BAGALKOT UNIVERSITY

Mudhol Road, Jamkhandi-587301 Dist: Bagalkot

PROGRAM /COURSE STRUCTURE AND SYLLABUS
FOR

MICROBIOLOGY

as per the Choice Based Credit System (CBCS) designed in accordance with Learning Outcomes-Based Curriculum Framework (LOCF)

For

Bachelor of Science
(MICROBIOLOGY)

(General Degree)
I and II Semester

w.e.f.

Academic Year 2024-25

Preamble for UG Syllabus of Bagalkot University

Bagalkot University Jamkhandi has been established by the Government of Karnataka and has started functioning from the academic year 2023-24. All the degree colleges other than engineering and medical colleges in the district of Bagalkote, are affiliated to this university as per the Karnataka State Universities Act 2000, as modified by the 26th Act of 2022. The students taking admission to any of the colleges in the district of Bagalkote, from the academic year 2023-24 will be students of Bagalkot University. The Government of Karnataka has instructed all the Universities to revise the under graduate syllabus as per the Government order no. ED 166 UNE 2023 Bengaluru Dated 08-05- 2024 from the academic year 2024-25.

Hence the Bagalkot University has revised the syllabus as suggested by its Board of Studies and approved by Academic Council and Syndicate. The subject code format for all the subjects of the new syllabus is also revised.

The subject code format is described in the following.

Subject Code Format

1	2	3	4	5	6	7	8	9	10
VER	DEGREE	SEM	DISCIPLINE			SUB. TYPE	SL. NO. FOR SUB. TYPE		TH/LAB/F
2	A	1	C	H	E	M	0	1	T
2	B	1	P	O	L	M	0	1	T

[1] The Version information gives the version of the syllabus. It can take values 1,2..9,a,b,…

[2] The UG degree codes to be provided as / The code applicable to all degrees

Sl. No	Degree Code		Degree
1	B.Sc.	A	Bachelor of Science
2	B.A	B	Bachelor of Arts
3	B.Com.	C	Bachelor of Commerce
4	BBA	D	Bachelor of Business Administration
5	BCA	E	Bachelor of Computer Applications
6	BSW	F	Bachelor of Social Work
7.	----------	S	Applicable to all degrees

[1] The Semester Information is provided as

Sl. No	Semester
1	1
2	2
3	3
….	

[4-6]The Discipline Information to be provided as

Sl No	Degree	Discipline Code
1	B.Com.	XXX
2	BCA	XXX
3	BBA	XXX
4	BSW	XXX
5	B.A	'HIS', POL',GEO','KAN', 'HIN' etc. The detailed list is to be provided
6	B.Sc.	'PHY','CHE', 'BOT','ELE' etc. The detailed List is to be Provided

[7] The Subject Type to be provided as

Sl. No.	TYPE	Description
1	Major	M
2	Language	L
3	Constitutional Moral Values	C
4.	Elective	E
5.	Skill / Practical based learning	S
6.	Mini Project	P
7.	Internship	I
8.	Case study/ Survey using principles of Research methodology	R

[8-9] The Running Serial Number is to be provided for a particular Subject type 01 to 99

[10] This character specifies the category of the subject namely, T=Theory, L-Practical, P-Project Work, F-Field work, Viva-V, I-Internship, Dissertation-D

Bagalkot University, Jamakhandi
Program Outcomes (PO), Program Specific Outcomes (PSO) and Course Outcomes (CO) of B.Sc. Microbiology (CBCS)

I. Program Outcomes (PO)

After successfully completing of B. Sc. Microbiology program, the students will be able to:

1. Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.

2. Students will demonstrate engagement in the Microbiology discipline through involvement in research or internship activities,

3. Basic knowledge about microbiology, biophysical techniques, biochemistry, cell biology, molecular biology, cancer biology, metabolic disorders etc.

4. To create awareness to become conscious citizens with a sense of responsibility towards their surrounding irrespective of any man made differences

II. Program Specific Outcomes (PSO)

After successfully completing of B. Sc. Microbiology Program, the students will be able to:

1. A general course emphasizing distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification.

2. This course also includes sophomore level material covering immunology, virology, epidemiology and DNA technology

3. Both theoretical and practical knowledge about general microbiology, molecular biology and biochemical techniques, which is the base for gaining scientific knowledge and insight about the subject.

