

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

in the

POSTGRADUATE PROGRAMME

MASTER OF SCIENCE

in

MICROBIOLOGY

**FOR THE STUDENTS ADMITTED FROM THE
ACADEMIC YEAR 2022 - 2023 AND ONWARDS**



HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

(Affiliated to Bharathiar University and Accredited by NAAC)

COIMBATORE-641028

TAMILNADU, INDIA.

Phone: 0422-4440555

Website: www.hindusthan.net/hicas/

PREAMBLE

Microbiology is a scientific discipline which is the most essential component of applied Life sciences. Quality education in this discipline offers remarkable opportunities in academics and Industry. The department of Microbiology was established in the year 2004. The objective of the department is to provide knowledge in various basic and applied aspects of Microbiology. The department also envisions preparing our students for industries by organizing interactive sessions with industrialists.

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 practical.

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

(5 PEO's are mandatory)

PEO 1: Qualified post graduates would become Microbiologists involved in Research

PEO 2: Post graduates would be Industry ready to take up jobs in Food, Pharmaceutical, Fermentation and diagnostics

PEO 3: Become Entrepreneurs in the respective fields

PEO 4: Post graduates would become resourceful educators in the Society

PEO 5: Develop a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems

PROGRAMME OUTCOME (PO)

- PO1:** Acquire the appropriate skills of Microbiology so as to perform their duties as Microbiologists.
- PO2:** Analyze the problems related to Microbiology and come up with suitable solutions.
- PO3:** Develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory and for scientific publishing of their research work in future.
- PO4:** Apply modern tools that will help them acquire interdisciplinary skills.
- PO5:** Develop communication skills and be able to work in teams.
- PO6:** Identify the need for life-long learning in the broadest context of technological change.
- PO7:** Prioritize new knowledge and analyze problems relevant to societal needs.

PROGRAMME SPECIFIC OUTCOME (PSO)

- PSO1:** Analyze the diverse Microbiological processes
- PSO2:** Acquire advanced skills in working with microbes in lab and pilot scale culturing
- PSO3:** Innovate and generate new knowledge
- PSO4:** Develop Entrepreneurial skills
- PSO5:** Improve participation in team work through projects

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

SCHEME OF EXAMINATIONS - CBCS & LOCF PATTERN

(For the Students admitted from the Academic year 2022-2023 and Onwards)

PG PROGRAMME

Programme: M.Sc

Branch: Microbiology

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									
22MBP01	DSC	Bacteriology	4	5	-	3	50	50	100
22MBP02	DSC	Virology	4	5	-	3	50	50	100
22MBP03	DSC	Mycology, Phycology & Parasitology	4	5	-	3	50	50	100
22MBP04	DSC	Biochemistry	4	4	-	3	50	50	100
22MBP05	DSC	Practical I – Bacteriology, Virology, Mycology, Phycology, Parasitology	3	-	5	9	50	50	100
22MBP06	DSC	Practical II – Biochemistry	3	-	5	6	50	50	100
22MBP07	SEC	Internship / Institutional Training / Mini-Project	2	-	-	-	100	-	100
22MBPE01	AEE	Open Elective - I	2	3	-	-	100	-	100
22MBPV01	ACC	JOC/VAC-I	1*	2	-	-	50**	-	50**
22MBPJ01	SEC	Aptitude / Placement Training	Grade*	2	-	-	50**	-	50**
-	SEC	SDR – Student Development Record	Assessment will be done in the end of III semester						
Total			26	26	10		500	300	800
Semester - II									
22MBP08	DSC	Applied Biotechniques	4	5	-	3	50	50	100
22MBP09	DSC	Immunobiology	4	5	-	3	50	50	100
22MBP10	DSC	Genetic Engineering	4	5	-	3	50	50	100
22MBP11	DSC	Medical Microbiology	4	4	-	3	50	50	100
22MBP12	DSC	Practical-III Immunobiology and Medical Microbiology	3	-	5	9	50	50	100
22MBP13	DSC	Practical -IV Applied Biotechniques and Genetic Engineering	3	-	5	9	50	50	100
22MBP14	SEC	Internship / Institutional Training / Mini-Project / Extension Activity	2	-	-	-	100	-	100
22MBPE02	AEE	Open Elective - II	2	3	-	-	100	-	100
22MBPV02	ACC	VAC-II	1*	2	-	-	50**	-	50**
22MBPJ02	SEC	Online Courses	Grade*	-	-	-	-	-	C/NC
22MBPJ03	SEC	Aptitude / Placement Training	Grade*	2	-	-	50**	-	50**

