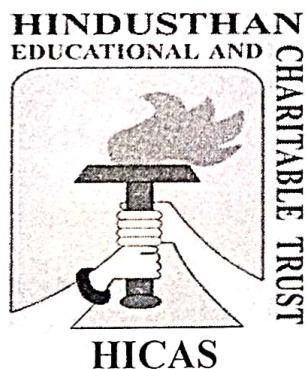


**LEARNING OUTCOMES–BASED CURRICULUM
FRAMEWORK (LOCF)**

in the

UNDERGRADUATE PROGRAMME MICROBIOLOGY

**FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2021 - 2022 AND ONWARDS**



HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

(Affiliated to Bharathiar University and Accredited by NAAC)

**COIMBATORE-641028
TAMILNADU, INDIA.**

Phone: 0422-4440555

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PREAMBLE

Microbiology is the study of microorganisms or microbes such as bacteria, viruses, fungi, algae, cyanobacteria, protozoa and prions. They are extremely important as their diverse activities range from causation of deadly diseases in humans, animals and plants to production of highly useful products like antibiotics, enzymes, alcohol, fermented foods and recycling of dead and decaying organic matter in the nature. Thus the science of Microbiology has an important role to play in health, agriculture, environment and industry. Several discoveries in the last two to three decades, which significantly impact these areas, have put Microbiology on the centre stage of teaching, research and development all over the globe.

VISION

To become a centre of academic excellence with highly qualified, knowledgeable, competent Microbiologists

To empower students as responsible citizens who can work for the progress of the society

MISSION

To incorporate outcome based curriculum by practicing innovative teaching methodologies both in theory and practicals

Building self confidence, values and optimistic thinking among the students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- **PEO 1:** Understand the impact of Microbiology in societal and environmental contexts
- **PEO 2:** Demonstrate the need for sustainable development
- **PEO 3:** Select and apply appropriate techniques and skills required as competitive Microbiologist
- **PEO 4:** To make students knowledgeable about the various basic concepts in a wide ranging contexts which involve the use of knowledge and skills of Microbiology
- **PEO 5:** Interpret the role of Microbiologists in the biotechnology industry and how they may be able to fit the bill in the industry

PROGRAMME OUTCOMES (PO's)

FOR LAB ORIENTED SCIENCE COURSES

- **PO1:** Students Acquire knowledge and understanding of the Microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.
- **PO2:** Problem Solving and Analysing is encouraged during the laboratory work. Students develop critical thinking and problem solving as related to Microbiology
- **PO3:** The graduates in Microbiology develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory work, environmental sustainability and ethics followed for scientific publishing of their research work in future.
- **PO4:** Skill to use important/ emerging tools/ databases, to retrieve data, and compare the data of the biological macromolecules with an interdisciplinary approach.
- **PO5:** The students graduating in Microbiology develop excellent communication skills both in the written as well as spoken language which are must for them to pursue higher studies from some of the best and internationally acclaimed universities and research institutions spread across the globe.
- **PO6:** Develop a broader perspective of the discipline of Microbiology to enable him/her to identify challenging societal problems and plan his/her professional career to develop innovative solutions for such problems and recognize the need for life-long learning in the broadest context of technological change.
- **PO7:** Competent enough to use Microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/ research projects etc

PROGRAMME SPECIFIC OUTCOME (PSO)

- PSO1:** Acquire, articulate, retain and apply specialized language and knowledge relevant to Microbiology.
- PSO2:** To prepare students as skilled scientific manpower with an understanding of Research ethics (public policy, biosafety, and intellectual property rights) involving microorganisms to contribute to application, advancement and impartment of knowledge in the field of Microbiology.
- PSO3:** Ability to present their work through written, oral, and visual presentations, including an original research proposal
- PSO4:** Students prepare them for careers in the industry, agriculture, and applied research where biological system is increasingly employed
- PSO5:** It is envisaged that the students trained under this curriculum will have the required attributes of knowledge, skills and temperament related to the subject of Microbiology

HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS), COIMBATORE-641028

SCHEME OF EXAMINATIONS - CBCS & LOCF PATTERN

(For the Students admitted from the Academic year 2021-2022 and Onwards)

UG PROGRAMME

Programme: B.Sc

Branch: MICROBIOLOGY

| Part | Course Code | Course Type | Course Title | Credit points | Lecture Hours/ Week | | Exam Duration (hours) | MAX. MARKS | | |
|----------------------|---|-------------|--|---|---------------------|-----------|-----------------------|------------|------------|------------|
| | | | | | Theory | Practical | | I.E. | E.E | Total |
| Semester – I | | | | | | | | | | |
| I | 21LAT01/ 21LAH01/ 21LAM01/ 21LAF01 | MIL | Tamil-I/ Hindi-I/ Malayalam – I/ French-I | 4 | 6 | - | 3 | 30 | 70 | 100 |
| II | 21ENG01 | AECC | English – I | 4 | 6 | - | 3 | 30 | 70 | 100 |
| III | 21MBU01 | DSC | Core I - Basic concepts of Microbiology | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU02 | DSC | Core II - Practical I – Basic concepts of Microbiology | 3 | - | 5 | 6 | 40 | 60 | 100 |
| III | 21MBU03 | GE | Allied I: Chemistry | 4 | 4 | - | 3 | 30 | 70 | 100 |
| III | 21MBU04 | GE | Allied II: Practical I – Chemistry | 2 | - | 3 | 3 | 40 | 60 | 100 |
| IV | 21MBUE01 | AEE | Open Elective - I | 2 | 3 | - | 3 | 100 | - | 100 |
| IV | 21GSU01 | AECC | Environmental Studies | 1 | 2 | - | 2 | 50 | - | 50 |
| IV | 21MBUV01 | SEC | VAC-I/Life Skills-I @ / Communicative English | 1* | 2 | - | 2 | 50 | - | 50** |
| IV | - | SEC | SDR- Student Development Report | Assessment will be in the Fifth Semester | | | | | | |
| V | - | AECC | Extension Activities NSS/NCC/SPORTS/YRC/SIS/SA | Assessment will be in the Fourth Semester | | | | | | |
| Total | | | | 25 | 28 | 8 | | 350 | 400 | 750 |
| Semester - II | | | | | | | | | | |
| I | 21LAT02/ 21LAH02/ 21LAM02/ 21LAF02 | MIL | Tamil-II/ Hindi-II/ Malayalam- II/French-II | 4 | 6 | - | 3 | 30 | 70 | 100 |
| II | 21ENG02 | AECC | English – II | 4 | 6 | - | 3 | 30 | 70 | 100 |
| III | 21MBU05 | DSC | Core - III - Biomolecules | 4 | 3 | 2 | 3 | 30 | 70 | 100 |
| III | 21MBU06 | DSC | Core - IV - Microbial Physiology and Metabolism | 4 | 4 | - | 3 | 30 | 70 | 100 |
| III | 21MBU07 | DSC | Core - V - Practical II / Microbial Physiology and Metabolism | 3 | - | 5 | 9 | 40 | 60 | 100 |
| III | 21MBU08 | GE | Allied III: Biochemistry | 3 | 3 | - | 3 | 30 | 70 | 100 |
| III | 21MBU09 | GE | Allied IV: Practical II - | 2 | - | 3 | 3 | 40 | 60 | 100 |

