

DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM & MARKING SCHEME

B.Sc. I, II, III, IV Semester

MICROBIOLOGY

(Based on Choice Based Credit System)

SESSION : 2023-24



ESTD : 1958

**GOVT. V.Y.T. PG AUTONOMOUS COLLEGE,
DURG, 491001 (C.G.)**

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A⁺, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com



Govt. V.Y.T. PG Autonomous College, Durg (Chhattisgarh)

(Erstwhile: Govt. Arts & Science College, Durg)

Proposed Scheme For 4Yr UG Program in Microbiology

Semester	Core Course (DSC)	Discipline Specific Elective	Generic Elective Course	Ability Enhancement Course	Skill Enhancement Course	Internship/Project	Value Added Courses	Total Credits
1	CC1 Microbiology (4)		Choose one from a pool of courses GE 1 (4)	Choose one from a pool of courses AEC (2)	Choose one from a pool of courses SEC (2)	Choose one from a pool of courses VAC (2)	Choose one from a pool of courses VAC (2)	22
	CC1 Botany (4)							
	CC1 Chemistry (4)							
2	CC2 Microbiology (4)		Choose one from a pool of courses GE 2 (4)	Choose one from a pool of courses AEC (2)	Choose one from a pool of courses SEC (2)	Choose one from a pool of courses VAC (2)	Choose one from a pool of courses VAC (2)	22
	CC2 Botany (4)							
	CC2 Chemistry (4)							
Students on exit shall be awarded undergraduate certificate (in the field of Multidisciplinary Study) after securing the requisite 44 credits in Semester 1 and 2								
3	CC3 Microbiology (4)	Choose one from a pool of courses DSE A/B/C (4)	Choose one from a pool of courses DSE A/B/C	Choose one from a pool of courses AEC (2)	Choose one from a pool of courses SEC (2)	Choose one from a pool of courses VAC (2)	Choose one from a pool of courses VAC (2)	22
	CC3 Botany (4)	Or						
	CC3 Chemistry (4)	Choose one from a pool of courses GE 3 (4)						
4	CC4 Microbiology (4)	Choose one from a pool of courses DSE A/B/C (4)	Choose one from a pool of courses DSE A/B/C	Choose one from a pool of courses AEC (2)	Choose one from a pool of courses SEC (2)	Choose one from a pool of courses VAC (2)	Choose one from a pool of courses VAC (2)	22
	CC4 Botany (4)	Or						
	CC4 Chemistry (4)	Choose one from a pool of courses GE 4 (4)						
Students on exit shall be awarded undergraduate Diploma (in the field of Multidisciplinary Study) after securing the requisite 88 credits in Semester IV								
5	CC5 Microbiology (4)	Choose one from a pool of courses DSE A/B/C (4)	Choose one from a pool of courses GE 4 (4)		Choose one from a pool of courses SEC (2)	Choose one from a pool of courses VAC (2)		22
	CC5 Botany (4)				Or			

	CC5 Chemistry (4)				Internship/Project/ Community outreach activity (2)		
6	CC6 Microbiology (4)	Choose one from a pool of courses DSE A/B/C (4)	Choose one from a pool of courses GE 4 (4)		Choose one from a pool of courses SEC (2) Or Internship/Project/ Community outreach activity (2)	22	
	CC6 Botany (4)						
	CC6 Chemistry (4)						
	Students on exit shall be awarded Bachelor of (in the field of Multidisciplinary Study) after securing the requisite 132 credits in Semester VI						
7	DSC A/B/C (4)	Choose 3 DSE course from a pool (3x4) Or Choose 2 DSE course from a pool and one GE course Or One DSE course and 02 GE course from a pool (Total 12)			Dissertation (6)	22	
8	DSC A/B/C (4)	Choose 3 DSE course from a pool (3x4) Or Choose 2 DSE course from a pool and one GE course Or One DSE course and 02 GE course from a pool (Total 12)			Dissertation (6)	22	
Students on exit shall be awarded Bachelor of (in the field of Multidisciplinary Study) (Honours or Honours with Academic projects/Entrepreneurship) after securing the requisite 176 credits in Semester VIII						Total	176