			Total	26	26	10		500	300	800
Semester – III										
22MBP15	DSC	Environmental and Agricultural Microbiology	4	4	-	3		50	50	100
22MBP16	DSC	Bioprocess Technology	4	4	-	3		50	50	100
22MBP17	DSC	Bioinformatics, Biostatistics & Research Methodology	4	4	-	3		50	50	100
22MBP18	DSE	DSE I - Electives –I	3	4	-	3		50	50	100
22MBP19	DSE	DSE II - Electives – II Practical V	3	-	5	9		50	50	100
22MBP20	DSC	Practical VI – Environmental and Bioprocess technology	3	-	5	9		50	50	100
22MBP21	DSC	Practical VII Bioinformatics and Biostatistics	2	-	3	3		50	50	100
22MBP22	SEC	Internship / Institutional visit / Training / Mini-Project / Extension Activity	2	-	-	-		100	-	100
22MBPE03	AEE	Open Elective-III	2	3	-	-		100	-	100
22MBPV03	ACC	VAC-III	1*	2	-	-		50**	-	50**
22MBPJ04	SEC	Aptitude / Placement Training	Grade*	2	-	-		50**	-	50**
22MBPJ05	SEC	Online Courses	Grade*	-	-	-		-	-	C/NC
22MBPJ06	SEC	SDR – Student Development Record	2*	-	-	-		-	-	-
Total			27	23	13			550	350	900
Semester – IV										
22MBP23	DSE	DSE III - Elective III	3	5	-	3		50	50	100
22MBP24	DSE	DSE-IV - Electives IV	3	5	-	3		50	50	100
22MBP25	DSC	Core - XVIII – Self-Study Course	4	-	-	3		50	50	100
22MBP26	SEC	Project Work /Student Research	5	-	-	-		100	100	200
Total			15	10				250	250	500

PG Scheme of Evaluation (Internal & External Components)

(For the students admitted during the academic year 2022-2023 and onwards)

1. Internal Marks

List of components for Internal Assessment

Components	Marks
Test	15
Model Exam	15
Internal Assessment components	20 #
TOTAL	50

S.No	Components
1	Multiple choice questions
2	Video teach
3	Co-operative or Collaborative Learning
4	Mini Project/Assignment
5	Case study
6	Seminar
7	Role Play
8	Management Games

(Any four components from the above list with five marks each will be calculated $4 \times 5 = 20$ marks)

2. a) Components for Practical I.E.

Components	Marks
Test -I	15
Test - II	15
Observation	10
Application*	10
Total	50

b) Components for Practical E.E.

Components	Marks
Experiments/Exercise	40
Record	5
Viva	5
Total	50

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

Internships/Industrial Training (I.E)		Mini Project (I.E)	Major Project Work		
Component	Marks		Component	Marks	Total Marks
Work diary	25	-	I.E a)Attendance	20	100
Report	50	50	b)Review	30	
Viva-voce	25	50	c) Report	25	
			d)Moc Viva-Voce/ Presentation	25	
Total	100	100	E.E*		
			a) Final report	60	100
			b)Viva-voce	40	
			Total		200

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

4. Value Added Courses and Aptitude/Placement courses:

Components	Marks
Two Test (each 1 hour) of 25 marks each QP is objective pattern (25x1=25)	50
Total	50

For all PG/MBA/MCA Programmes

(2022-2023 Regulations)

QUESTION PAPER PATTERN FOR CIA EXAM

Reg.No:-----

Q.P.CODE:

**HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
PG/MBA/MCA DEGREE CIA EXAMINATIONS -----20-----**

(-----Semester)

