

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2022

'B++' Grade (CGPA 2.96)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: MICROBIOLOGY

Name of the Course: B. Sc. I (Sem.-I & II)

(Syllabus to be implemented from June 2022)

Choice Based Credit System (CBCS) **(W.e.f. June 2022)**

Preamble:

The Curriculum development plays a very vital role in the development of quality of education. The education system should be such that students will be able to compete locally, regionally, nationally as well as globally. The present situation demands developing “learner-centric approach while redesigning of curriculum. There is also need to allow the flexibility in education system. The choice based credit system (CBCS) allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers and thus offers more flexibility for student. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. In view of this, PAH Solapur University, Solapur has implemented Choice Based Credit System of Evaluation at Undergraduate level. While designing the syllabi of microbiology for undergraduate course for semester V and VI, an attempt has been made to follow the pattern given in the UGCs Undergraduate Template. This will help to bring a match across all the Indian universities.

Introduction:

Microbiology deals with the study of microorganisms. This branch of life science has immensely grown up widening its horizons and opening new frontiers of knowledge. The scope of microbiology as a subject is immense due to its ability to control all critical points of many fields like medical, dairy, pharmaceutical, industrial, clinical, research, water industry, agriculture, nanotechnology, etc. A career in microbiology is lucrative option. There is demand of trained microbiologists in a vast range of industries and institutes like research and development laboratories of government and private hospitals, research organizations, pharmaceutical, food, beverage and chemical industries. To cater the needs, discipline specific papers on industrial, agricultural, environmental, medical microbiology, microbial biochemistry, virology and immunology have been included in the curriculum for semester V and VI. At the same time, the framework is so designed as to maintain standards of microbiology degree and the learning outcomes.

Learning Outcomes based approach to Curriculum Planning:

The Learning Outcomes-based Curriculum Framework (LOCF) for the B.Sc. (Honours) degree in Microbiology is designed to suit the need of the hour, in keeping with the emergence of new areas of microbiology. The framework is architected to allow for flexibility in programme design and course content development, while at the same time maintaining a basic uniformity in structure in comparison with other universities across the country. The programme is designed to build a strong microbiology knowledge base in the student and furthermore, acquaints the students with the applied aspects of this fascinating discipline as well. The student is thus equipped to pursue higher studies in an institution of her/his choice, and to apply the skills learnt in the programme to solving practical societal problems. The programme offers an elective course to the student for skill enhancement courses that prepares the student for an eventual job in academia or industry.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core Requirement is termed as a Core course.
 2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course. Discipline Specific Course (DSC) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective.
 3. **Ability Enhancement Compulsory Course (AECC):** The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement; (i) English and (ii) English/ Democracy, Elections and Good Governance. These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
- **Credit:** Credit is a numerical value that indicates students work load (Lectures, Lab work, Seminar, Tutorials, Field work etc.) to complete a course unit. In most of the universities 15 contact hours constitute one credit. The contact hours are transformed into credits. Moreover, the grading system of evaluation is introduced for B.Sc. course wherein process of Continuous Internal Evaluation is ensured. The candidate has to appear for Internal Evaluation of 10 marks and University Evaluation for 40 marks for each paper in semester I and II.

• Objectives of the course:

The objectives of B. Sc. Microbiology course are:

- 1) To impart knowledge with respect to the subject and its practicable applicability.
- 2) To enhance understanding of basic and advanced concepts in microbiology.
- 3) To develop the awareness of various emerging areas of Microbiology.
- 4) To train students for further studies helping in their bright career in the subject
- 5) To expose the students to different processes used in industries and in research field
- 6) To develop their ability to apply the knowledge of microbiology in day to day life.
- 7) To prepare the students to accept the challenges in life sciences.
- 8) To make students skillful to work in various industries, research labs and health sector.

Course outcome and Advantages: After completing the course students will be familiarized the with necessary laboratory techniques and tools of microbiology and provide an exposure in research, analytical and presentational skills. Microbiology has tremendous job potential. The successful students will be able well trained to get various microbiology related job.