4. To expose students to the field of microbiology and other allied life science subjects and prepare them for promising career options in research, industries and academics

PROGRAM STRUCTURE

Syllabus and Credits Structure under Choice Based Credit System [CBCS] General Degree for the Three Years B.Sc. with Microbiology Undergraduate Programme with effect from 2024-25

First Semester B.Sc. (Microbiology) Scheme

SEMESTER-I											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/ week**			**Credits**	**Duration of Exam** (Hrs)	**Teaching Department**
			IA	**SEE**	**Total**	**L**	**T**	**P**			
L1	------	Langauge 1	20	80	100	3	-	-	3	3	--------
L2	------	Langauge 2	20	80	100	3	-	-	3	3	----------
Major	2A1MICM01T	Introduction to Microbiology and Microbial Diversity	20	80	100	3	-	-	3	3	Microbiology
	2A1MICM01L	Introduction to Microbiology and Microbial Diversity	10	40	50	-	-	4	2	3	Microbiology
Major	------	Major Subject 2	20	80	100	3	-	-	3	3	---
	------	Practical	10	40	50	-	-	4	2	3	---
Major	-----	Major Subject 3	20	80	100	3	-	-	3	3	---
	-----	Practical	10	40	50	-	-	4	2	3	---
Common	2S1XXXC01T	Constitutional Values	10	40	50	2	-	-	2	2	Constitutional Values: Political Science
	2S1XXXC02T	Environment studies									Environmental Studies: Chemistry/ /Geography/ Botany
Total Marks					**700**	**Semester Credits**			**23**		

L1 & L2: Languages

Second Semester B.Sc. (Microbiology) Scheme

	SEMESTER-II										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/ week**			**Credits**	**Duration of exams (Hrs)**	**Teaching Department**
			IA	**SEE**	**Total**	**L**	**T**	**P**			
L3	----	Language 3	20	80	100	3	-	-	3	3	------
L4	----	Language 4	20	80	100	3	-	-	3	3	------
Major	2A2MICM02T	Microbial Physiology and Biochemistry	20	80	100	3	-	-	3	3	Microbiology
	2A2MICM02L	Microbial Physiology and Biochemistry	10	40	50	-	-	4	2	3	Microbiology
Major	----	Major Subject 2	20	80	100	3	-	-	3	3	----
	----	Practical	10	40	50	-	-	4	2	3	-----
Major	----	Major Subject 3	20	80	100	3	-	-	3	3	-----
	----	Practical	10	40	50	-	-	4	2	3	
Common	2S1XXXC01T	Constitutional Values	10	40	50	2	-	-	2	2	Constitutional Values: Political Science
	2S1XXXC02T	Environment Studies									Environmental Studies: Chemistry/Geography/ Botany
Total Marks					**700**	**Semester Credits**			**23**		

L3 & L4: Languages

B.Sc. I- Semester MICROBIOLOGY (Theory)

Course Code: 2A1MICM01T
Paper Title: **Introduction to Microbiology and Microbial Diversity**
Teaching Hours / Week: 3 Total Marks: Th- 80 + IA- 20 = 100
Total Teaching Hours: 40 Credits: 3

Course Outcomes (CO's): At the end of the course students will be able to

1. Learning the scientific methods and the history of science is the embodiment of scientific knowledge.
2. As an introductory part of Microbiology, students will get the basic ideas and practices from the contribution of several Microbiologists in the field of microbiology.
3. They will have to know the diversity of microbial world like algae, fungi, protozoa and their general characteristics and importance.
4.They will be understood various laboratory practices, biosafety and also know the applications of important instruments like biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH
5. Concept building about the relevance of biodiversity of microbial world

(Course Content)

	Contents	Hours
Unit-I	**History and mile stones in Microbiology**: Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky. Importance and Applications of Microbiology. Classification of microorganisms. Whittaker's five Kingdom concept. General characteristics and outline classification of Bacteria, Archaea, Mycoplasmas, Cyanobacteria, Fungi, Algae, Protozoa and Viruses.	**10**
Unit-II	**Methods of Sterilization:** Physical methods – Dry heat, Moist heat, Radiation methods, Filtration methods, Chemical methods and their applications. **Microbial cultures:** Methods of pure culture isolation, Single cell isolation, and Pure culture development. **Preservation of microbial cultures:** sub-culturing, over laying cultures with mineral oils, Storage at low temperature. **Staining Techniques**-Simple and differential staining techniques.	**10**