BRANCH: -----

Subject Name: -----

Time: Two Hours

Maximum: 50 Marks

Section-A (4 x 4=16 Marks)

Answer ALL Questions

ALL questions carry EQUAL Marks

(Q.No: 1 to 4 Either Or type)

Section-B (3 x 8=24 Marks)

Answer any THREE Questions out of FIVE Questions

ALL questions carry EQUAL Marks

(Q.No: 5 to 9)

Section-C (1 x 10=10 Marks)

(Compulsory Question: It should be a Case study/Application oriented/Critical analysis from any of the units)

(Q.No: 10)

QUESTION PAPER PATTERN FOR MODEL / END SEMESTER EXAM

Reg.No:-----

Q.P.CODE:

**HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
PG/MBA/MCA DEGREE MODEL EXAMINATIONS -----20-----**

(-----Semester)

BRANCH: -----

Subject Name: -----

Time: Three Hours

Maximum: 60 Marks

SECTION – A (5x4=20 marks)

Answer ALL Questions

ALL Questions carry EQUAL Marks

(Q.No 1 to 5 Either Or type)

(One question from each Unit)

SECTION – B (3x10=30 Marks)

Answer any THREE Questions Out of FIVE Questions

ALL Questions carry EQUAL Marks

(Q.No 6 to 10)

(One question from each Unit)

SECTION – C (1x10=10Marks)

(Compulsory Question: It should be a Case study/Application oriented/Critical analysis from any of the units)

(Q.No: 11)

5. Guideline for Open Elective

Two tests(each 2 hours) of 50 marks each [5 out of 8 descriptive type questions 5x10=50 Marks	Marks
	100

Guidelines:

1. The passing minimum for these items should be 50%
2. If the candidate fails to secure 50% passing minimum, he / she may have to reappear for the same in the Subsequent semesters
3. Item No's:4 is to be treated as 100% Internals and evaluation through online.
4. Item No.2: * - Application should be from the relevant practical subject other than the listed programmes. It must be enclosed in the practical record.

Blue Print of Question Paper for all PG Programmes

(For the academic year 2021-22, 2022-23)

FOR CIA I - QUESTION PATTERN

Max. Marks:50

Sec	Question No	Type	No of Question	Questions to be answered	Mark per question	K-level
A	1 to 4	Either or Type (a or b)	8	4	4 (4x4=16)	2 Questions will be in K1 4 Questions will be in K2 2 Questions will be in K3
B	5 to 9	Open choice	5	3	8 (3x8=24)	2 Questions will be in K3 2 Questions will be in K4 1 Questions will be in K5
C	10	Compulsory	1	1	10 (1x10=10)	1 Question will be in K5

FOR MODEL/ESE - QUESTION PATTERN

Max. Marks:60

Sec	Question No	Type	No of Questions	Questions to be answered	Mark per question	K-level
A	1 to 5	Either or Type (a or b)	10	5	4 (5x4=20)	2 Questions will be in K1 4 Questions will be in K2 4 Questions will be in K3
B	6 to 10	Open choice	5	3	10 (3x10=30)	2 Questions will be in K3 2 Questions will be in K4 1 Questions will be in K5
C	11	Compulsory	1	1	1 (1x10=10)	1 Question will be in K5

Distribution of section-wise marks with K levels for PG 2021-22, 2022-23

CIA - PG								
Sec.	K1	K2	K3	K4	K5	Total questions	Questions to be answered	Total marks
A- Either or type	2	4	2			8	4	4X4=16
B - Open choice			2	2	1	5	3	3X8=24
C- Compulsory Question					1	1	1	1X10=10
Total Marks	8	16	16	16	18			84
% of marks without choice	9.52	19.05	19.05	119.05	21.43			100

Model Exam - PG								
Sec.	K1	K2	K3	K4	K5	Total questions	Questions to be answered	Total marks
A- Either or type	2	4	4			10	5	5X4=20
B - Either or type			2	2	1	5	3	3X10=30
C - Compulsory Question					1	1	1	1X10=10
Total Marks	8	16	36	20	20			100
% of marks without choice	8	16	36	20	20			100