• **Medium of Instruction:** English

• **Syllabus Structure:**

• The University follows semester system.

• An academic year shall consist of two semesters.

• B.Sc. Part- I Microbiology shall consist of two semesters: Semester I and Semester II

In semester I: there will be two DSC papers having paper I to II of 50 marks each. English will be Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” .

In Semester II: there will be two DSC papers having paper III to paper IV of 50 marks each. There will be two Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” as a English with Democracy, Elections and Good governance

• **Scheme of Evaluation:**

As per the norms of the grading system of evaluation, for each paper out of 100 marks, the candidate has to appear for college internal assessment of 20 marks and external evaluation (University assessment) of 80 marks.

Semester – I: Theory: (Paper I & II=50+50=100 marks): Comprising DSC

a) University Examination (UA) (80 marks): No. of theory papers: 2 (paper I and paper II)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 2 (paper I and paper II) by conducting unit test/ open book test/ home assignment/ Group discussion.

c) Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” on English

Semester – II: Theory: (100 marks): Comprising DSC

a) University Examination (UA) (80 marks): No. of theory papers: 2 (paper III and paper IV)

b) Internal Continuous Assessment (CA) (20 marks) No. of theory papers: 2 (paper I and paper II) by conducting unit test/ open book test/ home assignment/ Group discussion.

c) Compulsory paper on “Ability Enhancement Compulsory Course (AECC)” on English and Democracy, Elections and good governance.

Practical Examination: (100 marks)

University Examination (80 marks): Number of questions on practicals for exam: 07

Practical-I: Based on Papers- I & II, III & IV (80 Marks UA)

Internal Continuous Assessment: (20 Marks CA)

Passing Standard:

The student has to secure a minimum of 4.0 grade points (Grade C) in each paper. A student who secure less than 4.0 grade point (39% or less marks, Grade FC/FR) will be declared fail in that paper and shall be required to reappear for respective paper. A student who failed in University Examination (theory) and passed in internal assessment of a same paper shall be given FC Grade. Such student will have to reappear for University Examination only. A student who fails in internal assessment and passed in University examination (theory) shall be given FR Grade. Such student will have to reappear for both University examination as well as internal assessment. In case of Annual pattern/old semester pattern students/candidates from the mark scheme the candidates shall appear for the same stipulated marks of external examination and his/her performance shall be scaled to 100 marks.

• ATKT:

Passed in all papers except 5 (Five) papers combined together of semester I and II of B.Sc. Part-I Microbiology examination and clearly passed in B.Sc. Part-I-Microbiology shall be permitted to enter upon the course of Semester III of B.Sc. II Microbiology.

Equivalent Subject for Old Syllabus

Sr. No.	Name of the Old Paper	Name of the New Paper
1)	Fundamentals of Microbiology	Introduction to Microbiology and Microbial Diversity
2)	Basic Techniques in Microbiology	Cell cytology and Microbial Techniques
3)	Microbial Physiology	Microbial Metabolism and Cultivation
4)	Applied Microbiology	Applied Microbiology