Unit-III	**Principles of microscopy**- Bright field and Electron microscopy (SEM and TEM). **Nutritional types of bacteria**: Microbiological media-Natural and Synthetic media maintenance and transport media. **Microbial growth:** Principles of growth, Kinetics of growth, **Methods of measuring growth: Direct methods:** viable plate counts, membrane filtration. **Indirect methods:** Metabolic activity – Measurements of DNA, Protein, Batch and continuous growth, Synchronous culture, Types of cultures-stock, batch, continuous and synchronous cultures.	**10**
Unit-IV	Cultivation of aerobes and anaerobes. Reproduction in bacteria and spore formation. **Ultra structure of Prokaryotic cell**- Variant components and invariant components. Cell wall of bacteria and fungi, Gram positive and Gram negative cell wall, Cell wall of fungi and yeasts. Morphology, Ultrastructure and Chemical composition of bacteria, Actinomycetes, Spirochetes, Mycoplasma. Economic importance of algae and fungi.	**10**

B.Sc. I- Semester MICROBIOLOGY (Practical)

Course Code: 2A1MICM01L Paper Title: **Introduction to Microbiology and Microbial Diversity**

Teaching Hours / Week: 4 Total Marks: Th- 40 + IA- 10 = 50

Total Teaching Hours: 40 Credits: 2

(Course Content)

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

Suggested Readings:

1.Pelczar,M.J.,Chan,E.C.S.andKreig,N.R.(1993).Microbiology.5thEdition,TataMc Graw Hill Publishing Co., Ltd., New Delhi.
2.Dube,R.C.andMaheswari,D.K.(2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
3.Power,C.B.and Daginawala, H.F.(1986).General Microbiology VolI& II
4.Prescott,M.J.,Harley,J.P.andKlein,D.A.(2010).Microbiology.5th Edition,WCBMc Graw Hill, New York.
5.Reddy,S.M.and Reddy,S.R.(1998).Microbiology□ PracticalManual,3rdEdition,Sri Padmavathi Publications, Hyderabad.
6.Singh,R.P.(2007).General Microbiology. Kalyani Publishers, New Delhi.
7.Stanier,R.Y.,Adelberg,E.A.andIngram,J.L.(1991).General Microbiology,5thEd., Prentice Hall of India Pvt. Ltd., New Delhi.

8.Microbiology Edited by Prescott
9.JayaBabu(2006).Practical Manual on Microbial Metabolism s and General Microbiology. Kalyani Publishers, New Delhi.
10. Gopal Reddy*et al.*, Laboratory Experiments in Microbiology

B.Sc. II- Semester MICROBIOLOGY (Theory)

Course Code: 2A2MICM02
Paper Title: **Microbial Physiology and Biochemistry**
Teaching Hours / Week: 3 Total Marks: Th- 80 + IA- 20 =100
Total Teaching Hours: 40 Credits: 3

Course Outcomes (CO's): At the end of the course, students will be able to

1. Students will have to acquire the clear cut knowledge of microbial growth and effect of environmental factors (like pH, temperature, salt concentration etc.) on microbial growth, nutrient uptake and transport, aerobic, anaerobic respiration, fermentation and at the same time phototrophic metabolism and nitrogen metabolism.
2. Here students will have to know the Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant and also Standard Free Energy Change of coupled reactions.
3. Students will have to acquire the clear cut knowledge regarding the properties, functions, structures of different bio-molecule like Carbohydrates, Lipids, Proteins, Enzymes and Vitamins.
4. Students will be able to run various biochemical tests like qualitative or quantitative tests for carbohydrates, reducing sugars, non reducing sugar, Lipids, and proteins.
5. They will have to study the protein secondary, tertiary structures, enzyme kinetics – calculation of Vmax, Km, Kcat values and effect of temperature, pH and heavy metals on enzyme activity.

(Course Content)

	Contents	Hours
Unit-I	**Carbohydrates**–Classification, chemistry, properties, and functions–mono,di, and polysaccharides. **Lipids –** classification, chemistry, properties and functions – free fatty acids, triglycerides, phospholipids, glycolipids & waxes **Proteins-**Isolation and characterization of proteins. Structural levels of proteins–primary, secondary, tertiary and quaternary, denaturation of proteins. Hydrolysis of proteins. **Amino acids** –Classification, structure and functions. Essential amino acids and functions of carboxyl and amino groups and side chains.	**10**
Unit-II	**Nucleic acids**–Structure, function and their properties. Chemical structure and base composition of nucleic acids, Watson Crick Model (B-DNA), other forms of DNA (A-and Z-DNA), Structural characteristics of RNA. Types of RNA.	**10**