PG Programme Regulations for the academic year 2022-2023

1. Internal marks components for all the candidates admitted from the academic year 2022-2023 and onwards is as follows.

For Theory courses

Components	Marks
Test	15
Model Exam	15
Internal Assessment components	20
TOTAL	50

For Practical courses

Components	Marks
Test-I	15
Test-II	15
Observation/Excercise	10
Application*	10
TOTAL	50

2. Pattern of question paper for External Examination will be maximum of 60 marks for all theory courses. The marks obtained will be converted into 50 marks as per the scheme.
3. Passing minimum marks for all PG programme is 50 % in internal and 50% in External and the composition of total 50 marks out of 100 marks.
4. 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. Distribution of marks for major project work for all PG Programmes will be of 50:50 pattern for both Internal and External in total of 200 marks.
5. Internship / Institutional Training / Mini-Project/ Extension Activity is related to the discipline. The students can be permitted to complete the Internship / Institutional Training / Mini-Project/ Extension Activity before the end of respective semesters (end of I, II and III semester) and submit a report.

Internship / Institutional Training/ Extension Activity	Not more than seven days
Mini project	During the course of study for not more than seven days.

6. For fully internal subjects, Two test will be conducted one at the time of CIA I and the other will be during Model Examinations.
7. Retest for the failure candidates in the above case should be conducted immediately before the End Semester Examinations.
8. For the Theory cum Practical blended courses, 50:50 Internal and External pattern will be followed for theory examination and Fully internal pattern will be followed for Practical examination. For theory part, External examination will be conducted as regular pattern (max of 70 marks) and it will be converted into 25 marks.

Course	Internal Marks		External marks		Total marks (Max. marks 50)	
	Min.	Max.	Min.	Max.	Min.	Max.
Theory	12.5	25	12.5	25	25	50
Practical	25	50	-		25	50

For Practical components for Theory cum Practical courses (Fully Internal)

Components	Marks
Test I	10
Test II	10
Experiment/Exercise	20
Record	5
Viva	5
Total	50

The Internal mark 50 will be converted into 25.

11. For the candidates admitted under the Fast Track System (FTS) must register their names to their concerned department heads and get approval from the COE office at the beginning of the II semester.
12. Self Study will be a Core Paper of the department for which the examination pattern of other theory subjects is followed.
13. Online courses is incorporated as a non-credit skill enhancement course for the III and IV semesters and Grades will be assessed based on the certificates produced by the students. It is compulsory to produce one online course certificate for each semester to avail grades for the students. (2 certificates in any of the online platform is mandatory).
14. SDR – Student Development Report to be received by the department from the students till end of the Third semester. (Evidences of Curriculum activities and Co-curriculum activities).
15. Open elective courses:
Departments can offer list of subjects which teaches moral ethics to the young community for the better future. The topics relevant to Indian ethics, Culture, Women rights, Yoga, Green farming, Indian constitution etc., as an open elective courses. These courses can be offered by the department or other department as inter department courses. Marks earned for this subject will not be included for the CGPA calculation.

Regulations of Fast Track System (FTS)

- From the academic year 2021-22, our college is offering Fast Track System (FTS) for all UG and PG programmes. In this system, we are offering two courses under the course type of Discipline Specific Elective (DSE) in the sixth semester for all UG programmes and fourth semester for all PG programmes, which are equivalent and related with National Programme on Technology Enhanced Learning/Study Webs of Active-Learning for Young Aspiring Minds (NPTEL/SWAYAM) courses.
- The students have the option of taking two subjects of the sixth semester of their programme through NPTEL/SWAYAM portal from the list given by NPTEL and can complete the online course before fifth semester and submit the received original certificates to the COE office for getting approval. If the student completes these courses before the beginning of the sixth semester (UG)/fourth semester (PG), the candidate can be considered and exempted to write the examination from the assigned DSE courses in the sixth semester/fourth semester. They should complete only the self study course and project work during the VI/IV semester as assigned in the scheme. The candidate who completes the online courses and submits the successful course completion credentials, the credit transfer will be considered as per our Scheme of Examination for qualifying the degree. The minimum duration of the registered online course must be 12 weeks. Course duration of less than 12 weeks will not be considered.
- For all PG programmes, the candidates who were admitted during the academic year 2021-2022 under the Fast track system, for the self study course, the internal mark component will be as follows. For others regular internal pattern follows.