| | | | | | | | | | | |
|-----------------------|----------|------|--|-----------|-----------|-----------|---|------------|------------|-------------------|
| | | | Biochemistry | | | | | | | |
| III | 21MBU10 | SEC | Internship / Industrial Visit / Mini Project | 1 | - | - | - | 100 | - | 100 |
| IV | 21MBUV02 | SEC | VAC-II/Life Skills-II @/ Language | 1* | 2 | - | 2 | 50 | - | 50** |
| IV | 21MBUJ01 | SEC | Aptitude / Placement Training | Grade* | 2 | - | 2 | 50 | - | 50** |
| Total | | | | 25 | 26 | 10 | | 330 | 470 | 800 |
| Semester - III | | | | | | | | | | |
| III | 21MBU11 | DSC | Core - VI - Microbial Taxonomy and Genetics | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU12 | DSC | Core - VII - Practical- III Microbial Taxonomy and Genetics | 3 | - | 5 | 9 | 40 | 60 | 100 |
| III | 21MBU13 | DSE | Elective I /DSE I - | 3 | 3 | - | 3 | 30 | 70 | 100 |
| III | 21MBU14 | DSE | Elective II/DSE II - Practical | 3 | - | 5 | 9 | 40 | 60 | 100 |
| III | 21MBU15 | GE | Allied V- Basic Computers and Bioinformatics | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU16 | GE | Allied VI: Practical-III- Basic Computers and Bioinformatics | 3 | - | 5 | 3 | 40 | 60 | 100 |
| IV | 21MBUE02 | AEE | Open Elective-II | 2 | 3 | - | 3 | 100 | - | 100 |
| IV | 21GSU02 | AECC | Human Rights | 1 | 2 | - | 2 | 50 | - | 50 |
| IV | 21MBUJ02 | SEC | Aptitude / Placement Training | Grade* | 2 | - | 2 | 50 | - | 50** |
| IV | 21MBUJ03 | SEC | Online Course | - | 1 | - | - | - | - | C/NC [‡] |
| Total | | | | 25 | 21 | 15 | | 360 | 390 | 750 |
| Semester - IV | | | | | | | | | | |
| III | 21MBU17 | DSC | Core - VIII - Medical Microbiology | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU18 | DSC | Core - IX - Immunology | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU19 | DSC | Core - X - Practical IV- Medical Microbiology | 3 | - | 5 | 9 | 40 | 60 | 100 |
| III | 21MBU20 | DSC | Core - XI - Practical-V - Immunology | 2 | - | 4 | 9 | 40 | 60 | 100 |
| III | 21MBU21 | DSC | Core - XII - Advanced Microbiology | 4 | 4 | - | 3 | 30 | 70 | 100 |
| III | 21MBU22 | GE | Allied VII: Biophysics, Biomathematics & Biostatistics | 3 | - | 3 | 3 | 30 | 70 | 100 |
| III | 21MBU23 | GE | Allied VIII: Practical IV: Biophysics, | 2 | - | 3 | 3 | 40 | 60 | 100 |

| | | | | | | | | | | |
|----------------------|----------|------|--|-----------|-----------|-----------|---|------------|------------|-------------------|
| | | | Biomathematics & Biostatistics | | | | | | | |
| III | 21MBU24 | SEC | Internship / Institutional Training / Mini-Project | 1 | - | - | - | 100 | - | 100 |
| IV | 21MBUV03 | ACC | VAC-III | 1* | 2 | - | 2 | 50 | - | 50** |
| IV | 21MBUJ04 | SEC | Aptitude / Placement Training | Grade* | 2 | - | 2 | 50 | | 50** |
| IV | 21MBUJ05 | SEC | Online Course | - | 1 | - | - | - | - | C/NC [‡] |
| IV | 21GSU03 | AECC | Internet Security | 1 | 2 | - | 2 | 50 | - | 50 |
| V | 21GSU04 | AECC | Extension Activities NSS/NCC/SPORTS/YRC/SIS/SA# | 2 | - | - | - | - | - | C/NC [‡] |
| Total | | | | 28 | 21 | 15 | | 390 | 460 | 850 |
| Semester – V | | | | | | | | | | |
| III | 21MBU25 | DSC | Core - XIII - Virology and Nanotechnology | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU26 | DSC | Core - XIV - Environmental and Agricultural Microbiology | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU27 | DSC | Core - XV - Practical VI- Virology and Nanotechnology | 2 | - | 4 | 9 | 40 | 60 | 100 |
| III | 21MBU28 | DSC | Core - XVI - Practical VII Environmental & Agricultural Microbiology | 3 | | 5 | 9 | 40 | 60 | 100 |
| III | 21MBU29 | DSE | Elective III/ DSE III - | 3 | 3 | - | 3 | 30 | 70 | 100 |
| III | 21MBU30 | DSE | Elective IV/DSE IV - Practical | 3 | - | 5 | 9 | 40 | 60 | 100 |
| IV | 21MBUE03 | AEE | Open Elective-III | 2 | 3 | | 3 | 100 | - | 100 |
| IV | 21GSU05 | AECC | General Awareness | 1 | 1 | | 2 | 50 | - | 50 |
| IV | 21GSU06 | AECC | Law of Ethics | 1 | - | | 2 | 50 | - | 50 |
| IV | 21MBUV04 | ACC | VAC-IV | 1* | 2 | | 2 | 50 | - | 50** |
| IV | 21MBUJ06 | SEC | Aptitude / Placement Training | Grade* | 2 | | 2 | 50 | - | 50** |
| IV | 21MBUJ07 | SEC | Online Course | - | 1 | | - | - | - | C/NC [‡] |
| IV | 21MBUJ08 | SEC | SDR- Student Development Report | 2* | - | - | - | - | - | - |
| Total | | | | 25 | 22 | 14 | | 410 | 390 | 800 |
| Semester – VI | | | | | | | | | | |
| III | 21MBU31 | DSC | Core - XVII-Food Microbiology & Food safety | 5 | 5 | - | 3 | 30 | 70 | 100 |
| III | 21MBU32 | DSC | Core - XVIII-Industrial Microbiology | 5 | 5 | - | 3 | 30 | 70 | 100 |

| | | | | | | | | | | |
|--------------|---------|-----|---|-----------|-----------|----------|---|------------|------------|------------|
| III | 21MBU33 | SEC | Project Work /Student Research / Paper | 4 | - | 4 | - | 40 | 60 | 100 |
| III | 21MBU34 | DSC | Core - XIX - Self-Study Course Bioethics, Biosafety and Intellectual Property Rights | 3 | - | - | 3 | 30 | 70 | 100 |
| Total | | | | 17 | 10 | 4 | | 130 | 270 | 400 |

- denotes Extra credits which are not added with total credits.
- **denotes Extra marks which are not added with total marks.
- VAC-Value Added Course(Extra Credit Courses)
- *Grades depends on the marks obtained
- † C-Completed/ NC- Not Completed

| Range of Marks | Equivalent remarks |
|----------------|--------------------------------|
| 80 and above | Exemplary |
| 70-79 | Very good |
| 60-69 | Good |
| 50-59 | Fair |
| 40-49 | Satisfactory |
| Below 40 | Not Satisfactory=Not completed |

- Part IV& V not included in total marks and CGPA calculation.
- I.E-Internal Exam
- E.E-External Exam
- J-Job Oriented Course
- E-Open Elective Papers

PASSING MINIMUM

- Passing Minimum for UG 40% and for PG 50 %
- For UG : 35 % (25 marks) in EE and 40 % in Total Marks
- For PG 50 % (30 marks) in EE and 50 % in Total Marks.

ABSTRACT FOR SCHEME OF EXAMINATION

(For the candidates admitted during the academic year 2021 - 2022 and onwards)

| Part | Course | Papers | Credit | Total Credits | Marks | Total Marks |
|----------|---|--------|--------|----------------------------------|-------|---------------------------|
| Part I | Languages/ (MIL) | 2 | 4 | 8 | 100 | 200 |
| Part II | English/AECC-I | 2 | 4 | 8 | 100 | 200 |
| Part III | Core /DSC | 18 | 3/4/5 | 71 | 100 | 1800 |
| | Self-Study Course / DSC | 1 | 3 | 3 | 100 | 100 |
| | Allied /GE | 8 | 2/3/4 | 24 | 100 | 800 |
| | Electives/DSE | 4 | 3 | 12 | 100 | 400 |
| | Project / SEC | 1 | 4 | 4 | 100 | 100 |
| Part IV | Open Electives /AEE | 3 | 2 | 6 | 100 | 300 |
| | AECC –EVS/ HR/IS/GA/LE | 5 | 1 | 5 | 50 | 250 |
| | Value Added Course | 2 | 1 | 2* | 50 | 100** |
| | Aptitude / Placement Training / SEC | 4 | Grade* | Grade* | 50 | 200** |
| | Online courses / SEC | 3 | - | - | - | C/NC |
| | Life Skills / SEC | 2 | 1 | 2* | 50 | 100** |
| | Internship/Institutional Training/Mini-Project (Summer Courses #) | 2 | 1 | 2 | 100 | 200 |
| | SDR- Student Development Report | 1 | 2 | 2* | - | - |
| Part V | Extension Activities NSS / NCC/Sports/YRC / SIS / SA - AECC | 1 | - | 2 | - | C/NC |
| | Total | | | 142 (6 Extra Credits) | | 4350 + (400**) |

