosphoenolpyruvate, 1,3-Bisphosphoglycerate, Thioesters, ATP.

Unit 6: Biomolecules
Carbohydrates
Families of monosaccharides: aldoses and ketoses, trioses, tetrose, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Disaccharides; concept of reducing and non-reducing sugars, projections of, Polysaccharides, starch and glycogen. Structural Polysaccharides, cellulose, peptidoglycan and chitin.

Lipids
Definition and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions, Essential fatty acids. Triacyl glycerols structure, functions and properties. Saponification Structural lipids.

Proteins
Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitterion. Titration curve of amino acid and its Significance, Classification, biochemical structure and notation of standard protein amino acids.

Enzymes
Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes, Mechanism of action of enzymes: active site, Lock and key hypothesis, and Induced Fit hypothesis. Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanism Definitions of terms – enzyme unit, specific activity and turnover number.

Vitamins
Classification and characteristics with suitable examples, sources and importance

PRACTICAL
1. Study and plot the growth curve of E. coli by turbidometric and standard plate count methods.
2. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data
3. Effect of temperature on growth of E. coli
4. Effect of pH on growth of E. coli
5. Effect of carbon and nitrogen sources on growth of E. coli
6. Effect of salt on growth of E. coli
7. Demonstration of alcoholic fermentation
8. Demonstration of the thermal death time and decimal reduction time of E. coli.
9. Properties of water. Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
10. Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant
11. Standard Free Energy Change of coupled reactions
12. Qualitative/Quantitative tests for carbohydrates, reducing sugars, non reducing sugars
13. Qualitative/Quantitative tests for lipids and proteins
14. Study of protein secondary and tertiary structures with the help of models
15. Study of enzyme kinetics – calculation of Vmax, Km, Kcat values
16. Study effect of temperature, pH and Heavy metals on enzyme activity
17. Estimation of any one vitamin

SUGGESTED READINGS

Preamble:

- This paper would enable students to learn the epidemiology and food borne diseases and pathogens
- Various methods of pathogen detection, beneficial and harmful effects of microbes in food industry, food safety standards, spoilage by microorganisms, food preservation
- Screening of microorganisms strain improvement fermented microbial products, biofuels and industrial applications of microorganisms.

Unit 1: Introduction to Food and Dairy Microbiology  

Unit 2: Food Intoxications  
Staphylococcus aureus, Clostridium botulinum and mycotoxins; Food infections: Bacillus cereus, Vibrio parahaemolyticus, Escherichia coli, Salmonellosis, Shigellosis, HACCP, Indices of food sanitary quality and sanitizers

Unit 3: Food Spoilage  

Unit 4: Milk & Milk products  
Definition, Composition, Nutritive value and Properties. Microbiology of milk. Testing of milk quality

Unit 5: Fermented milk products  
Contamination, spoilage and preservation of milk and milk products. Production, control and Significance of some milk products.

Unit 6: Food Preservation  
Food Preservation: General principles, Physical methods of food preservation (High temperature, Low temperature and Drying), Chemical methods of food preservation (Food additives) and Biological methods of food preservation. Food borne diseases and their control, Food Infection and Intoxication. Detection of food borne pathogens and their toxins by various methods. Patents, GMP and LP.
PRACTICAL

- Study different parts of fermenter
- Microbial fermentations for the production and estimation (qualitative and quantitative) of Enzymes: (a) Amylase and Protease (b) Amino acid: Glutamic acid (c) Organic acid: Citric acid
  Alcohol: Ethanol
- A visit to any educational institute/industry to see an industrial fermenter, and other downstream processing operations
- Isolation microbes from spoiled foods- fruits, vegetables, milk etc
- Identify the industrially important microorganisms.

Suggested readings

SEMESTER - V
DSEM-2: Microbial Genetics & Recombinant DNA Technology (Theory)

CREDITS: 06
Total Hrs: 60

Preamble:
- This paper involves the basic concepts of genetics. It is an important tool in dissecting the
  genetic structure of an organism.
- It gives an idea how genetic information is stored and organized in DNA molecule,
  mutagenesis and DNA repair.
- Type of plasmids, mechanism of genetic exchange, cloning and plasmids exchange,
  transposable elements, are emphasized.