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science and Technology

Choice Based Credit System (CBCS),

(w.e.f.2022-23) Revised Structure for B. Sc-I

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class :	B.Sc.- I Semester – I									
Ability Enhancement Compulsory Course (AECC)		English Paper I Part-A (communication skill)		4.0			50	40	10	2.0
Core Courses (*Students can opt any Four Subjects from the Twelve Subjects Listed below.		DSC 1A	Paper- I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 2A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 3A	Paper-I	2.5	--	--	50	40	10	4.0
			Paper-II	2.5	--	--	50	40	10	
		DSC 4A	Paper-I	2.5	--	--	50	40	10	4.0
		Paper-II	2.5	--	--	50	40	10		
Total				24	--	--	450	360	90	18
Class :	B.Sc.- I Semester – II									
Ability Enhancement Course(AECC)		English Paper I Part-B (communication skill)		4.0			50	40	10	2.0
Core Courses (*Students can opt any Four Subjects from the Twelve Subjects Listed below.		DSC 1B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 2B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 3B	Paper-III	2.5	--	--	50	40	10	4.0
			Paper-IV	2.5	--	--	50	40	10	
		DSC 4B	Paper-III	2.5	--	--	50	40	10	4.0
		Paper-IV	2.5	--	--	50	40	10		
		Democracy, Elections and Good Governance		3			50	40	10	NC
Total (Theory)				24	--	--	450	360	90	18
Core Practical		DSC 1 A & 1B	Practical I	--	--	4	100	80	20	4.0
		DSC 2 A & 2B	Practical I	--	--	4	100	80	20	4.0
		DSC 3A & 3B	Practical I	--	--	4	100	80	20	4.0
		DSC 4A & 4B	Practical I	--	--	4	100	80	20	4.0
Total (Pract.)						16	400	320	80	16
Grand Total				48		16	1300	1040	260	52

***Core Courses: Chemistry/Physics/ /Mathematics/Statistics/Botany/Zoology/ Microbiology/ Electronics/Computer Science Geology/ Geography/Psychology**

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology Choice Based Credit System (CBCS)(w.e.f.2023-24)

Revised Structure for B. Sc-II

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Name			L	T	P				
Class :		B.Sc.- II Semester – III								
Core Courses (*Students can opt any Three subjects among the Four Subjects offered at B. Sc. I. OR Students can opt any Two subjects among the Four Subjects offered at B. Sc. I and any one from the Additional Interdisciplinary subjects.	DSC 1C	AIC-1A	Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
	DSC 2C		Paper-V	3	--	--	50	40	10	4.0
			Paper-VI	3	--	--	50	40	10	
	DSC 3C		Paper-V	3	--	--	50	40	10	4.0
Paper-VI	3	--	--	50	40	10				
Total Sem.-III				18	--	--	300	240	60	12
\$ SEC-1				4	--	--	100	80	20	4
Class :		B.Sc.- II Semester –IV								
Core Courses (*Students can opt any Three subjects among the Four Subjects offered at B.Sc. I. OR Students can opt any Two subjects among the Four Subjects offered at B.Sc. I and any one from the Additional Interdisciplinary subjects.	DSC 1D	AIC-1B	Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
	DSC 2D		Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
	DSC 3D		Paper-VII	3	--	--	50	40	10	4.0
			Paper-VIII	3	--	--	50	40	10	
Environmental Studies				3	--	--	50	40	10	NC
Total Sem-IV				18			300	240	60	12
Total (Theory)				36	--	--	600	480	120	24
Core Practical	DSC 1C & 1D	AIC 1A & 1B	Pr. II & III	--	--	8	200	160	40	4.0
	DSC 2C & 2D		Pr. II & III	--	--	8	200	160	40	4.0
	DSC 3C & 3D		Pr. II & III	--	--	8	200	160	40	4.0
Total (Practicals)						24	600	480	120	24
Grand Total				36		24	1200	960	240	48
\$ SEC-1				4			100	80	20	4

*Core Courses: Chemistry/Physics/ /Mathematics/Statistics/Botany/Zoology/ Microbiology/ Electronics/Computer Science/ Geology/ Geography/Psychology

Additional Interdisciplinary Courses - Geochemistry/Biochemistry/Meteorology/Plant Protection/NCC etc.
 \$The students can choose MOOCs/ NPTEL/SWAYAM/Path Shala/Add-on / Skill based courses of university/college initiated courses of same credits.

\$ These courses are not compulsory, but after completion of these courses students get additional credits on their mark lists.