List of Open Elective Papers

| | |
|---|--|
| Open Electives | Yoga for Human Excellence Human Health & Hygiene Indian Culture and Heritage Indian Constitution and Political System Consumer Awareness and Protection Professional Ethics and Human Values Human Rights, Women's Rights & Gender Equality Disaster Management Green Farming Corporate Relations start a Business? Research Methodology and IPR General Studies for Competitive Examinations IIT JAM Examination (for Science only) CUCET Examination |
| VAC Papers | <ol style="list-style-type: none">1. Human Microbiome2. Public Health Microbiology3. Mushroom Cultivation Technology4. Biofertilizers and Biopesticides5. Microbial Quality Control in Food & Pharmaceutical Industries6. Forensic Microbiology7. Intellectual Property Rights8. Plant Pathology & Disease Management9. Microbial Biotechnology10. Communicable and Non-Communicable Diseases11. Medical Informatics |
| Courses offered by the Departments to other Programmes | |

ELECTIVES

| List of Elective Papers/ DSE (Can choose any one of the paper as electives) | | | |
|--|-------------|----------|---|
| | Course Code | Semester | Title |
| Electives/ DSE-I | 21MBU13A | III | Microbial Biotechnology |
| | 21MBU13B | | Pharmaceutical Microbiology |
| | 21MBU13C | | Human Microbial Disease Management |
| Electives/ DSE-II | 21MBU14A | III | Practicals - Microbial Biotechnology |
| | 21MBU14B | | Practicals - Pharmaceutical Microbiology |
| | 21MBU14C | | Practicals - Plant Pathology and Disease Management |
| Electives/ DSE-III | 21MBU29A | V | Genetic Engineering |
| | 21MBU29B | | Entrepreneurship in Microbiology |
| | 21MBU29C | | Veterinary Microbiology |
| Electives/ DSE-IV | 21MBU30A | V | Practicals - Genetic Engineering |
| | 21MBU30B | | Practicals - Microbial Products |
| | 21MBU30C | | Practicals - Human, Plant & Veterinary Microbiology |

ONLINE COURSES (DSC-XVIII & DSC-XIX/ Fast track)

OLC 4: Food Microbiology and Food Safety (SWAYAM)


OLC 5: Industrial Biotechnology (SWAYAM)


Syllabus Coordinator


Academic Council – Member Secretary

Co-ordinator
Academic Audit Cell
Hindusthan College of Arts & Science,
Coimbatore-641 028.


BOS-Chairman/Chairperson
HEAD
Department of Microbiology
Hindusthan College of Arts & Science
Coimbatore - 641 028


PRINCIPAL
PRINCIPAL
Hindusthan College of Arts and Science
Hindusthan Gardens, Behind Nava India,
Coimbatore - 641 028.

Regulations

1. Internship / Institutional Training / **Mini-Project** is related to the discipline can be permitted to complete during the end of I and III semesters for minimum seven days each and permitted to submit a report.

| | |
|-------------------------------------|----------------------------|
| Internship / Institutional Training | Not more than seven days |
| Mini project | Depends on the departments |

2. Project work is considered as a special course involving application of knowledge in problem solving / analyzing /exploring a real-life situation. A Project work may be given in lieu of a discipline specific elective paper.
3. **FAST TRACK SYSTEM:**

Two core courses DSE- III & DSE- XIV are the subjects which are to be related with NPTEL courses.

The Students have the options of taking two subjects of the sixth semester of Microbiology programme through NPTEL / Swayam portal from the list given or offered by NPTEL and approved by the department for which credit transfer is permitted. The students should inform the department prior to the registration of the course and get due approval for the same. If the student completes these courses before the start of the sixth semester, the student can be considered for a fast track programme, and do the project works alone during the sixth semester apart from the self study paper. Once the student submits the successful course completion credentials as required by the college for the NPTEL/SWAYAM online courses, then the credit transfer will be considered for qualifying the degree.

4. **If the students who are all completed the NPTEL courses before semester -V, they can avail exemption from appearing exams of DSC- XVIII & DSC- XIX in Fast track scheme.**
5. NSS / NCC/Sports/YRC / SIS / SA is mandatory for all students as per New Education Policy and the students must attend the allocated hours within two years and complete the programme. They will be evaluated during the end of second year (Fourth Semester) and also a certificate will be issued.
6. SDR – Student Development Report to be received by the department from the students till end of the fifth semester. (Evidences of Curriculum activities and Co-curriculum activities)
7. For online courses minimum of 2 certificates in any of the online platform is mandatory.

Extension Activities

NSS – National Service Scheme, as enrolled member with the College Unit.

NCC – National Credit Corps, as enrolled member with the College Unit.

SPORTS – Sports & Games Participation with College Team

YRC / RRC– Youth Red Cross / Red Ribbon Club, as enrolled member with the College Unit.

Rotaract Club - Rotaract Club, as enrolled member with the College Unit.

SIS – Special Interest Subjects, as approved by the Academic Council

SA – Social Activity for not less than 50 hours with NGGO like Aram Foundation / Shanthi Social Service / Siruthuli / Kulangal Pathukappu Amaipu /Old age Home / Nature Foundation / etc.

SEC-Skill Enhancement Course (Life Skills/ Aptitude/Placement Training/online course/Internship/SDR)

ECC- Ability Enhancement Compulsory Course (Environmental Studies/ Human Rights/Internet Security/ General Awareness/ Law of Ethics/Extension Activities)

UG Courses- Scheme of Evaluation (Internal & External Components)

(For the students admitted during the academic year 2021-2022 and onwards)

1. Internal Marks for all UG

| Components | Marks |
|--------------|-----------|
| Test I | 5 |
| Test II | 5 |
| Model Exam | 10 |
| Assignment | 5 |
| Attendance* | 5 |
| TOTAL | 30 |

*Split-up of Attendance Marks

- ♣ 75-79 - 1 marks
- ♣ 80-84 - 2 marks
- ♣ 85-89 - 3 marks
- ♣ 90-94 - 4 marks
- ♣ 95-100 - 5 marks

2. a) Components for Practical I.E.

| Components | Marks |
|--------------|-----------|
| Test -I | 20 |
| Test - II | 20 |
| Total | 40 |

b) Components for Practical E.E.

| Components | Marks |
|--------------|-----------|
| Experiments | 50 |
| Record | 5 |
| Viva | 5 |
| Total | 60 |

3. Institutional/ Industrial Training, Mini Project and Major Project Work

| Institutional / Industrial Training (I.E) | | Mini Project (I.E) | Major Project Work | | |
|---|------------|--------------------|-----------------------|-------|-------------|
| Component | Marks | Marks | Component | Marks | Total Marks |
| Work diary | 25 | - | I.E | | |
| Report | 50 | 50 | a)Attendance | 10 | |
| Viva-voce | 25 | 50 | b)Review/Work diary* | 30 | 40 |
| Total | 100 | 100 | E.E** a) Final report | 40 | |
| | | | b)Viva-voce | 20 | 60 |
| | | | Total | | 100 |

*Review is for Individual Project and Work Diary is for Group Projects
(group consisting of minimum 3 and maximum 5)

**Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

4. Guidelines for Internet Security/Human Rights/Law of Ethics/Environmental studies (Part IV)

| Components | Marks |
|---|-----------|
| Two Tests (each 2 hours) of 20 marks each [4 out of 7 descriptive type questions 4 x 5 = 20 Marks] | 40 |
| Two assignments (2 x 5) | 10 |
| Total | 50 |

5. Guidelines for General Awareness (Part IV)

| Components | Marks |
|---|-------|
| Two Tests (each 2 hours) of 25 marks each [50 objective type questions $50 \times 1/2 = 25$ Marks] | 50 |

6. Guidelines for Open Elective (Part IV)

| No of Activities | Marks |
|---|-------|
| Two Tests (each 3 hours) of 50 marks each [5 out of 8 descriptive type questions $5 \times 10 = 50$ Marks] | 100 |

7. Value Added Courses / Aptitude/Placement courses:

| Components | Marks |
|---|-----------|
| Two Test (each 1 hour) of 25 marks each QP is objective pattern ($25 \times 1 = 25$) | 50 |
| Total | 50 |