Unit 1: Genome organization and Mutations 10 hrs

Genome organization: E. coli, Saccharomyces, Tetrahymena Mutations and mutagenesis:
Definition and types of Mutations; Physical and chemical mutagens; Molecular basis of
mutations; Functional mutants (loss and gain of function mutants); Uses of mutations Reversion
and suppression: True revertants; Intra- and inter-genic suppression; Ames test; Mutator genes

Unit 2: Plasmids 10 hrs

Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear
plasmids, yeast- 2 μ plasmid, Plasmid replication and partitioning, Host range, plasmid-
incompatibility, plasmid amplification, Regulation of copy number, curing of plasmids

Unit 3: Mechanisms of Genetic Exchange 10 hrs

Transformation - Discovery, mechanism of natural competence Conjugation - Discovery,
mechanism, Hfr and F' strains, Interrupted mating technique and time of entry mapping
Transduction - Generalized transduction, specialized transduction, LFT & HFT lysates, Mapping
by recombination and co-transduction of markers.Features of T4 genetics, Genetic basis of lytic
versus lysogenic switch of phage lambda

Unit 4: Transposable Elements 10 hrs

Prokaryotic transposable elements – Insertion Sequences, composite and non-composite
transposons, Replicative and Non replicative transposition, Mu transposon Eukaryotic
transposable elements - Yeast (Ty retrotransposon), Drosophila (P elements), Maize (Ac/Ds)
Uses of transposons and transposition

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Unit 5: DNA sequencine

DNA sequencing - direct sequencing, indirect sequencing, Maxam and Gilbert method, Sangers method, RNA sequencing, PCR sequencing. Hosts for recombinant DNA technology: Prokaryotes – Bacteriophages, E. coli, B. subtilis, Streptomyces, Eukaryotic – Yeasts and Fungi

Unit 6: Genome libraries

Genome libraries – construction and screening of genome libraries, chromosome walking, cDNA libraries. PCR – principles, types and applications, primer design and applications

PRACTICAL

- Preparation of Master and Replica Plates
- Study the effect of chemical (HNO2) and physical (UV) mutagens on bacterial cells
- Study survival curve of bacteria after exposure to ultraviolet (UV) light
- Isolation of Plasmid DNA from E.coli
- Study different conformations of plasmid DNA through Agaraose gel electrophoresis.
- Demonstration of Bacterial Conjugation
- Demonstration of bacterial transformation and transduction 8. Demonstration of AMES test

Suggested reading

5. SSPrinciples of Genetics. 8th Ed. Wiley-India
6. Russell PJ. (2009), i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
V- SEMESTER
(Skill Enhancement Course Microbiology)

SECM-1: Microbes in Sustainable Agriculture & Development

CREDITS: 06
Total Hrs: 60

Preamble:
- As India is an agricultural country one should have the basic concepts of agriculture in day to day life
- The concepts of agriculture of agriculture microbiology involves plant diseases caused by fungi, bacteria and viruses
- Role of biopesticides, biofertilizers and plant-microbe interactions

Unit 1: Soil Microbiology, Organic & Inorganic Matter in Soil 10hrs
Soil as Microbial Habitat, Soil profile and properties, Soil formation, Diversity and distribution of microorganisms in soil. Mineralization of cellulose, hemicelluloses, lignocelluloses, lignin and humus, phosphate, nitrate, silica, potassium

Unit 2: Biological nitrogen fixation 10hrs
Biological nitrogen fixation: General chemistry, mechanism and genetics of biological nitrogen fixation. Nitrogen fixation by diazotrophs-Rhizobium, Azatobacter, Azosphirillum, Frankia and Blue Green Algae

Unit 3: Microbial Activity in Soil and Green House Gases 06hrs
Carbon dioxide, methane, nitrous oxide, nitric oxide – production and control

Unit 4: Microbial Control of Soil Borne Plant Pathogens 10hrs
Bio control mechanisms and ways, Microorganisms used as biocontrol agents against Microbial plant pathogens, Insects, Weeds

Unit 5: Biofertilization, Phytostimulation, Bioinsecticides 14 hrs
Plant growth promoting bacteria, biofertilizers – symbiotic (Bradyrhizobium, Rhizobium, Frankia), Non Symbiotic (Azosphirillum, Azotobacter, Mycorrhizae, MHBs, Phosphate solubilizers, algae), Novel combination of microbes as biofertilizers, PGPRs.
Biotech feed, Silage, Biomanure, biogas, biofuels – advantages and processing parameters

Unit 6: Genetically Modified Crops (GM Crops) 10hrs
Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals.