Name and Signatures

Chairperson/ HOD- Dr. Pragma Kulkarni

Subject Expert - Dr. Anita Mahiswar

Subject Expert - Dr. Sonal Mishra

VC Nominee – Dr. Prakash Saluja

Industrial Representative- Shri Amitesh Mishra

Member of Other Department- Dr. Ranjana Shrivastava

Student Nominee – Ms. Yogita Lokhande

Departmental members

1. Mrs. Rekha Gupta

2. Mrs. Neetu Das

3. Ms. Anamika Sharma

4. Ms. Mrinalini Soni

5. Ms. Neetu Bhargav

1. In 1st semester Hindi Language, 2nd semester English Language and Environmental studies in 3rd and 4th Semester will be offered as AEC.
2. Students are required to take Generic Specific courses (courses from other than A/B/C Disciplines)
3. DSC-1 to DSC-7 shall be core courses of either Discipline A or B or C.
4. If a student wishes to Major in Discipline A, then he/she should earn at least 60 credits from DSCs and DSEs, Research Methodology of Discipline A and dissertation written on a topic of Discipline A.
5. Minor in a Discipline will be awarded to a student if he/she earns 24 credits from GEs (other than B and C) along with major in A.
6. Completion of core courses from host institute is mandatory.
7. Students may take up SEC, GEC and DSEC of equivalent credits from any other institute/ online platforms/MOOC/ ODL from UGC recognized organizations.

Name and Signatures

<p>Chairperson/ HOD- Dr. Pragma Kulkarni Subject Expert - Dr. Anita Mahiswar Subject Expert - Dr. Sonal Mishra VC Nominee - Dr. Prakash Saluja Industrial Representative- Shri Amitesh Mishra Member of Other Department- Dr. Ranjana Shrivastava</p>	<p>Student Nominee - Ms. Yogita Lokhande Departmental members 6. Mrs. Rekha Gupta 7. Mrs. Neetu Das 8. Ms. Anamika Sharma 9. Ms. Priya-Sao 9. Mandeepi Soni 10. Neetu Bhargava</p>
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Department of Microbiology

Govt. V.Y.T. PG Autonomous College, Durg (C.G.)

**Subject: Syllabus Approval for Semester and CBCS curriculum for B.Sc. with Microbiology
(as NEP 2022 Multi-Disciplinary Course System) by the members of Board of Studies
for Session 2023-24**

Semester I	No. of Credits	Semester II	No. of Credits
DSC: BMB 101 Microbial World and Principles of Microbiology	3	DSC: BMB 201 Basic Biochemistry and Physiology	3
DSC: BMBL 101 Lab Course	1	DSC: BMBL 201 Lab Course	1
*SEC:	2	*SEC:	2
**GE	3	**GE	3
BMBL 101 Lab Course	1	BMBL 201 Lab Course	1

*** SEC: Students may opt for any one SEC in any of the semesters till Semester VI. Successful completion of at least one SEC of the Discipline is mandatory for award of Degree.**

BMBSE 01 Microbiological Analysis of Air, Water & Soil to Pollution Control

BMBSE 02 Microbial Products – Bio-fertilizer & Bio-pesticides

BMBSE 03 Microbial Diagnostics and Public Health

BMBSE 04 Microbial Products – Bio-fertilizer & Bio-pesticides

****GE: Students may opt any one GE course other than the core courses selected for award of Degree.**

Semester III	No. of Credits	Semester IV	No. of Credits
DSC: BMB 301 Microbial Techniques and Instrumentation	3	DSC: BMB 401 Environmental Microbiology and Microbial Ecology	3
DSC: BMBL 301 Lab Course	1	DSC: BMBL 401 Lab Course	1
DSE: BMB 302/ **GE	3	DSE: BMB 402/ **GE	3
DSE: BMBL 302	1	DSE: BMBL 402	1
*SEC:	2	*SEC:	2
Semester V	No. of Credits	Semester VI	No. of Credits
DSC: BMB 501 Agriculture, Food and Dairy Microbiology	3	DSC: BMB 601 Medical and Veterinary Microbiology and Immunology	3
DSC: BMBL 501 Lab Course	1	DSC: BMB L601 Lab Course	1