\$ SEC courses run by colleges should be communicated to university for information & necessary action.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Faculty of Science & Technology

Choice Based Credit System (CBCS)(w.e.f.2024-25)

Revised Structure for B. Sc-III

Subject/ Core Course	Name and Type of the Paper		No. of papers/ Practical	Hrs/week			Total Marks Per Paper	UA	CA	Credits
	Type	Name		L	T	P				
Class :	B.Sc.- III Semester - V									
Ability Enhancement Course(AECC)	English (Business English)		Paper II Part A	4	--	--	50	40	10	2.0
Core Courses: (Students can opt any one subjects among the three Subjects excluding Interdisciplinary/Additional subject offered at B. Sc-II.)	DSC 1 E		Paper IX	4	--	--	100	80	20	4.0
	DSC 1 F		Paper X	4	--	--	100	80	20	4.0
	DSC 1 G		Paper XI	4	--	--	100	80	20	4.0
	DSE 1 A/B/C		Paper XII	4	--	--	100	80	20	4.0
Total Theory Sem-V				20	--	--	450	360	90	18
	\$ SEC-2			4	--	--	100	80	20	4.0
Class :	B.Sc.- III Semester –VI									
Ability Enhancement Course(AECC)	English (Business English)		Paper II Part B	4	--	--	50	40	10	2.0
Core Coursest: (Students can opt any one subjects among the three Subjects excluding interdisciplinary / Additional subject offered at B.Sc. II.	DSC 1 H		Paper XIII	4	--	--	100	80	20	4.0
	DSC 1 I		Paper XIV	4	--	--	100	80	20	4.0
	DSC 1 J		Paper XV	4	--	--	100	80	20	4.0
	DSE 2 A/B/C		Paper XVI	4	--	--	100	80	20	4.0
Total Theory Sem-VI				20	--	--	450	360	90	18
Core	DSC 1E &1H		Practical IV	--	--	5	100	80	20	4.0
	DSC 1F & 1 I		Practical V	--	--	5	100	80	20	4.0
	DSC 1G & 1 J		Practical VI	--	--	5	100	80	20	4.0
	DSE 1A/B & 2 A/B		Practical VII	--	--	5	100	80	20	4.0
Total (Practicals)						20	400	320	80	16
Grand Total				40		20	1300	1040	260	52
	\$ SEC-2			4			100	80	20	4

§The students can choose MOOCs/ NPTEL/SWAYAM/Pathshala/Add-on / Skill based courses of university/college initiated courses of same credits.

§ These courses are not compulsory, but after completion of these courses students get additional credits on their

Mark lists. §SEC Courses initiated by colleges should be communicated to university for information and necessary action.

Summary of the Structure of B.Sc. Program as per CBCS pattern

Class	Semester	Marks-Theory	Credits-Theory	Marks-Practical	Credits-Practical's	Total - credits
B.Sc.-I	I	450	18	--	--	18
	II	450	18	400	16	34
B.Sc.-II	III	300	12	--	--	12
	IV	300	12	600	24	36
B.Sc.-III	V	450	18	--	--	18
	VI	450	18	400	16	34
Total		2400	96	1400	56	152
	SEC sem.- III & V	200	8			8

B.Sc. Programme :

Total Marks : Theory + Practicals = 2400(+200) +1400 =3800+200

Credits : Theory + Practicals = 96(08) + 56 = 152+08

Numbers of Papers Theory: Ability Enhancement Compulsory Course (AECC) 04

Theory: Discipline Specific Core Paper (DSC) 20

Theory: Discipline Specific Elective paper (DSE) 02

Skill Enhancement Course (SEC) 04

Total : Theory Papers (Core paper-22) 30

: Practical Papers 11

Abbreviations:

L: Lectures T: Tutorials P: Practical UA : University Assessment CA : College Assessment CC: Core Course AEC : Ability Enhancement Course DSE : Discipline Specific Elective Paper SEC : Skill Enhancement Course, AIC: Additional Interdisciplinary Courses

Note:

Each theory papers of 50 Marks should be of two Units.

Each theory papers of 100 Marks should be of four Units.

Each theory paper Unit is of 15 Lectures.