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- Study soil profile
- Study microflora of different types of soils
- Rhizobium as soil inoculants characteristics and field application
- Azotobacter as soil inoculants characteristics and field application
- Design and functioning of a biogas plant
- Isolation of cellulose degrading organisms

Suggested readings
SEMESTER – VI

SECM-2: Medical Microbiology & Immunology

CREDITS: 06
Total Hrs: 60

Preamble:
- Medical microbiology deals with the significance of microorganisms in human health
- Students will be exposed to study important diseases caused by microorganisms, modes of transmission, host pathogen interactions and so on
- Immunology is a science dealing with the body’s defence system against various pathogens. It focuses on the concepts of immune factors and immune systems, antigen-antibody reactions and immune diagnosis

Unit 1: Normal Microflora of the Human Body and Host Pathogen Interaction 10hrs
Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection, Pathophysiologic effects of LPS

Unit 2: Bacterial, Viral, Protozoan & Fungal Diseases 10hrs

Unit 3: Immunology and Immunotechnology 10hrs
Introduction: Origin, concept and historical development of immunology.
Immunity: Definition, Types of immunity-Innate and Acquired immunity.

Unit 4: Biology & Immune Cell 10hrs
B cells-Origin, development, maturation and surface molecules. T cells- Origin, development, maturation and surface molecules; Subsets of T cells. Structure and function of T Cell receptors.

Unit 5: Antigen-Antibody Reactions 10hrs
Mechanism and principles of antigen antibody reactions. Types and determination of antigen antibody reactions – Radio immune assay, Ouchterlony double diffusion technique, Complement fixation test, Enzyme linked immunosorbent assay and Immuno blotting
Unit 6: Sample Collection, Transport and Diagnosis

Collection, transport and culturing of clinical samples, principles of different diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes). Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

PRACTICAL

- Identify bacteria (any three of E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
- Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
- Study of bacterial flora of skin by swab method
- Perform antibacterial sensitivity by Kirby-Bauer method
- Determination of minimal inhibitory concentration (MIC) of an antibiotic.
- Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)
- Study of various stages of malarial parasite in RBCs using permanent mounts.

Suggested reading:
SEMESTER- VI
SECM-3: Industrial Microbiology

CREDITS: 06
Total Hrs: 60

Preamble:
- This paper would enable students to learn the epidemiology and food borne diseases and pathogens
- Various methods of pathogen detection, beneficial and harmful effects of microbes in food industry, food safety standards, spoilage by microorganisms, food preservation
- Screening of microorganisms strain improvement fermented microbial products, biofuels and industrial applications of microorganisms.

Unit 1: Industrially Important microorganisms 10hrs
Isolation screening and preservation of industrially important organisms inoculums development for industrial fermentation. Protoplast fusion technique

Unit 2: Media for Industrial fermentation: 08hrs

Unit 3: Types of fermentation processes, Bio-reactors and Measurement of fermentation parameters 14 hrs
Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (eg. baker’s yeast) and continuous fermentations Components of a typical bio-reactor, Types of bioreactors-Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration

Unit 4: Down-Stream Processing 08hrs
Cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying

Unit 5: Microbial Production of Industrial Products 10hrs
Micro-organisms involved, media, fermentation conditions, downstream processing and uses Citric acid, ethanol, penicillin, glutamic acid, Vitamin B12 Enzymes (amylase, protease, lipase) Wine, beer

Unit 6: Enzyme Immobilization 10hrs
Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)
PRACTICAL

- Study different parts of fermenter
- Microbial fermentations for the production and estimation (qualitative and quantitative) of Enzymes: (a) Amylase and Protease (b) Amino acid: Glutamic acid (c) Organic acid: Citric acid
  Alcohol: Ethanol
- A visit to any educational institute/industry to see an industrial fermenter, and other downstream processing operations
- Isolation microbes from spoiled foods- fruits, vegetables, milk etc
- Identify the industrially important microorganisms.