DSE: BMB 502	3	DSE: BMB 602	3
DSE: BMBL 502	1	DSE: BMBL 602	1
**GE	3	**GE	3
*SEC/ Internship/Project/ Community outreach activity	2	*SEC/ Internship/Project/ Community outreach activity	2
Semester VII	No. of Credits	Semester VIII	No. of Credits
DSC: BMB 701 Industrial Microbiology	4	DSC: BMB 801 Microbial Biotechnology	4
Choose any 2 From Pool of Courses DSE: BMB 702 Microbial genetics (3Th+1T)	4	Choose any 2 From Pool of Courses DSE: BMB 802 Microbial Enzyme Technology (3)	3
-	-	BMB 802 Lab Course	1
DSE: BMB 703 Food fermentation and Domestic Applications (3Th+1T)	4	DSE: BMB 803 Advanced Microbiology (3Th +1T)	4
DSE: BMB 704 Basic Computer, Biostatistics and Bioinformatics	3	DSE5: BMB 804: Biosafety and Intellectual Property Rights (3Th +1T)	4
BMBL 704 Lab Course	1	-	-
Dissertation	6	Dissertation	6

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni Subject Expert - Dr. Anita Mahiswar Subject Expert - Dr. Sonal Mishra VC Nominee – Dr. Prakash Saluja Industrial Representative- Shri Amitesh Mishra Member of Other Department- Dr. Ranjana Shrivastava	Student Nominee – Ms. Yogita Lokhande Departmental members 1. Mrs. Rekha Gupta 2. Mrs. Neetu Das 3. Ms. Anamika Sharma 4. Ms. Mrinalini Soni 5. Ms. Neetu Bhargav
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Marking Scheme

4Yr UG Program B.Sc. (Multidisciplinary) with Microbiology

CBCS Pattern

Session 2023-24

B.Sc. Microbiology

Course Name	Course Code	End Sem		Internal Assessment		Total	
		Max.	Min.	Max.	Min.	Max.	Min.
DSC	BMBC	60	24	15	6	75	30
DSC	BMBL	25	10	-	-	25	10
SEC	BMBS	20	8	5	2	25	10
DSE	BMBD	80	32	20	8	100	40

Absolute Grading System (for conversion of marks into grade points)




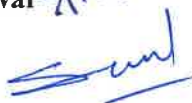






Letter Grade	Grade point	MB TH%	MB Lab %	SEC %
O (Outstanding) 10	10	90-100	95-100	95-100
A+(Excellent) 9	9	80-90	90-95	80-95
A (Very Good) 8	8	70-80	80-90	70-80
B+(Good) 7	7	60-70	70-80	60-70
B (Above Average) 6	6	50-60	60-70	50-60
C(Average) 5	5	40-50	50-60	40-50
P (Pass) 4	4	35-40	40-50	35-40
F(Fail) 0	0	0	0	0
Ab (Absent) 0	0	0	0	0

Sample Grade Sheet (Example)

Courses	Credit Ci	Marks ESE	Marks obtained	Internal	% Marks Obtained =80%ESE +Int	Grade Point Gi	CiGi	SGPA
Chemistry	3	75	70	20	76/80 = 96%	10	30	8.09
Botany	3	75	50	20	60/80 =75%	8	24	
Microbiology	3	75	60	20	80	7	28	
Chem Lab	1	25	20	-	80	8	8	
Bot Lab	1	25	23	-	92	10	10	
Micro Lab	1	25	23	-	92	10		
GEC 1 (Biotech eg)	4	100	70	15	71	8	32	
AEC (Hindi)	2	50	30	10	34/50=68%	7	14	
VAC (Yoga/Sports/PD)	2	50	30	10	68%	7	14	
SEC 01	2	50	40	10	84%	9	18	
Total	22	450	280		560	62	178	

CGPA of an Academic = SGPA1 +AGPA2/ 2 or (SGPA1 + SGPA2 +SGPAn)/n, *n is total number of Sem.

Name and Signatures

Chairperson/ HOD- Dr. Pragya Kulkarni 	Student Nominee – Ms. Yogita Lokhande 
Subject Expert - Dr. Anita Mahiswar 	Departmental members
Subject Expert - Dr. Sonal Mishra 	1. Mrs. Rekha Gupta 
VC Nominee – Dr. Prakash Saluja	2. Mrs. Neetu Das 
Industrial Representative- Shri Amitesh Mishra	3. Ms. Anamika Sharma 
Member of Other Department- Dr. Ranjana Shrivastava 	4. Ms. Mrinalini Soni 
	5. Ms. Neetu Bhargav 

Session 2023-24

B.Sc. Microbiology

Semester I

BMB 101 Microbial world and Principles of Microbiology

Credits: 3; Lectures: 45

Upon successful completion of the course students will be able –

- CO1** To developed a good knowledge of the development of Microbiology and the contributions made by prominent scientists in this field
- CO2** To understand the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory
- CO3** To be able to explain the useful and harmful activities of the microorganisms
- CO4** To perform basic experiments to grow and study microorganisms in the laboratory