Guidelines:

1. The passing minimum for these items should be 40%
2. If the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent Semesters
3. Item No's:4,5,6 and 7 are to be treated as 100% Internal papers.
4. For item No.07, Tests conducted through online modules (Google Form/any other)

UG PATTERN
QUESTION PAPER PATTERN FOR CIA I and CIA II EXAM

Reg.No:-----

Q.P.CODE:

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
----- **DEGREE CIA-I/CIA-II EXAMINATIONS** -----20-----
(----- SEMESTER)

BRANCH: -----

SUBJECT NAME: -----

Time: Two Hours

Maximum:50 Marks

SECTION - A (6 x 1 = 6 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 1 to 6: Multiple choice/Fill up the blanks /True or False questions)

SECTION - B (4x 5 = 20 marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 7 to 10 Either Or type)

SECTION - C (2x12 = 24 marks)

Answer any **TWO** Questions out of **THREE** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No: 11 to 13)

QUESTION PAPER PATTERN FOR MODEL/END SEMESTER EXAMINATION

Reg.No:-----

Q.P.CODE:

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
----- **DEGREE MODEL EXAMINATIONS** -----20-----
(-----SEMESTER)

BRANCH : -----

SUBJECT NAME:-----

Duration: Three Hours

Maximum: 70 Marks

SECTION - A (10x1=10 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks

(Q.No 1 to 10 Multiple choice/Fill up the blanks /True or False questions)

(Two questions from each unit)

SECTION - B (5x6=30 Marks)

Answer **ALL** Question

ALL Questions Carry **EQUAL** Marks

(Q.No 11 to 15 Either or type)

(One question from each Unit)

SECTION- C (3x10=30 Marks)

Answer any **THREE** Questions out of **FIVE** Questions

ALL Questions carry **EQUAL** Marks

(Q.No 16 to 20) (One question from each Unit)

For UG (Question paper pattern) (Max. 70 marks)

| | |
|--|--|
| Sec-A (10x1=10marks) | All Questions will be in K1 Level |
| Sec-B (5x6=30marks) Either or type | 4 Questions will be in K1 Level, 3 Questions will be in K2, K3 each |
| Sec-C (3x10=30marks) Any 3 out of 5 questions | 2 Questions will be in K2, 3 Questions will be in K3 & K4 level |

| | | | | | | | | | |
|--------------|---------|--------------------------------|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU01 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | BASIC CONCEPTS OF MICROBIOLOGY | | | | | | Semester: | I |
| Hrs/Week: | 5 | L | 5 | T | - | P | - | Credits: | 5 |

COURSE OBJECTIVES:

- 1.To discuss about the basics and fundamentals of Microbiology
- 2.To illustrate the structure and function of bacteria
- 3.To construct knowledge on microscopic techniques to observe the microorganisms
- 4.To develop basic skills in aseptic techniques
- 5.To impart knowledge on the methods to cultivate and preserve microorganisms

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|--|----------------|
| CO1 | Summarize the fundamental concepts of Microbiology and analyze the contributions of Scientists | K1, K2, K3, K4 |
| CO2 | Explain the structure and function of bacterial cell. | K1, K2, K3, K4 |
| CO3 | Apply microscopic techniques to observe and categorize microorganisms | K1, K2, K3, K4 |
| CO4 | Compare the core principles of sterilization and the different methods of sterilization. | K1, K2, K3, K4 |
| CO5 | Discover the pure culture techniques and Illustrate preservation of cultures | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU01 | BASIC CONCEPTS OF MICROBIOLOGY | Sem: I |
|----------|--|--------|
| Unit No. | Topics | Hours |
| I | History and Scope of Microbiology Spontaneous generation theory and conflict - Contributions of Antony Von Leeuwenhoek - Joseph Lister - Louis Pasteur - Robert Koch - Edward Jenner-Elie Metchnikoff - Martinus Beijerinck - Alexander Fleming - Selman Abraham Waksman - John Tyndall - Sergei WinoGradsky - Scope of Microbiology - Microbiology Institutions in India. | 12 |
| II | Bacterial Cell structure and Function Shapes of Bacteria - Subcellular structures of microbes- slime layer - capsule, cell wall- Gram positive and Gram negative, cytoplasmic membrane - fimbriae - pili-flagella - storage granules- comparison of prokaryotic and eukaryotic organisms- sporulation and germination- cell division in bacteria - binary fission. | 12 |
| III | Microscopy, Stains and Staining Techniques Working principle and applications of light microscopes- Bright field, Dark field, Phase contrast, Fluorescence, confocal scanning microscope-Electron microscope- SEM and TEM- <i>in situ</i> Electron Microscopy. Definition of auxochrome, chromophores, dyes, Staining methods- Simple and Differential (Gram and Acid fast), Negative, Capsule, Flagellar, Endospore and fungal staining - Wet mount and LPCB. | 12 |
| IV | Sterilization and Disinfection Principles, methods of sterilization: Physical methods: Dry heat (Hot air oven), Moist | 12 |

| | | |
|---|--|----|
| | heat (Autoclave) – Sterilization control. Filtration (Membrane & HEPA) - Biosafety cabinets and Radiation (UV). Chemical sterilization: Chemical agents and mode of action: Phenol Coefficient test–Fumigation. | |
| V | Culture techniques, Maintenance and Preservation of cultures Media preparations: Solid and liquid- Types of media: Synthetic and semi synthetic enriched, enrichment, selective, differential. Anaerobic culture technique: Wright's tube, Roll tube, McIntosh fields jar method. Pure culture technique: Serial dilution, pour, spread, streak plate methods. Culture preservation- Mineral oil method and Lyophilization- Lyophilizer. Culture collection centers. | 12 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, and Online – Google classroom.

TEXT BOOKS:

1. Prescott, Hareley.P and Klein.A., "Microbiology", McGraw Hill Publishers, New Delhi.2017
2. Michael J Pelczar.Jr., "Microbiology", McGraw Hill Publishers, NewDelhi.2001

REFERENCE BOOKS

1. R.C Dubey., "Textbook of Microbiology", S. Chand and Company Ltd, New Delhi. 2013
2. Geeta Sumbali and Mehrotra R.S., "Principles of Microbiology", Tata McGraw Hill Publishers.New Delhi.2009.
3. Gerard J. Tortora and Berdell R. Funke Christine L. Case., "Microbiology, An Introduction", Calif Benjamin/Cummings Pub. Co., SanFrancisco.2015
4. Jacquelyn G. Black, Laura J. Black., "Microbiology: Principles and Explorations", Wileys Publishers, New Jersey.2012

WEB RESOURCES

<<https://open.oregonstate.education/generalmicrobiology/>>

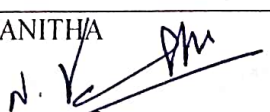

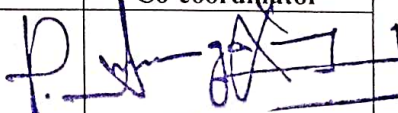
MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | M | S | S | M | S | M |
| CO2 | S | M | M | M | L | S | S |
| CO3 | S | S | M | M | L | S | M |
| CO4 | S | L | M | S | L | S | S |
| CO5 | S | M | M | L | L | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|---|--|---|
| DR. N.VANITHA  Name & Signature of the Staff | DR. LALI GROWTHER  Name & Signature |  Name & Signature |

Co-ordinator
Curriculum Development Cell
Mishasthan College of Arts & Science,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|---|---|---|---|---|-----------|-----------------------------|---|
| Course Code: | 21MBU02 | Course Title | | | | | Batch: | 2021-2022 and Onwards | |
| | | PRACTICAL I – BASIC CONCEPTS OF MICROBIOLOGY | | | | | Semester: | I | |
| Hrs/Week: | 5 | L | - | T | - | P | 5 | Credits: | 3 |

COURSE OBJECTIVES:

1. To learn the bio-safety and Good laboratory practices
2. To illustrate the structure and function of bacteria
3. To construct knowledge on microscopic techniques to observe the microorganisms
4. To develop basic skills in aseptic techniques and to impart knowledge on sterilization methods
5. To cultivate and preserve microorganisms