Practical paper of 100 Marks is of at least 20 practical.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
B.Sc. I (Semester I)

DSE 4A: Paper I – Introduction to Microbiology and Microbial Diversity		
THEORY COURSE (02 credits)		Total Lectures 30L
Unit No.	Content of Unit	Lectures Allotted
I	<p>History and Scope of Microbiology</p> <p>A. Historical Background: a) Contribution of Robert Hook, Antony Van Leuwenhoek, Ernst Ruska</p> <p>b) Theory of spontaneous generation: Francisco Redii, John Needham, Friedrich Schroder and Van Dusch, Louis Pasteur (Swan neck flask experiment) and John Tyndall.</p> <p>c) Golden era of Microbiology (1857-1914) - i) Germ theory of fermentation ii) Germ theory of disease</p> <p>d) Contribution of Martinus Beijerinck, Sergei Winogradsky, Joseph Lister and Dmitri Ivanovski, Edward Jenner, Eli Metchnikoff, Salman Waksman, Alexander Fleming. in development of applied microbiology.</p> <p>B. a) Branches of Microbiology</p> <p>b) National Institutes related to microbiology in India – NIV, NARI, NCCS, CCMB, Serum Institute of India, Vasantdada Sugar Institute.</p>	15
II	<p>Microbial Diversity</p> <p>A. General Characteristics, occurrence and economic importance of microorganisms –</p> <p>a) Acellular – Viruses (definition and example of Phytophage, Zoophage and Bacteriophage), Viroid, Prions b) Cellular – i) Bacteria (Size, Shape and Arrangement) ii) Mycoplasma iii) Rickettsia iv) Actinomycetes v) Archaeobacteria vi) Algae vii) Fungi viii) Protozoa</p> <p>B. Differences between prokaryotic and eukaryotic cell</p> <p>C. Bacterial Taxonomy - a) Basic principles of nomenclature b) Criteria for bacterial classification and identification – Morphological, cultural, Biochemical and molecular by 16S rRNA gene sequencing, % G + C (Introductory concept),</p>	15 L

DSC4A: Paper II: Cell cytology and Microbial Techniques		
THEORY COURSE (02 credits)		Total Lectures 30L
Unit No.	Content of Unit	Lectures Allotted
I	<p>Cellular organization of Bacteria</p> <p>A) Structure, composition and Functions of :</p> <ul style="list-style-type: none"> i) Cell wall-Gram-positive and Gram-negative bacteria ii) Definitions of sphaeroplast and protoplast iii) Cell membrane -fluid mosaic model iv) Cytoplasm- Ribosome, mesosome and nucleoid v) Ultrastructure of endospore vi) Capsule and slime layer vii) Flagella and Pili 	15
II	<p>Basic techniques in Microbiology</p> <p>A) Microscopy</p> <ul style="list-style-type: none"> i) Basic concept-Magnification, numerical aperture and resolving power. ii) Principle, working and application of compound microscope and electron microscope (Scanning electron microscope (SEM), Transmission electron microscope (TEM). <p>B) Staining techniques –</p> <ul style="list-style-type: none"> i) Definition, types of stain ii) Different methods of staining- monochrome, negative, Differential, iii) Special staining - Cell wall staining (by Chance's method) and capsule staining (by Maneval's method) <p>C) Sterilization techniques:</p> <ul style="list-style-type: none"> i) Definitions of- sterilization, disinfection, antiseptic, germicide, microbiostasis and sanitization ii) Sterilization by Physical agents-Temperature (dry heat and moist heat), Radiation -U.V rays and γ-rays and Membrane Filtration. <p>iii) Sterilization by chemical agents</p> <p>Phenol and phenolic compounds , Ethyl alcohol, Halogens- chlorine and iodide, Heavy Metals – Copper and Mercury and Gaseous agents- Ethylene oxide, β- propiolactone, formaldehyde.</p>	15 L

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Sc. I (Semester II)