Unit 1- History of microbiology and introduction to the microbial world. Germ theory of disease, Development of various microbiological techniques and golden era of microbiology. Contributions of Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming, and Edward Jenner. Baltimore classification of virus, the three-domain system of Carl Woese, Five kingdom classification of Whittaker and their utility. **(08 Lectures)**

Unit 2- Physiochemical and biological characteristics of microorganisms (including viruses); General characteristics of Cellular microorganisms- Virus, Bacteria, wall-less forms - MLO (mycoplasma and spheroplasts) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance. **(09 Lectures)**

Unit 3- General characteristics, structure, mode of reproduction and economic importance of actinomycetes with special reference to its application in medicine and industry. General characteristics, occurrence, structure, reproduction and importance of Fungi, Cyanobacteria and Protozoa. **(08 Lectures)**

Unit 4- Methods of studying microorganism; Staining techniques: simple staining, Gram staining, negative staining and acid-fast staining. Sterilization techniques (physical & chemical sterilization). Culture media & conditions for microbial growth. Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation of pure cultures. **(08 Lectures)**

Unit 5- Beneficial and harmful microbes and their role in daily life. Gram positive and gram-negative bacteria General characteristic features and importance of following microorganisms- Influenza virus, Lactobacillus, Clostridium, Staphylococcus, E. coli, Mycobacterium, Pseudomonas, Aspergillus, Penicillium, Trichophyton, Microspermum. **(12 Lectures)**

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

Recommended Books:

1. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
2. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
3. Alcomo, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).
4. Black J.G. Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York, (2002).
5. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
6. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication
7. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.
8. Jacquelyn g. Black. Microbiology Principles and explorations. John wiley & sons, inc.
9. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson
10. Tom Besty, D.C Jim Koegh. Microbiology Demystified McGraw-Hill.

Session 2023-24
B.Sc. Microbiology
Semester I
BMBL 01 Lab Course

Credit: 1; Lab Periods: 30

List of Practical Exercises

Upon successful completion of the Lab course students will be able-

- CO 1** To be familiar with common laboratory instruments/ equipment of microbiology
- CO 2** To understand the methods of obtaining microorganisms under lab conditions for study
- CO 3** To differentiate microorganisms on the basis of microscopic features
- CO 4** To Study common microscopic organisms

List of exercises

1. Microbiology Good Laboratory Practices and Bio-safety.
2. 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.
3. Preparation of culture media (liquid & solid) for bacterial cultivation.
4. Handling and care of laboratory equipment - autoclave, hot air oven, incubator, and laminar airflow.
5. Sterilization of media using autoclave and assessment of sterility.
6. Sterilization of glassware using hot air oven.
7. Pouring, Plating and Streaking of Pure culture technique
8. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
9. Gram staining of bacteria
10. Observation of microorganisms - bacteria, cyanobacteria protozoa, fungi, yeasts, and algae from natural habitats.
11. Study of common fungi and protozoan using temporary / permanent mounts.

Name and Signatures:


Chairperson/ HOD


Subject Expert


Subject Expert

VC Nominee

Industrial Representative


Member of Other Department


Student Nominee

Departmental members:











Session 2023-24

**B.Sc. Microbiology
Semester II**

BMB 201 Basic Biochemistry and Physiology

Credits: 3; Lectures: 45

Upon successful completion of the course students will be able to–

- CO1** Developed a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell.
- CO2** Have developed how the carbohydrates make the structural and functional components such as energy generation and as storage food molecules for the bacterial cells
- CO3** Well conversant about multifarious function of proteins; are able to calculate enzyme activity and other quantitative and qualitative parameters of enzyme kinetics; also knowledge about lipids and nucleic acids.
- CO4** Student are able to make buffers, study enzyme kinetics and calculate V_{max} , K_m , K_{cat} values.