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|---|----------------|
| CO1 | Practice handling of glasswares and experiment with equipments | K1, K2, K3, K4 |
| CO2 | Identify, test and interpret the microbial growth in different media | K1, K2, K3, K4 |
| CO3 | Experiment with various staining techniques, micrometry and hanging drop method | K1, K2, K3, K4 |
| CO4 | Interpret the pure culture techniques and differentiate cultures in media | K1, K2, K3, K4 |
| CO5 | Apply and analyze anaerobic cultivation methods | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU02 | PRACTICAL I - BASIC CONCEPTS OF MICROBIOLOGY | Sem: I |
|---------------------|---|--------|
| LIST OF EXPERIMENTS | | Hours |
| 1. | Microbiology – Good laboratory practices & Biosafety. | 5 |
| 2. | Cleaning of Glassware. | 5 |
| 3. | Operation and maintenance of Microscope. | 5 |
| 4. | Culture media preparation and colony characteristics in agar medium. | 5 |
| 5. | Selective and differential media: a) EMB agar b) Mannitol salt agar d) Mac conkey agar e) SS agar | 4 |
| 6. | Pure culture techniques – Serial dilution, Pour plate, Spread plate and Streak Plate methods | 4 |
| 7. | Demonstration of the presence of microflora in the environment by exposing nutrient agar plates in the air | 4 |
| 8. | Enumeration of bacteria, fungi and actinomycetes from soil. | 4 |
| 9. | Determination of Motility – Hanging drop method, agar deep and swarming motility assay. | 4 |

| | |
|---|---|
| 10. Staining of Bacteria and fungi a. Simple staining b. Gram staining c. Negative staining d. Acid fast staining(demo) e. Endospore staining f. Fungal wet mount –KOH g. Fungal staining – Lacto Phenol Cotton Blue | 4 |
| 11. Micrometry- determination of size of bacteria. | 4 |
| 12. Cultivation of anaerobes- Wright's tube method, Mc'Intosh fildesjar | 4 |
| 13. Assessment of sterility of Hot air oven and Autoclave | 4 |
| 14. Bacterial culture preservation techniques – Paraffin method (Mineral oil), Saline suspension method and silica gel – permanent slide preparation. | 4 |

Teaching methods:

Hands on Experiments

TEXT BOOK:

N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, Microbiological Techniques, 2013, MJP Publisher.

REFERENCE BOOK

James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual, 2014: Pearson.

WEB RESOURCES

<https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf>

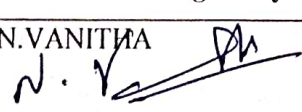
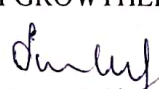
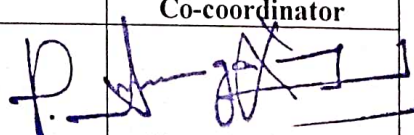
MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | S | M | M | L | S | S |
| CO2 | S | S | M | L | M | S | S |
| CO3 | S | S | M | M | S | S | S |
| CO4 | M | S | S | S | S | S | S |
| CO5 | S | S | S | M | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|--|--|--|
| DR. N.VANITHA  | DR. LALI GROWTHER  |  |
| Name & Signature of the Staff | Name & Signature | Name & Signature |

Co-ordinator
Curriculum Development Cell
Mishasthan College of Arts & Sciences,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--------------------|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU03 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | ALLIED-I CHEMISTRY | | | | | | Semester: | I |
| Hrs/Week: | 4 | L | 4 | T | - | P | - | Credits: | 4 |

COURSE OBJECTIVES:

1. To learn about atomic structure and bonding.
2. To know the basic industrial application of chemical compounds.
3. To understand the core concepts of organic chemistry i.e. resonance, inductive effect, hyperconjugation, etc. and their application.
4. To acquire knowledge on the concepts of electrochemistry.
5. To write a general form of the rate law for any chemical reaction and define the order of a chemical reaction.

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|--|----------------|
| CO1 | Correlate the chemical bonding structure | K1, K2, K3, K4 |
| CO2 | Categorize and illustrate the geometric and isomeric properties of molecules | K1, K2, K3, K4 |
| CO3 | Apply and analyze the laws of conductance and buffer solutions | K1, K2, K3, K4 |
| CO4 | Categorize solutions chemically | K1, K2, K3, K4 |
| CO5 | Analyze the rate and order of chemical reactions | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU03 | ALLIED-I CHEMISTRY | Sem: I |
|----------|---|--------|
| Unit No. | Topics | Hours |
| I | Chemical Bonding Molecular orbital theory - bonding, antibonding and non-bonding orbitals, molecular orbitals. MO configuration of H ₂ , N ₂ , O ₂ , F ₂ . Bond order. Diamagnetism and paramagnetism. Preparation, properties, structure and uses of Borane, NaBH ₄ and Borazole. | 09 |
| II | Industrial Chemistry Synthesis, properties and uses of silicones. Fuel gases: natural gas, water gas, semi water gas, carburetted water gas, producer gas, oil gas (manufacturing details not required). Dye Chemistry Terms: Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect- Dyes: azo (Methyl Orange) and triphenylmethane (Malachite green) dyes- Preparation and uses. | 09 |
| III | Covalent bond Orbital overlap, hybridization, geometry of organic molecules- CH ₄ , C ₂ H ₄ , and C ₂ H ₂ . Inductive effect, electrometric, mesomeric, hyperconjugative and steric effect. Effects in properties of compounds. Stereoisomerism: Conditions of optical activity, Optical isomerism of tartaric acid, Racemisation - Resolution | 10 |

| | | |
|----|--|----|
| | of racemates, Geometrical isomerism of maleic and fumaric acids. | |
| IV | Conductance Types (definition only) - Ostwald dilution law - Kohlraush's law-Applications. Conductometric titrations. pH and its calculations- Buffers in living systems- Action of buffer solutions- Henderson Hasselbalch equation | 10 |
| V | Solutions and Chemical Kinetics Types - Liquid in Liquid - Raoult's law - Deviation from ideal behavior (positive and negative deviation) - Fractional distillation. Kinetics- Rate, order, molecularity, pseudo first order, determination of order. Effect of temperature on the rate. Energy of activation. | 10 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, and Online – Google classroom.

TEXT BOOKS:

1. Malik, Wahid U., G.D. Tuli and R.D. Madan. *Selected Topics in Inorganic Chemistry*, 7th ed., New Delhi S.Chand & Company Ltd., 2007.
2. *Principles of Inorganic Chemistry*, B.R. Puri L.R. Sharma, Shobanlal Nagin Chand & Co., 1996

REFERENCE BOOKS

1. *Inorganic Chemistry*, P.L.Soni, Sultan Chand & Sons., 2013.
2. *Organic Chemistry*, Vol. 1, 2, 3, S. M. Mughergee, S.P. Singh, R.P. Kapoor, Wiley Eastern., 2001.
3. *Advanced Organic Chemistry*, B.S. Bahl, Arun bahl, S.Chand & Co., 2005.
4. *Essentials of Physical Chemistry*, B.S. Bahl and G.D. Tuli, S.Chand & Co., 2010.
5. *Text book of Physical Chemistry*, P.L.Soni, D.B. Dharmarke, Sultan Chand & Sons., 2014.

WEB RESOURCES

<<https://www.emedicalprep.com/study-material/chemistry/chemical-bonding/molecular-orbital-theory/>>
 <<http://eyrie.shef.ac.uk/eee/cpe630/comfun5.html>>
 <<https://www.emedicalprep.com/study-material/chemistry/chemical-bonding/molecular-orbital-theory/>>
 <<http://eyrie.shef.ac.uk/eee/cpe630/comfun5.html>>

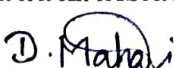
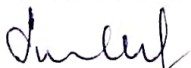
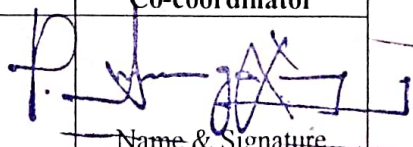
MAPPING WITH PROGRAMME OUTCOMES

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | L | M | L | M | S | S |
| CO2 | S | L | M | S | S | S | S |
| CO3 | S | S | M | S | S | S | S |
| CO4 | S | S | M | M | S | S | S |
| CO5 | S | S | L | S | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|--|--|---|
| DR.D.MAHALAKSHMI  Name & Signature of the Staff | DR. LALI GROWTHER  Name & Signature |  Name & Signature |

Co-ordinator

Curriculum Development Cell

Mindusthen College of Arts & Sciences,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--------------------------------|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU04 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | ALLIED PRACTICAL II -CHEMISTRY | | | | | | Semester: | I |
| Hrs/Week: | 3 | L | - | T | - | P | 3 | Credits: | 2 |

COURSE OBJECTIVES:

1. To develop the quantitative skills in volumetric analysis.
2. To estimate the quantity of chemical compounds through volumetric analysis.
3. To understand various procedures in organic compound analysis.
4. To know the elemental composition in organic compounds.
5. To distinguish between organic compounds.