DSC 4B: Paper III: Microbial Metabolism and Cultivation		
THEORY COURSE (02 credits)		Total Lectures 30L
Unit No.	Content of Unit	Lectures Allotted
I	<p>Biomolecules and Bioenergetics:</p> <p>A) Biomolecules: Structure and function of a) Carbohydrates b) Proteins c) Lipids d) Nucleic acids- i) DNA ii) RNA</p> <p>B) Bioenergetics: First and Second law of Thermodynamics, Definition of Gibbs free energy, enthalpy and entropy, High energy compounds and structure of ATP, definition of Metabolism, Anabolism and Catabolism.</p> <p>C) Enzymes and metabolic pathways: i) Definition -apoenzyme, coenzymes, cofactors, prosthetic group and active site. ii) Types of enzymes - extracellular and intracellular, constitutive and induced enzyme. iii) Mechanism of enzyme action: Lock and key hypothesis and induced fit hypothesis.</p> <p>iv) Catabolism of glucose- EMP pathway, Fate of Pyruvate- i) Aerobic ii) Anaerobic (Ethanol) iii) Microaerophilic (Lactic acid)</p>	15
II	<p>Microbial Nutrition and Cultivation Technique</p> <p>A) Microbial Nutrition: i) Nutritional requirements of microorganisms ii) Nutritional types of Microorganisms based on Carbon and Energy source.</p> <p>B) Cultivation techniques of Microorganisms</p> <p>1) Culture Media: i) Definitions with example- Living media and Non-living media- (Natural, Synthetic, Semi synthetic, Differential, Enriched and Selective).</p> <p>2) Methods of Pure culture: i) Serial dilution ii) Streak Plate, Spread Plate and Pour Plate technique.</p>	15 L

DSC 4B: Paper IV: Applied Microbiology

THEORY COURSE (02 credits)

Total Lectures 30L

Unit No.	Content of Unit	Lectures Allotted
I	<p>Water and sewage Microbiology</p> <p>A. Water Microbiology: a) Sources of Microorganisms in water b) fecal pollution of water and its indicator c) routine bacteriological analysis of water for detection and differentiation of coliforms –</p> <p>i) qualitative (presumptive, confirmed and completed) and IMViC and Eijkman test</p> <p>ii) Quantitative Test – MPN</p> <p>d) Municipal water purification process: Sedimentation, Filtration and Disinfection</p> <p>B. Sewage Microbiology: a) Definition, Types and Microflora of sewage b) Definition of DO , BOD and COD, c) Treatment of Sewage – Primary (Physical), Secondary (Chemical) and Tertiary (Biological) method</p>	15
II	<p>Medical Microbiology</p> <p>A. Definitions:- Infection, etiology, etiological agents, disease, pathogen, incubation period, fomite, pathogenicity, virulence, morbidity rate, mortality rate, opportunistic pathogen, carriers, host, epidemiology, prophylaxis.</p> <p>B. Types of diseases:- Epidemic, endemic, pandemic & sporadic</p> <p>C. Types of infections: Primary, Secondary, acute, chronic, reinfection, cross infection, Mixed infection, congenital, local, systemic and generalized</p> <p>D. Mode of transmission of diseases: 1) Inoculation 2) Ingestion 3) Contact 4) Inhalation</p> <p>E. Preventive and control measures for: 1) Water and food borne diseases 2) Air borne diseases 3) Vector borne diseases 4) Diseases transmitted through physical contact</p>	15 L