Unit 1- Concept of bio-molecules-Building blocks of life: Macromolecules, Concept of Bioenergetics- First and second laws of Thermodynamics, Energy rich compounds: ATP, amino acids the building blocks of proteins. Classification biochemical structure and notation of standard protein amino acids, Ninhydrin reaction, General formula of amino acid and concept of zwitterion, Non-protein amino acids: Gramicidin, beta-alanine, D alanine and D-glutamic acid.
(08 Lectures)

Unit 2- Carbohydrate: Monosaccharides – aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, mutarotation and anomers of glucose. Furanose and pyranose forms of glucose and fructose, chair and boat forms of glucose. Disaccharides - concept of reducing and non-reducing sugars, occurrence of maltose, lactose, and sucrose, polysaccharides - storage polysaccharides, starch and glycogen. Structural polysaccharides, cellulose, peptidoglycan and chitin

Protein: Primary, secondary, tertiary and quaternary structures. Enzymes: Structure of enzyme, Apoenzyme and cofactors, prosthetic group, Classification of enzymes, Mechanism of action of enzymes: active site, Lock and key hypothesis, and Induced Fit hypothesis. K_m , and allosteric mechanism. Definitions of terms – enzyme unit, Effect of pH and temperature on enzyme activity. Enzyme inhibition: competitive- sulfa drugs; non-competitive-heavy metal salts.

(12 Lectures)

Unit 3- Lipids: Definition and major classes of storage and structural lipids. Fatty acids, structure and functions. Essential fatty acids. Triacylglycerols structure, functions and properties. Saponification Structural lipids. Phosphoglycerides: Building blocks, general structure, functions and properties. Structure of Sphingolipids: building blocks, structure of sphingosine, Lipid functions: cell signals, cofactors, Introduction to lipid micelles, monolayers, bilayers.

Nucleic acids and vitamins: Base composition. A+T and G+C rich genomes. Structure and functions of DNA and RNA. Concept and types of vitamins and their role in metabolism.

(12 Lectures)

Unit 4- Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, generation time and specific growth rate, synchronous growth, diauxic growth curve. Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophile), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic).

(06 Lectures)

Unit 5- Microbial growth in response to nutrition and energy – Autotroph/Phototroph, heterotrophy, Chemo-lithoautotroph, Chemo-lithoheterotroph, Chemoheterotroph, Chemolithotroph, photolithoautotroph, Photo-organoheterotroph. Passive and facilitated diffusion. Primary and secondary activetransport, concept of uniport, symport and antiport.

(07 Lectures)

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

Dpt. of Microbiology, Govt. VIT PG Auto. College, Durgam

Recommended Books:

1. Tortora, G.J., Funke, B.R and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
2. Stanbury, Biochemistry
3. Voet. Fundamentals of biochemistry Wiley
4. M.M. Cox, D. L. Nelson. Lehninger's principles of biochemistry.
5. W H Freeman Stryer. Biochemistry W H Freeman
6. Stanier, Ingraham, Wheelis and Painter. The Microbial world. Mc Millan Educational Ltd., London.
7. Moat and Foster, Microbial Physiology. Wiley.
8. Umbreit. Essentials of Bacterial Physiology.
9. Skokatch. Bacterial Physiology and Metabolism.
10. Kushner, D.J. Microbial life in Extreme Environments. Academic Press.
11. Pawar. C.B. Cell Biology.
12. Sturart. Harris and Harris. The control of Antibiotic Resistance in Bacteria.
13. Franklin and Snow, Biochemistry of Antimicrobial Action. Chapman and Hall, New York.
14. Philipp. G. Manual of Methods for General Bacteriology.
15. David T. Plummer. An Introduction to Practical Biochemistry.
16. Subba Rao, N.S. Soil Microorganisms and Plant Growth.

Session 2023-24
B.Sc. Microbiology
Semester II
BMBL 02 Lab Course

Credits: 1; Lab Periods: 30

List of Practical Exercises

Upon successful completion of the Lab course students will be able-

CO 1 To be familiar with pH scale and buffers


CO 2 To understand the qualitative and quantitative tests for carbohydrates and proteins

CO 3 To study enzyme kinetics and factors affecting

CO 4 To analyse the growth properties of E.coli

1. Properties of water, concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts.
2. Qualitative/Quantitative tests for carbohydrates, reducing sugars, non-reducing sugars.
3. Qualitative/Quantitative tests for lipids and proteins.
4. Study of protein secondary and tertiary structures with the help of models.
5. Study of enzyme kinetics – calculation of V_{max} , K_m , K_{cat} values.
6. Study effect of temperature, pH and heavy metals on enzyme activity.
7. Study and plot the growth curve of E.coli by turbidometric and standard plate count methods.
8. Calculations of generation time and specific growth rate of bacteria from the graph plotted with the given data.
9. Effect of temperature, pH, carbon and nitrogen sources on and salt growth of E.coli.
10. Demonstration of the thermal death time and decimal reduction time of E.coli.