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|--|----------------|
| CO1 | Estimate chemicals by volumetric method | K1, K2, K3, K4 |
| CO2 | Infer the presence of elements | K1, K2, K3, K4 |
| CO3 | Experiment with organic compounds | K1, K2, K3, K4 |
| CO4 | Analyze the functional group tests | K1, K2, K3, K4 |
| CO5 | Analyze and identify compounds using functional groups | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| | | |
|--|--|--------|
| 21MBU04 | ALLIED PRACTICAL II - ALLIED CHEMISTRY PRACTICALS | Sem: I |
| | LIST OF EXPERIMENTS | Hours |
| VOLUMETRIC ANALYSIS | | |
| 1. Estimation of sodium hydroxide using standard sodium carbonate. | | 4 |
| 2. Estimation of hydrochloric acid- standard oxalic acid. | | 4 |
| 3. Estimation of oxalic acid- standard sulphuric acid. | | 4 |
| 4. Estimation of ferrous sulphate- standard Mohr salt solution. | | 4 |
| 5. Estimation of $KMnO_4$ - standard ferrous sulphate. | | 4 |
| ORGANIC ANALYSIS | | |
| 6. Systematic analysis of organic substance | | 16 |
| i) Detection of Elements (N, S, Halogens). | | |
| ii) To distinguish between aliphatic and Aromatic. | | |
| iii) To distinguish between saturated and unsaturated. | | |
| iv) Functional group tests for phenols, acids (mono and di), aromatic primary amine, amide, diamide, carbohydrate. | | |
| v) Functional groups characterized by confirmatory test. | | |

Teaching methods:
Hands on Experiments

TEXT BOOKS:

1. *Vogel's text book of quantitative Chemical Analysis Sixth edition-J Mendham, R C Denney, J D Barnes, M J K Thomas, 2009*
2. *Vogel's Textbook of Practical Organic Chemistry, 5e, B.S. Furniss, A. J. Hannaford, P.W.G. Smith, A. R. Tatchell, 2003*

REFERENCE BOOKS

1. *Physical Chemistry [Seventh Edition] by Julio Atkins, Peter; De Paula, 2002*
2. *Practical Physical Chemistry by B. Viswanathan, P. S. Raghavan, 2014*
3. *Instrumental Methods Of Chemical Analysis by B.K Sharma, 1899*

WEB RESOURCES

- <http://www.brainkart.com/article/Estimation-of-sodium-hydroxide_38685/>
<<https://ncert.nic.in/ncerts/l/lelm108.pdf>>
<https://www.csub.edu/Chemistry/organic/manual/Lab14_QualitativeAnalysis.pdf>


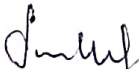
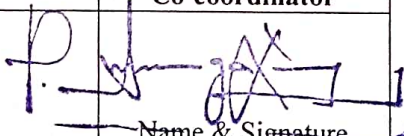
MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | L | S | M | M | M | S | S |
| CO2 | M | S | M | M | L | S | S |
| CO3 | M | S | M | S | L | S | S |
| CO4 | M | S | M | S | M | S | S |
| CO5 | S | S | M | M | L | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|--|--|--|
| DR.D.MAHALAKSHMI  Name & Signature of the Staff | DR. LALI GROWTHER  Name & Signature |  Name & Signature |

Co-ordinator
Curriculum Development Cell
Hindusthan College of Arts & Science,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--------------|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU05 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | BIOMOLECULES | | | | | | Semester: | II |
| Hrs/Week: | 5 | L | 3 | T | - | P | 2 | Credits: | 4 |

COURSE OBJECTIVES:

1. To impart theoretical and practical knowledge on the molecular basis of life
2. To give strong foundation on the influence and role of structure in reactivity of biomolecules
3. To understand the biochemical role and significance of macromolecules
4. To explain the mechanism of enzyme catalysis and their commercial applications
5. To analyze biomolecules qualitatively

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|---|----------------|
| CO1 | Categorize the structure and properties of carbohydrates and proteins | K1, K2, K3, K4 |
| CO2 | Classify lipids and nucleic acids | K1, K2, K3, K4 |
| CO3 | Compare the properties of enzyme and their applications | K1, K2, K3, K4 |
| CO4 | Analyze carbohydrates and amino acids | K1, K2, K3, K4 |
| CO5 | Experiment with lipids | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU05 | BIOMOLECULES | Sem: II |
|----------|---|---------|
| Unit No. | Topics | Hours |
| I | Carbohydrates Carbohydrates: Definition, classification, structure, properties, Chemistry and functions. Monosaccharides – Disaccharides- Oligosaccharides- Polysaccharides. | 07 |
| II | Proteins – Structure, properties and Classification of amino acids – Chemical reaction of amino acids due to carbonyl and amino groups. Titration curve of amino acid and its significance. Peptides-Glutathione, Oxytocin and Vasopressin. Classification and function of proteins- structural level of organization. | 07 |
| III | Lipids Classification and properties of lipids. Types of fatty acids – Significance of lipoproteins, glycolipids and phospholipids. Biological significance of steroids and cholesterol. Lipid functions: cell signals, cofactors, prostaglandins. | 08 |
| IV | Nucleic acids- Structure of Purines and Pyrimidines; Nucleotides and Nucleosides. DNA: double helix: A, B and Z forms; Denaturation and renaturation of DNA. RNA: types, unusual bases. | 07 |
| V | Enzymes Classification of enzymes with examples, coenzymes and cofactors (structures not required) – Active site: Lock and key model- induced fit hypothesis. Factors affecting enzyme activity. Enzyme inhibitors. Clinical and industrial applications | 07 |

| | | |
|--------------------------------------|--|----|
| | of enzymes. | |
| List of Practical Experiments | | |
| | 1. Analysis of carbohydrates a) Glucose b) Fructose c) Sucrose d) Lactose e) Xylose and e) Starch | 12 |
| | 2. Analysis of Amino acids a) Histidine b) Tyrosine c) Tryptophan and d) Arginine | 06 |
| | 3. Determination of acid number of oil | 03 |
| | 4. Determination of iodine number of oil | 03 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, Online – Google classroom and Hands-on experiments.

TEXT BOOKS:

1. Deb A.C., "Fundamentals of biochemistry", New Central Book Agency, Calcutta.2001
2. Lehninger A.L., and Nelson D.I., " Principles of Biochemistry", Cox- CBS Publishers, NewDelhi.2013
3. Wilson, E., Walker, J., Practical Biochemistry-Principles and techniques, Cambridge University press (2010)

REFERENCE BOOKS

1. Moat, A.G. and Foster, J.W., "Microbial Physiology", Springer, New York.2002
2. Ambika Shanmugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, NewDelhi.2016
3. Sathyanarayana U., "Biochemistry", Books and Allied Pvt. Ltd., New Delhi.2017.
4. Lubert Stryer., "Biochemistry", Freeman and Company, NewYork.2002
5. Boyer, R.F., Modern Experimental Biochemistry. Nenjamin / Cummings publishing company Inc. Redwoodcity, California (2012).