Suggested readings
SEMESTER – VI

SECM-4: Environmental Microbiology

Preamble:

- This Paper involves the concept of environment, origin Development of Environmental Microbiology.
- They also learn about microbial community and the microbial diversity of microorganisms from various environment.
- They study about Water Pollution, Air Pollution & Soil pollution.

Unit 1: Introduction 08hrs
Introduction: Origin, Concept and Development of Environmental Microbiology

Unit 2: Microbial Community 10hrs

Unit 3: Microbial diversity 12hrs

Unit 4: Water Pollution 12hrs

Unit 5: Air pollution 10hrs
Air pollution and Radiation hazards: Sources and characteristics of air pollutants; Health hazards due to air pollution; Green house gases and green house effect. Ozone hole and acid rain. Radiation hazards and safety measures – sources, effect of radiations and safety measures.

Unit 6: Soil pollution 08hrs
Soil pollution: Sources and characteristics of soil pollutants. Effects of soil pollution on human health and crop productivity

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PRACTICAL

- Identify bacteria (any three of E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
- Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
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- Study of various stages of malarial parasite in RBCs using permanent mounts.

Suggested reading:

### GULBARGA UNIVERSITY KALABURAGI

#### B.Sc. I. SEMESTER MICROBIOLOGY PRACTICAL EXAMINATION MODEL PAPER

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<tr>
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### GULBARGA UNIVERSITY KALABURAGI

#### B.Sc. II. SEMESTER MICROBIOLOGY PRACTICAL EXAMINATION MODEL PAPER

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### B.Sc. III Semester Microbiology Practical Examination Model Paper

**Time:** 03 hrs.  
**Paper No. 3**  
**Max. Marks:** 40

1. Major question: 12  
2. Minor Question: 08  
3. Spotters: 10  
4. Viva: 05  
5. Records/Submission: 05  
**Total Marks:** 40

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### B.Sc. IV Semester Microbiology Practical Examination Model Paper

**Time:** 3hrs.  
**Paper No. 4**  
**Max. Marks:** 40

1. Major Question: 12  
2. Minor Question: 08  
3. Spotters: 10  
4. Viva: 05  
5. Submission of Records: 05  
**Total:** 40

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**B.Sc. V SEMESTER: DSE-1 MICROBIOLOGY PRACTICAL EXAMINATION MODEL PAPER**

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### GULBARGA UNIVERSITY KALABURAGI

**B.Sc. VI. SEMESTER MICROBIOLOGY PRACTICAL EXAMINATION MODEL PAPER**

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Model Question paper for theory examination for Core and DSE papers:

GULBARGA UNIVERSITY, KALABURAGI

B.Sc ----- Semester Degree Theory Examination in Microbiology, month, year.
Paper:

Time: 3 h
Max. Marks: 80

Instruction to Candidates: 1. Answer all the questions.
2. Draw diagrams wherever necessary

I. Answer any TEN of the followings in two or three sentences (2x10 = 20)
   a.
   b.
   c.
   d.
   e.
   f.
   g.
   h.
   i.
   j.
   k.
   l.

II. Answer any FOUR of the followings in brief (4x5 = 20)
    02.
    03.
    04.
    05.
    06.
    07.

III. Answer any FOUR of the followings (4x10 = 40)
    08.
    09.
    10.
    11.
    12.
    13.
Model Question paper for internal theory examination for Core and DSE papers:

GULBARGA UNIVERSITY, KALABURAGI

B.Sc ----- Semester Degree Theory Internal Examination in Microbiology, month, year.

Paper:

Time: 1 h

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I. Answer any Two of the followings in two or three sentences (2x2.5=5)
   a.
   b.
   c.

II. Answer any ONE of the followings in brief (1x5=5)
   d.
   e.

III. Answer any ONE of the followings (1x10=10)
   f.
   g.
MODEL QUESTION PAPER FOR SEC THEORY EXAMINATION:

GULBARGA UNIVERSITY, KALABURAGI

B.Sc ----- Semester Degree Theory Internal Examination in Microbiology, month, year.

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Total Marks 40

NOTE: For SCE paper there will not be internal theory examination. Instead the candidate shall submit the report on the practical carried out during the semester for TEN marks.

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