Name and Signatures:


Chairperson/ HOD


Subject Expert


Subject Expert

VC Nominee

Industrial Representative


Member of Other Department


Student Nominee

Departmental members:











Session 2023-24

B.Sc. – Microbiology

Skill Based Enhancement Course

BMBSE 01 Microbiological Analysis of Air, Water & Soil to Pollution

Control

Credits: 02 (1Th +1Lab)

Total: 15 Lectures + 30 Lab

Upon successful completion of the course students will be able to–

CO1 Established a very good understanding of air, water and soil inhabiting microorganisms

CO2 Recognized the methods of analysis of air, water and soil and contribute to control of environmental pollution

Aero-microbiology: Bioaerosols, Air borne microorganisms, allergens (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres.

Water- microbiology: Water borne pathogens; water borne diseases.

Soil- microbiology: Soil borne pathogens; soil borne diseases.

Sampling of Bioaerosol: air samplers, methods of analysis, CFU, culture media for bacteria and fungi, Identification characteristics.

Sampling of Water: methods to detect potability of water samples: (a) standard qualitative procedure; presumptive/MPN tests, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests

Sampling of soil: sample collection and analysis. Isolation and identification of pathogens. Soil testing methods.

Control Measures: Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration. Precipitation, chemical disinfection, filtration, high temperature, UV light. Soil treatment.

Name and Signatures:

Chairperson/HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

Reference Books-

1. Medigan, M.T., Martinko, J. M. and Parker, J. Brock Biology of Microorganisms. Pearson Education Inc. New York
2. Alexander, M John. Microbial ecology. Wiley & Sons, Inc., New York.
3. Alexander, M John. Introduction to soil microbiology. Wiley & Sons Inc., New York.
4. Barker, KH, and Herson, D.S. Bioremediation. Mc Craw Hill Inc., New York.
5. Chapelle, F.H. Ground Water Microbiology and Geochemistry. New York: John Wiley & Sons, 2000.
6. Droste, R. L. Theory and Practice of Water and Wastewater Treatment. New York: John Wiley & Sons, 1996.
7. K.R. Aneja. Laboratory Manual of Microbiology and Biotechnology New Age Publications. 2014

Name and Signatures:

 Chairperson/ HOD	 Subject Expert	 Subject Expert	VC Nominee
Industrial Representative	 Member of Other Department	Student Nominee	
Departmental members:			
			
			

Dpt. of Microbiology, Govt. VYT PG Auto. College, Durg

Session 2023-24

B.Sc. – Microbiology

Skill Based Enhancement Course

BMBSE 02 Microbial Products – Bio-fertilizer & Bio-pesticides

Credits: 02 (1Th +1Lab)

Total: 15 Lectures + 30 lab

Upon successful completion of the course students will be able to–

CO1 Developed a very good understanding of microorganisms used as biofertilizers/ Biopesticides

CO2 Get acquainted with the methods of the production of Biofertilizers/ bio pesticides/bioinsecticides

Bio fertilizers: General account of the microbes used as bio fertilizers for various crop plants and their advantages over chemical fertilizers.

Symbiotic N2 fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, *Frankia* - Isolation, characteristics, Cyanobacteria as bio-fertilizers- Isolation, characterization, mass multiplication, field application.

Non - Symbiotic Nitrogen Fixers: Free living *Azospirillum*, *Azotobacter*- free isolation, characteristics, mass inoculum production and field application

Phosphate Solubilizers: Phosphate solubilizing microbes - Isolation, characterization, mass Inoculum production, field application. PGPR – Isolation and Characterization; mass production and application

Mycorrhizal Bio-fertilizers: Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of VAM

Bioinsecticides: General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, production, Field applications

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

Reference Books

1. Eldor A .Paul. Soil Microbiology.
2. Ecology and Biochemistry.VI Edition: Academic Press, (2007).
3. Eugene L.Madsen.Environmental Microbiology:From Genomesto Biogeochemistry. I Edition, Wiley-Blackwell Publishing. (2008).
4. Agrios,G.N.Plant pathology. Harcourt Asia Pvt. Ltd. (2000).
5. Buchanan.B.B.,Gruissem,W and Jones, R.L Biochemistry and Molecular Biology of Plants. I.K. International Pvt.Ltd. (2000).
6. Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill ,6th reprint (2006).
7. K.S. Bilgrami , H. C. Dube. A textbook of modern pathology. 6th Edition,Vani Educational Books, a division of Vikas, (1984).
8. Shalini Suri. Biofertilizer and Biopesticide Aph Publishing Corporation (2011)