WEB RESOURCES

<<https://www.studocu.com/en-ca/document/university-of-saskatchewan/biomolecules/lecture-notes/lecture-notes-all-lectures/331690/view>>


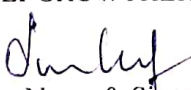

MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | S | M | S | S | S | S |
| CO2 | S | M | M | L | S | S | S |
| CO3 | S | S | M | S | M | S | S |
| CO4 | S | S | S | M | S | S | S |
| CO5 | S | S | S | M | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|--|--|---|
| Ms.T.KRITHIKA  | DR. LALI GROWTHER  |  |
| Name & Signature of the Staff | Name & Signature | Name & Signature |

Co-ordinator
Curriculum Development Cell
Kannur College of Arts & Science
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU06 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | MICROBIAL PHYSIOLOGY AND METABOLISM | | | | | | Semester: | II |
| Hrs/Week: | 4 | L | 4 | T | - | P | - | Credits: | 4 |

COURSE OBJECTIVES:

1. To transfer knowledge on various aspects of microbial physiology and metabolism
2. To explain the nutritional requirements and role of factors influencing the microbial growth.
3. To understand the mechanism of respiration and fermentation
4. To relate various microbial biosynthetic pathways.
5. To understand the mechanism and significance of cell signaling molecules

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|--|----------------|
| CO1 | Categorize microbial nutritional requirements and growth of bacteria | K1, K2, K3, K4 |
| CO2 | Illustrate the metabolic pathways involved in aerobic respiration | K1, K2, K3, K4 |
| CO3 | Analyze the pathways of anaerobic respiration and fermentation | K1, K2, K3, K4 |
| CO4 | Categorize the cell signaling molecules | K1, K2, K3, K4 |
| CO5 | Illustrate the microbial biosynthetic pathways | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU06 | MICROBIAL PHYSIOLOGY AND METABOLISM | Sem: II |
|----------|--|---------|
| Unit No. | Topics | Hours |
| I | Nutrition Nutritional requirements of microorganisms –macro elements, micro elements and growth factors, nutritional groups of microbes - transport mechanisms and types-simple diffusion – facilitated diffusion- active transport – group translocation - Iron uptake. Growth curve – Generation time – factors influencing microbial growth – batch, continuous, synchronous growth - diauxic growth. Methods of evaluating microbial growth. | 09 |
| II | Aerobic respiration EMP – HMP – ED pathways – TCA cycle- electron transport chain (ETC) – components, comparison of Mitochondrial and Bacterial ETC - oxidative and Substrate level phosphorylation, uncouplers and Inhibitors. | 10 |
| III | Anaerobic respiration and Fermentation Anaerobic respiration – sulphur, nitrogenous compounds, and CO ₂ as terminal electron acceptor - Methanogenesis - Fermentation – alcoholic, lactic acid, propionic, butanediol and mixed acid fermentation. | 10 |
| IV | Cell Signaling and Photosynthesis Signaling molecules and their receptors - Functions of cell receptors – quorum sensing. Photosynthesis in green bacteria, purple bacteria and cyanobacteria – | 09 |

| | | |
|---|---|----|
| | oxygenic and anoxygenic, carbon dioxide fixation. | |
| V | Biosynthesis Biosynthesis of bacterial cell wall - Biosynthesis of aminoacids (Pyruvate family)- Biosynthesis of fatty acids - general pathway-Biosynthesis of purine and pyrimidine nucleotides denovo and salvage pathways- bioluminescence | 10 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, and Online – Google classroom.

TEXT BOOKS:

1. Caldwell DR., "Microbial physiology and Metabolism", WMC Brown Publishers, New Delhi. 1995
2. Moat, A.G. and Foster, J.W., "Microbial Physiology", Springer, New York.2002

REFERENCE BOOKS

1. Schlegel HG., "Microbiology" Cambridge University press, London. 2009
2. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R., "Microbial Physiology", McGraw-Hill Higher Education New York. 2008
3. Lehninger, Nelson and Cox., "Principles of Biochemistry", W.H. Freeman & Company, New York. 2013

WEB RESOURCES

- <<http://textbookofbacteriology.net/nutgro.html>>
 <<https://www.biologydiscussion.com/microorganisms/nutritional-requirements-of-microorganisms/55070>>


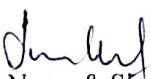
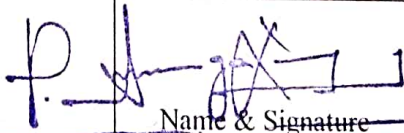
MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | M | S | L | M | S | S |
| CO2 | S | L | M | S | S | S | S |
| CO3 | S | M | M | M | S | S | S |
| CO4 | S | L | S | S | M | S | S |
| CO5 | S | L | L | S | M | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|---|--|--|
| Ms.T.KRITHIKA  Name & Signature of the Staff | DR. LALI GROWTHER  Name & Signature |  Name & Signature |

Co-ordinator
Curriculum Development Cell
Mithashan College of Arts & Science,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--|---|---|---|---|-----------|-----------------------------|---|
| Course Code: | 21MBU07 | Course Title | | | | | Batch: | 2021-2022 and Onwards | |
| | | PRACTICAL III - MICROBIAL PHYSIOLOGY & METABOLISM | | | | | Semester: | II | |
| Hrs/Week: | 5 | L | - | T | - | P | 5 | Credits: | 3 |

COURSE OBJECTIVES:

1. To understand the generation time of bacteria
2. To perform and understand the biochemical characteristics of bacteria .
3. To develop the skill to evaluate bacterial growth in different media
4. To study the hydrolytic enzymes in bacteria
5. To analyze the effects of different factors on bacterial growth

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|---|----------------|
| CO1 | Calculate the generation time of bacteria by different methods | K1, K2, K3, K4 |
| CO2 | Infer the biochemical characteristics of microorganisms | K1, K2, K3, K4 |
| CO3 | Analyze and identify organisms using carbohydrate fermentation test | K1, K2, K3, K4 |
| CO4 | Examine and analyze the degradation of polymers by microorganisms | K1, K2, K3, K4 |
| CO5 | Infer the factors affecting microbial growth | K1, K2, K3, K4 |

K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU07 | PRACTICAL II - MICROBIAL PHYSIOLOGY & METABOLISM | Sem: II |
|---------------------|---|---------|
| LIST OF EXPERIMENTS | | Hours |
| 1. | Determination of generation time of <i>E.coli</i> a. Neubauer counting chamber. b. Turbidity. c. Viablecount | 09 |
| 2. | Biochemical characterization: a) IMViC tests. b) Catalase, Oxidase c) Urease and nitrate tests. d) Triple sugar iron agar test. | 09 |
| 3. | Carbohydrate fermentation tests. | 08 |
| 4. | Hydrolysis test: a. Starch hydrolysis. b. Gelatin hydrolysis. c. Casein hydrolysis | 08 |

| | |
|---|----|
| 5. Effect of pH and temperature on growth of <i>E.coli</i> . | 08 |
| 6. Effect of salt on growth of <i>E.coli</i> . | 08 |
| 7. Effect of carbon and nitrogen sources on growth of <i>E.coli</i> . | 08 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, and Online – Google classroom.

TEXT BOOKS:

1. N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, *Microbiological Techniques*, 2013, MJP Publisher.
2. R.Sowndravally, D.Pooja, *Biochemistry Practical Manual*, 2019, Elsevier India.

REFERENCE BOOKS

1. James G. Cappuccino, Natalie Sherman, *Microbiology: A Laboratory Manual*, 2014: Pearson.
2. Valleys practical clinical biochemistry, 2006, Heineman medical books, NewDelhi

WEB RESOURCES

- <<https://sites.google.com/site/microbialphysiologyoddsem/practicals>>
 <https://www.researchgate.net/publication/306018042_Microbiology_Laboratory_Manual>
 <https://www.researchgate.net/publication/332028407_Biochemistry_A_Practical_Manual>


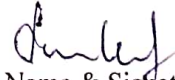
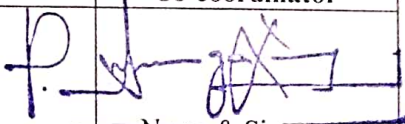
MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
|----------|-----|-----|-----|-----|-----|-----|-----|
| CO1 | S | S | M | S | S | S | S |
| CO2 | S | S | M | S | S | S | S |
| CO3 | S | S | M | S | M | S | S |
| CO4 | S | S | S | L | S | S | S |
| CO5 | S | S | L | L | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
|---|--|---|
| Dr.N.HEMA SHENPAGAM  Name & Signature of the Staff | DR. LALI GROWTHER  Name & Signature |  Name & Signature |

Co-ordinator
Curriculum Development Cell
Hindusthan College of Arts & Science,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|-----------------------------|---|---|---|---|-----------|-----------------------------|---|
| Course Code: | 21MBU08 | Course Title | | | | | Batch: | 2021-2022 and Onwards | |
| | | ALLIED - BIOCHEMISTRY (MIC) | | | | | Semester: | II | |
| Hrs/Week: | 3 | L | 3 | T | - | P | - | Credits: | 3 |

COURSE OBJECTIVES:

1. To understand the concepts of buffer systems.
2. To understand the mechanism of extraction and utilization of energy in living cells
3. To explain the fundamental properties and importance of vitamins, minerals and hormones
4. To give insight into the inborn errors of metabolism
5. To explain the principle and applications of various analytical instruments in determination and characterization of biomolecules.