Practical Course B.Sc. – I Microbiology

Marks: 80+20

1. Good microbiology laboratory practices and Biosafety
2. Principle, working and applications of Common laboratory instruments
 - a) Autoclave
 - b) Hot Air Oven
 - c) Incubator
 - d) Colony Counter
 - e) PH Meter
 - f) Laminar Air flow
3. Handling and Care of compound Microscope
4. Monochrome staining
5. Negative staining
6. Gram staining
7. Special Staining Procedures - Cell Wall (Chance's Method)
8. Special staining Procedures - Capsule (Maneval's Method)
9. Preparation of Saline and culture media a) Peptone Water b) Nutrient Broth c) Nutrient agar d) MacConkey's agar e) Starch Agar f) Milk agar g) Sabouraud's agar
10. Demonstration of inoculation techniques – Broth, Slant, Stab, Spot, Spread, Streak and Pour plate
11. Determination of CFU by Serial Dilution Technique using sewage / food / soil/ water sample
12. Study of colony characteristics of bacterial isolates.
13. study of bacterial motility by Hanging drop technique
14. Isolation and identification of *E.coli* by four quadrant method using MacConkeys Agar.
15. Isolation and identification of *Bacillus sp.* by four quadrant method using Nutrient Agar.
16. Mounting of Fungi (a) *Aspergillus* (b) *Rhizopus* (c) *Penicillium* (d) *Mucor*
17. Study of coliforms by IMViC test.
18. Study of sugar fermentation - Glucose, Lactose,
19. Detection of Amylase activity
20. Detection of Caseinase activity

List of the Minimum equipments and related requirements for B.Sc – I

- 1) Centrifuge (Desktop): One
- 2) Hot plate: One
- 3) Hot air oven: One
- 4) Bacteriological incubator: One
- 5) Compound Microscope: one for each student
- 6) Light Microscope: Two
- 7) Separate room for fine instruments of size 10'×15' feet dimension
- 8) A separate culture room of at least 10'×10' feet dimension
- 9) Laminar air flow cabinet: One
- 10) Distillation assembly: One (Glass)
- 11) Water bath: One
- 12) Colony counter: One
- 13) Refrigerator: One
- 14) Computer with Internet facilities and printer: One
- 15) Micropipette: One
- 16) pH meter
- 17) Digital weight balance
- 18) Autoclave

References:

1. Outline of Biochemistry – Cohn and Stump
2. Biochemistry – Lehninger
3. Enzymes – Dixon and Web
4. Text book of Medical Microbiology – Ananthnarayan
5. Review of Medical Microbiology – Jawetz et al
6. Microbiology – Zinsser
7. Medical Microbiology – Cruickshank
8. Medical Microbiology - Davis and Dulbecco
9. Medical Bacteriology – Dey and Dey
10. Biology of Microorganisms – Brock, Parker, Madigen, 9th edition
11. Microbiology – Prescott and Harley, 5th edition
12. General microbiology – Stanier
13. General microbiology – Pawar and Daginawala Vol I and II
14. Advances in Biotechnology – S.W. Jogdand.
15. Textbook of Biotechnology – R.C. Dubey,
16. Biotechnology – B.D. Singh
17. Fundamentals of Bacteriology by A.J. Salle
18. Textbook of Microbiology by Pelczar, Tata McGraw Hill Publication.

B.Sc. Part I Microbiology

Practical Question Paper pattern for University assessment (UA)

Total Marks: 100 (80+20) Marks

Q. 1. Isolation, Colony Characters, Gram Staining and Motility of *Bacillus* spp / *E.coli* 25

Or

Q.1 Determination of CFU by Serial Dilution Technique using sewage / food / soil/ water sample

Q.2 Staining 10

Cell wall/ Capsule.

Q.3. Mount and Identify given fungus 10

Q. 4 Biochemical Test 10

Indol/ Methyl Red/ Voges proskauer/ Citrate Utilization/

Q.5. Enzyme Activity 10

Amylase/ Caseinase/ Glucose / Lactose fermentation

Q. 6 Spotting 10

(A) Identify and give its Use (Microscope Part)

(B) Identify and give Significance of (laboratory instrument)

(C) In which Staining Method it is used and give its significance (Stain)

(D) In which Medium it is used and give its significance (Media Component)

(E) In which Test it is used and give its significance (Indicator/Reagent)

Q. 7. Journal 5

College Assessment (CA) practical question paper pattern Marks 20

Q.1 Isolation by studying colony characters/staining techniques 10

Q.2 Spotting 05

Q. 3 Viva, Journal, Attendance 05