Dpt. of Microbiology, Govt. VYT PG Auto College, Durg

Session 2023-24

B.Sc. – Microbiology

Skill Based Enhancement Course

BMBS 03 Microbial Diagnostics and Public Health

Credits: 02 (1Th +1Lab)

Total: 15 Lectures + 30 lab

Upon successful completion of the course students will be able to–

CO1 Developed understanding of collection of different clinical samples, their transport, culture and examination by staining, and molecular and immunological diagnostic methods for diagnosis of microbial diseases.

CO2 Established understanding of antibiotic sensitivity testing, water and food testing skills use of testing kits available in the market.

Diseases of human body systems: Various Bacterial, Viral, Fungal and Protozoan.

Collection of Clinical Samples: Oral cavity, throat, skin, Blood, CSF, urine and faeces and precautions required. Method of transport of clinical samples to laboratory and storage.

Direct Microscopic Examination and Culture: Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria.

Preparation and use of culture media: Blood agar, Chocolate agar, Lowenstein-Jensen medium, Mac Conkey agar, Distinct colony properties of various bacterial pathogens.

Serological Methods: Agglutination, ELISA, Kits for Rapid Detection of Pathogens: Typhoid, Dengue and HIV, Swine flu.

Testing for Antibiotic Sensitivity in Bacteria: Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method.

Reference Books

1. Ananthanarayan R and Paniker CKJ. Textbook of Microbiology. 7th Edition. University Press Publication. (2005).

Name and Signatures:

Chairperson/ HOD

Subject Expert

Subject Expert

VC Nominee

Industrial Representative

Member of Other Department

Student Nominee

Departmental members:

Session 2023-24

**B.Sc. Microbiology
Semester III**

BMB 301 Microbial Techniques and Instrumentation

Credits: 3; Lectures: 45

Upon successful completion of the course students will be able to-

CO1: Understand principles of sterilization for microbiological work

CO2: Knowledge of number of analytical instruments and to performing various laboratory manipulations

CO3: Handling and use of microscope for the study of microorganisms and also get introduced a variety of modifications in the microscopes for specialized viewing

CO4: Several separation techniques which may be required to be handle later as microbiologists.

Unit 1- Microbial techniques: Maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-cultivable bacteria; Buffers in culture medium; Cultivation of fungi, actinomycetes, yeast and cyanobacteria. Cultivation of anaerobes. Types and applications of Antiseptic, Germicide, Sanitizer, Fungicide, Virucide, Bacteriostatic and Bactericidal agent. Chemical disinfectants. **(10 Lectures)**

Unit 2- Microscopy: Principle, Mechanism and application of photo optical instruments (different types of microscopes), Bright field, Dark field, phase contrast microscope, Fluorescence microscopy, Confocal microscopy, Scanning and Transmission Electron Microscopy(SEM & TEM). **(09 Lectures)**

Unit 3- Principle of pH meter, Types of electrodes, factors affecting pH measurement, application of pH meter. Centrifugation: Principle and types (Analytical and Preparatory, differential and Rate zonal), ultracentrifugation techniques and its applications. **(08 Lectures)**

Unit 4- Chromatography: Principle and techniques with applications (Partition, adsorption, ion-exchange, exclusion and affinity chromatography). Electrophoretic technique (agarose and polyacrylamide gel) its Components, working and applications. **(08 Lectures)**

Unit 5- Spectrophotometric techniques: Electromagnetic spectrum, Basic principles & Law of absorption and radiation; principle, mechanism and applications of instruments (UV and Visible spectrophotometer). Radiobiological techniques: characters of radioisotopes, autoradiography, Radioisotope dilution technique and pulse chase experiments. **(10 Lectures)**

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Session 2023-24
B.Sc. Microbiology
Semester III
BMBL 03 Lab Course

Credits: 1; Lab Periods: 30

List of Practical Exercises

Upon successful completion of the Lab course students will be able –

- CO 1 To be familiar with common laboratory instruments/equipment of microbiology
- CO 2 To understand the methods of obtaining microorganisms under lab conditions for study
- CO 3 To differentiate microorganisms on the basis of microscopic features
- CO 4 To study common microscopic organisms