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|--|----------------|
| CO1 | Define and deduce the principle of buffer system and acid base balance | K1, K2, K3, K4 |
| CO2 | Illustrate metabolic pathways and bioenergetics | K1, K2, K3, K4 |
| CO3 | Categorize the properties, physiological functions and deficiency of vitamins and minerals | K1, K2, K3, K4 |
| CO4 | Identify the hormonal imbalance and analyze their physiological effects | K1, K2, K3, K4 |
| CO5 | Analyze bioinstrumentation techniques | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU08 | ALLIED - BIOCHEMISTRY (MIC) | Sem: II |
|----------|---|---------|
| Unit No. | Topics | Hours |
| I | Buffer system pH – acid base indicators, principle and application of pH meter - Henderson – Hasselbalch equation – Maintenance of blood pH - buffer systems – respiratory mechanism – renal mechanism - acidosis and alkalosis – distribution of fluids in the body – dehydration. Preparation of solutions- Normality, molarity and molality. | 07 |
| II | Bioenergetics Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates - ATP - oxidation – reduction reactions – Oxidoreductases - oxidases, dehydrogenases, oxygenases, – organization of the respiratory chain in mitochondria. ETC - Oxidative phosphorylation - ATP synthase. | 07 |
| III | Vitamins and Minerals Classification, properties, and physiological functions of vitamins – fat soluble – (A, D, E and K) and water soluble (B and C) – deficiency – Macroelements – Physiological importance of Calcium, Phosphorus, Magnesium, Sodium and Potassium – Trace elements – Physiological functions of Iron, Copper, Zinc, Selenium and Iodine | 07 |

| | | |
|----|---|----|
| IV | Hormones and Inborn errors of Metabolism General characteristics – classification – functions of hormones – oxytocin – vasopressin – thyroid – T3,T4 – pancreas – insulin – Hyperglycemia – Glucagon – Hypoglycemia. Hereditary anemias – sickle cell anemia and thalassemia – errors of carbohydrate (galactosemia) and protein metabolism (phenylketonuria) – disease and syndromes. | 07 |
| V | Analytical techniques and its application Shaker, Rotatory vacuum evaporator, Sonicator -Types of centrifuge – low and high speed, Ultra centrifuge- UV and Visible spectrophotometer-IR spectroscopy-FTIR-principle and application- Paper, TLC, Ion exchange, HPLC, AGE and PAGE. | 08 |

Teaching methods:

Lecturing, PowerPoint Projection through LCD, Assignment, Discussion, Activity, and Online – Google classroom.

TEXT BOOKS:

1. Deb A.C., "Fundamentals of biochemistry", New Central Book Agency, Calcutta.2011
2. Lehninger A.L., and Nelson D.I., "Principles of Biochemistry Cox- CBS Publishers, New delhi.2005

REFERENCE BOOKS

1. Ambika Shammugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, New Delhi.2008
2. Sathyanarayana U., "Biochemistry", Books and Allied Pvt. Ltd., New Delhi.2008
3. Lubert Stryer., "Biochemistry", Freeman and Company, New York.2002
4. Upadhyay & Upadhyay. Biophysical Chemistry. 2010 Edition. Himalaya Publishing House.2010
5. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry. 2nd Edition.1993

WEB RESOURCES

<https://www.brainkart.com/subject/Biochemistry_302/>


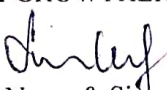

MAPPING WITH PROGRAMME OUTCOMES

| PO CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
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| CO1 | S | L | M | L | S | S | S |
| CO2 | S | L | L | S | M | S | S |
| CO3 | S | M | L | S | M | S | S |
| CO4 | S | S | S | M | L | S | S |
| CO5 | S | S | L | S | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

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| | | |
|--|--|---|
| Course Designed by | Verified by HOD | Approved by CDC Co-coordinator |
| Ms.T.KRITHIKA  | DR. LALI GROWTHER  |  |
| Name & Signature of the Staff | Name & Signature | Name & Signature |

Curriculum Development Cell
Hindusthan College of Arts & Science,
Coimbatore-641 028.

| | | | | | | | | | |
|--------------|---------|--|---|---|---|---|---|-----------|-----------------------------|
| Course Code: | 21MBU09 | Course Title | | | | | | Batch: | 2021-2022 and Onwards |
| | | ALLIED: PRACTICAL II - BIOCHEMISTRY | | | | | | Semester: | II |
| Hrs/Week: | 3 | L | - | T | - | P | 3 | Credits: | 2 |

COURSE OBJECTIVES:

1. To understand the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths.
2. To understand the concepts of preparation of buffers
3. To identify the pH in solutions
4. To use and analyze the results of photometry
5. To analyze various biomolecules quantitatively.

COURSE OUTCOMES:

| S.No | COURSE OUTCOME | BLOOMS LEVEL |
|------|---|----------------|
| CO1 | Experiment with pH meter | K1, K2, K3, K4 |
| CO2 | Apply and analyze the concepts of molarity and normality for solution preparation | K1, K2, K3, K4 |
| CO3 | Experiment with Proteins, Vitamins and carbohydrates | K1, K2, K3, K4 |
| CO4 | Analyze the properties of lipids | K1, K2, K3, K4 |
| CO5 | Infer the absorption maxima of standard proteins with UV spectrophotometer | K1, K2, K3, K4 |

KI- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate

SYLLABUS:

| 21MBU09 | ALLIED: PRACTICAL II – BIOCHEMISTRY | Sem: II |
|---------------------|--|---------|
| LIST OF EXPERIMENTS | | Hours |
| 1. | Preparation of Solutions (Molar and Normal Solutions) | 3 |
| 2. | Preparation of Buffers – Acids and Alkaline Range | 3 |
| 3. | Measurement of pH | 3 |
| 4. | Quantitative determination of carbohydrate by Anthrone method | 4 |
| 5. | Estimation of protein by Lowry method | 4 |
| 6. | Quantitative determination of protein by Bradford method | 4 |
| 7. | Estimation of Carbohydrate by DNS method | 4 |
| 8. | Estimation of ascorbic acid by DNPH method | 4 |
| 9. | Determination of Maximum absorption (μ_{max}) spectra of standard Proteins | 4 |
| 10. | Study of Proteins-Primary, Secondary and tertiary structures with the help of models | 3 |

Teaching methods:
Hands on Experiments

TEXT BOOKS:

1. Wilson, E., Walker, J., *Practical Biochemistry-Principles and techniques*, Cambridge University press (2010).
2. Boyer, R.F., *Modern Experimental Biochemistry*. Nenjamin/Cummings publishing company Inc. Redwoodcity, California (2012).

REFERENCE BOOKS

1. R.Sowndravally, D.Pooja, *Biochemistry Practical Manual*, 2019, Elsevier India.
2. Valleys *practical clinical biochemistry*, 2006, Heineman medical books, NewDelhi

WEB RESOURCES

<<https://www.researchgate.net/publication/313745155> *Practical Biochemistry A Student Companion*>


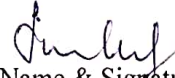
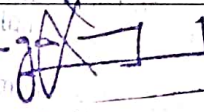
MAPPING WITH PROGRAMME OUTCOMES

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
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| CO1 | S | S | M | L | S | S | S |
| CO2 | S | S | S | L | S | S | S |
| CO3 | S | S | S | L | S | S | S |
| CO4 | S | S | S | L | S | S | S |
| CO5 | S | S | S | S | S | S | S |

S-Strong, M- Medium, L – Low

ASSESSMENT PATTERN (if deviation from common pattern)

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