Unit-III	**Aerobic respiration** - Glycolysis, TCA cycle, Electron transport, oxidative and substrate level phosphorylation. Kreb'scycle, monophosphate (HMP) shunt, gluconeogenesis. **Anaerobic respiration** Fermentation, biochemical mechanisms of lactic acid, and ethanol fermentations. Nitrate and sulphate respiration. Outlines of oxygenic and an oxygenic photosynthesis in bacteria.	**10**
Unit-IV	**Properties and classification of Enzymes**. Biocatalysis; lock and key models. Co-enzymes and Co-factors. Factors affecting catalytic activity. Inhibition of enzyme activity-competitive, non competitive. **Enzyme kinetics:** Effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature.	**10**

B.Sc. II- Semester MICROBIOLOGY (Practical)

Course Code: 2A2MICM02L Paper Title: **Microbial Physiology and Biochemistry**

Teaching Hours / Week: 4 Total Marks: Th- 40 + IA- 10 = 50

Total Teaching Hours: 40 Credits: 2

(Course Content)

Contents	Hours
1. Qualitative Analysis of Carbohydrates. 2. Qualitative Analysis of Amino acids. 3. Colorimetric estimation DNA by diphenylamine method.	**10**
4. Estimation of RNA by Orcinol method. 5. Colorimetric estimation of proteins by Biuret/Lowry method. 6. Estimation of reducing sugar-Anthrone method.	**10**
7. Estimation of sugar by titration method–Benedict's method. 8. Determination of pKa and pI values of amino acids. 9. Assay of amylase activity.	**10**
10. Effect of temperature/pH on enzyme activity 11. Demonstration of immobilization of enzyme activity. 12. Any other practical depending on feasibility	**10**

Suggested Readings:

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

ASSESSMENT METHODS

Formative Assessment for Theory

Evaluation Scheme for Internal Assessment: Continuous Internal Assessment (CIA)

Assessment Criteria 20 marks		
1st Internal Assessment Test for 20 marks of 1 hour duration after 8 weeks and later marks should be reduced to 5	CIA : C1	5 Marks
2nd Internal Assessment Test for 40 marks 2 hours duration after 15 weeks and marks should be reduced to 10	CIA : C2	10 Marks
Assignment/ Activity	CIA : C3	05 Marks
Total		20 Marks

Summative Assessment for Theory:

SEMESTER END EXAM : SEE	C4	80 Marks

Formative Assessment for Practical:

Assessment Criteria 10 marks		
Internal Test including basic understanding of the concept, Viva Voce, Journal. Test should be conducted for 50 marks and later it should be reduced for 10 marks	CIA : C1	10 Marks

Summative Assessment for Practical:

SEMESTER END EXAM : SEE	C2	40 Marks

Scheme of Semester End Practical Examination: 40 Marks
(Question Paper Pattern)

I/II/III/IV/V/VI SEMESTER B.Sc. PRACTICAL EXAMINATION-_____-2024

MICROBIOLOGY

COURSE CODE: COURSE TITLE

Assessment Distribution of Marks

(Perform all the experiments as per the instructions in each question)

1. Major Experiments	**12 Marks**
2. Minor Experiments	**08 Marks**
3. Identifications (A-D)	**12 Marks**
4. Viva	**04 Marks**
5. Journal	**04 Marks**

Total: 40 Marks

Note: Same Scheme may be used for IA (Formative Assessment) examination for 40 marks and converted to 10 IA marks

Instructions to set the question paper and question paper pattern :

Instruction to set the question paper.

1. Question number 1 has 12 sub questions consisting of 3 questions from each unit. Each question carries two marks. Student has to answer any ten questions.
2. Question number 2 to 7 are from unit I to IV.
   Each question carries five marks. Student has to answer any four questions
3. Question number 8 to 12 are from unit I to IV.
   Each question carries ten marks. Student has to answer any four questions.

Question Paper pattern

B.Sc. Degree Examination
MICROBIOLOGY

Time: 3 hours Max. Marks: 80

		Part- A	
1.		**Answer any <u>TEN</u> questions**	**10 x 2 = 20**
	a)		
	b)		
	c)		
	d)		
	e)		
	f)		
	g)		
	h)		
	i)		
	j)		
	k)		
	l)		
		Part-B	
		Answer any <u>Four</u> questions	**4 x 5 = 20**
	2		
	3		
	4		
	5		
	6		
	7		
		Part-C	
		Answer any FOUR questions	**4 X 10 = 40**
	8		
	9		
	10		
	11		
	12		