1. Study of fluorescent micrographs to visualize bacterial cells.
2. Ray diagrams of phase contrast microscopy and electron microscopy.
3. Separation of mixtures by paper/ thin layer chromatography.
4. Demonstration of column packing in any form of column chromatography.
5. Separation of protein mixture by any form of chromatography.
6. Separation of protein mixture by Polyacrylamide Gel Electrophoresis(PAGE).
7. Determination of absorption max for an unknown sample and calculation of extinction coefficient.
8. Separation of components of a given mixture using a laboratory scale centrifuge.
9. Understanding density gradient centrifugation with the help of pictures.

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Reference Books

1. Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5th Edition Cambridge University Press (2000).
2. Murphy D.B. Fundamental of light Microscopy & Electron Imaging. 1st Edition. Wiley-Liss.(2001).
3. K L Ghatak. Techniques and methods in biology PHI publication (2011).
4. Pranav Kumar. Fundamentals and techniques of biophysics and molecular biology (2016)
5. Aurora Blair. Laboratory techniques & Experiments in biology. Intelliz Press.
6. D.T Plummer. An Introduction to practical Biochemistry. McGraw Hill Publication 1987.
7. Beckner, W.M., Kleinsmith L.J. and Hardin J. The world of cell. IV edition Benjamin/Cummings (2000).

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**B.Sc. Microbiology
Semester IV**

BMB 401 Environmental Microbiology and Microbial Ecology

Credits: 3; Lectures: 45

Upon successful completion the students will be able –

- CO1:** To developed a fairly good knowledge and understanding of different types of environments and habitats where microorganisms grow
- CO2:** To be able to identify the important role microorganisms in maintaining healthy environment by degradation of solid/liquid wastes
- CO3:** To understand the significance of BOD/COD for assessing quality of water
- CO4:** To developed the practical skills for conducting based on standard microbiological tests.

Unit –1 Terrestrial Environment: Soil profile and soil microflora. Aquatic Environment: Microflora of fresh water and marine habitats; Atmosphere: Aeromicroflora and dispersal of microbes. Animal Environment: Microbes in/on human body (microbiomics) & animal (ruminants) body. Extreme Habitats: Extremophiles, Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels. **(10 Lectures)**

Unit – 2 Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (Composting and sanitary landfill). Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment **(08 Lectures)**

Unit – 3 Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests. **(10 Lectures)**

Unit – 4 Contributions of Beijerinck, Winogradsky, Kluyver, Van Niel, Martin Alexander, Selman A. Waksman. Structure and function of ecosystems. Biological Interaction: A. Microbe–Microbe Interactions: Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Biocontrol agents. B. Microbe–Plant Interactions: Roots, Aerial Plant surfaces, Biological Nitrogen fixation (symbiotic/nonsymbiotic - biofertilizers) **(09 Lectures)**

Unit – 5 **Carbon cycle:** Microbial degradation of cellulose, hemicelluloses, lignin and chitin
Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction.
Phosphorus cycle: Phosphate immobilization and solubilisation. **Sulphur cycle:** Microbes involved in sulphur cycle Other elemental cycles: Iron and manganese. **(08 Lectures)**

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Departmental members:**

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Session 2023-24
B.Sc. Microbiology
Semester IV
BMBL 04 Lab Course

Credits: 1; Lab Periods: 30

List of Practical Exercises

1. Analysis of soil pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria & fungi) from soil.
3. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
4. Assessment of microbiological quality of water.
5. Determination of BOD of wastewater sample.
6. Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease)
7. Isolation of Rhizobium from root nodules.
8. Study the Effect of salt concentration on growth of microbes.
9. Study the Effect of pH concentration on growth of microbes.
10. Demonstration of Winogradsky's Column Preparation.

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Departmental members:

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Reference Books

1. Medigan, M.T., Martinko, J. M. and Parker, J. Brock Biology of Microorganisms. Pearson Education Inc. , New York
2. Alexander, M John. Microbial ecology. Wiley & Sons, Inc., New York.
3. Dr. R.P. Singh, Text book of Microbiology, Kalyani publication.
4. Dr. C.B. Power and Dr. H.F. Dagainawala, General microbiology Vol. I and Vol. II, Himalaya Publication.
5. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
6. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication
7. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.
8. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.

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