TEST	Max. Marks	Mode
CIA I	50 (50x1=50)	Online objective type
Model Exam.	50 (50x1=50)	Online objective type

Out of these two tests, the total marks will be converted into 40 marks as Internal.

- For all UG programmes, the candidates who were admitted during the academic year 2021-2022 under the Fast track system, for the self study course, the internal mark component will be as follows. For others regular internal pattern follows.

TEST	Max. Marks	Mode
CIA I	50 (50x1=50)	Online objective type
CIA II	50 (50x1=50)	Online objective type
Model Exam.	50 (50x1=50)	Online objective type

Out of three tests, the total mark will be converted into 30 marks as Internal.

- For the students admitted in Fast Track System, must enroll their names to the concerned department heads and get approval from the COE office at the beginning of III semester for all UG Programmes and at the beginning of II semester for all PG programmes.
- The students who cleared and got certified for online courses under the fast track system, the grade obtained will be converted into average marks of range. The received certificates must be submitted to the COE office for approval of the Controller and the Principal. The FTS courses will be treated as fully external.

Abstract for Scheme of Examination

(For the students admitted during the academic year 2022 - 2023 and onwards)

Course	Papers	Credit	Total Credits	Marks	Total Marks
Core /DSC	11	4	44	100	1100
Self-Study Course / DSC	1	4	4	100	100
Electives/ DSE	4	3	12	100	400
Practical / DSC	6	3/2	17	100	600
Project / SEC	1	5	5	200	200
<i>Internship/ Institutional Training/ Mini-Project / Extension Activity</i>	3	2	6	100	300
<i>Open Electives /AEE</i>	3	2	6	100	300
<i>Value Added Course</i>	3	1*	3*	50	150**
<i>Aptitude / Placement Training/ SEC</i>	3	Grade*	Grade*	50	150**
<i>Online Courses / SEC</i>	2	Grade*	Grade*	-	-
SDR - SEC	1	2*	2*	-	-
Total			94 + (5 Extra Credits)		3000 + (300**)

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 up 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. Developmental Biology2. Inheritance Biology3. System Physiology - Plant4. System Physiology - Animal5. Diversity of Life Forms6. Ecological Principles7. Evolution And Behaviour
Courses offered by the Departments to other Programmes	

List of Elective Papers/ DSE
(Can choose any one of the paper as electives)


	Course Code	Group	Title
Electives/ DSE-I	22MBP18A	A	Pharmaceutical Microbiology
	22MBP18B	B	Microbial Genomics and Proteomics
	22MBP18C	C	Microbial production of Recombinant molecules
Electives/ DSE-II	22MBP19A	A	Practical V - Pharmaceutical Microbiology
	22MBP19B	B	Practical V - Microbial Genomics and Proteomics
	22MBP19C	C	Practical V - Microbial production of Recombinant molecules
Electives/ DSE-III	22MBP23A	A	Food Microbiology and Food Safety
	22MBP23B	B	Entrepreneurial Microbiology
	22MBP23C	C	Organic Chemistry in biology and drug development
Electives/ DSE-IV	22MBP24A	A	Industrial Biotechnology
	22MBP24B	B	Advanced Microbiology
	22MBP24C	C	Experimental Biotechnology

LIST OF NPTEL COURSES

- Food Microbiology and Food Safety
- Industrial Biotechnology
- Experimental Biotechnology
- Organic Chemistry in biology and drug development


Syllabus Coordinator


Academic Council – Member Secretary


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


Principal
PRINCIPAL
Hindusthan College of Arts & Science (Autonomous),
Hindusthan Gardens, Behind Nava India,
Coimbatore - 641 028.

Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP01	BACTERIOLOGY	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives

1. To recognize, identify and differentiate the internal and external structures of prokaryotic and eukaryotic microbial cells.
2. To outline the taxonomical classification of microorganisms and the methods used in taxonomy
3. To explain the nutritional requirements of microorganisms and the stages of microbial growth
4. To describe the basic metabolic properties of microbial cells
5. To explain the biosynthetic pathways and cell signaling

Unit	Course Contents	Hours	K Level
I	History and Cell structure History and scope of microbiology. Morphology and Ultra structure of bacteria - Subcellular structures - Capsule, slime layer- cell wall- Gram positive and Gram negative, cytoplasmic membrane - pili- Fimbriae - flagella - storage granules- ribosomes - genetic material – Staining techniques-Gram stain, Acid fast-Endospore- <u>Comparison of prokaryotic and eukaryotic organisms</u> - Sporulation and germination – cell division. Culture collection centers – EzTaxon.	13	Up to K5
II	Taxonomy Principle, classification - Phenetic, Phylogenetic, Genotypic; Modern approaches - Numerical, Molecular, Sero-taxonomy, Chemo-taxonomy. Taxonomic Ranks. Techniques in Microbial Taxonomy: Classical and Molecular type (16S rRNA gene based) - Phylogenetic tree. Bergey's manual of systematic bacteriology-II edition - general characteristics and organization - Archaea (Crenarchaeota); Euryarchaeota (Methanobacterium, Halobacterium); Proteobacteria – (Alpha- Caulobacter; Beta-Alcaligenes; Gamma-Legionella; Delta- Myxococcus; Epsilon- Camphylobacter), Low G+C Gram positive bacteria - High G+C Gram positive bacteria – Bifidobacterium - Fusobacterium – Extremophiles and anaerobic cultivation: Glove box, roll tubes, anaerobic jar (anoxomat anaerobic system).	13	Up to K5
III	Bacterial Nutrition <u>Nutritional requirements of Microorganisms –nutritional groups - transport mechanisms and types-simple diffusion – facilitated diffusion- active transport- group translocation- Ion transport. Growth curve – generation time - factors influencing microbial growth – growth kinetics-Batch and continuous cultivation -synchronous growth -diauxic growth.</u>	13	Up to K5
IV	Respiration and Fermentation EMP – HMP – ED pathways – TCA cycle- Electron transport chain – Oxidative and Substrate level phosphorylation. Photosynthesis – Oxygenic and Anoxygenic, Carbon dioxide fixation. Sulphur, nitrogenous compounds and CO ₂ as terminal electron acceptor - Fermentation – alcoholic, lactic acid, propionic, butanediol, acetate, amino acid and mixed acid fermentation.	13	Up to K5
V	Biosynthesis and cell signaling Biosynthesis of bacterial cell wall, biosynthesis of aminoacids (Pyruvate	13	Up to K5

family) - bioluminescence. Cell signaling- types-mechanisms-G-protein linked receptors, hormone receptors and second messengers – Quorum sensing		
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***Self Study (Underlined)**

Book for Study

1. Prescott, Hareley.P and Klein.A., “Microbiology”, McGraw Hill Publishers, New Delhi, 2017

Books for Reference

- 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
5. Michael J Pelczar.Jr., “Microbiology”, McGraw Hill Publishers, NewDelhi.2001

Web Resources

<https://open.oregonstate.education/generalmicrobiology/>>
<<http://textbookofbacteriology.net/nutgro.html>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- This course provides a strong foundation on the fundamental concepts like structure, taxonomy, growth and metabolism of microbes

Activities to be given

- Preparation of an album of staining images

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Categorize microbial nutritional requirements and growth of bacteria	Upto K5
CLO2	Illustrate the metabolic pathways involved in aerobic respiration	Upto K5
CLO3	Analyze the pathways of anaerobic respiration and fermentation	Upto K5
CLO4	Categorize the cell signaling molecules	Upto K5
CLO5	Illustrate the microbial biosynthetic pathways	Upto K5

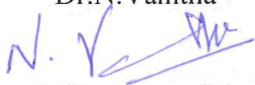
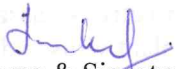
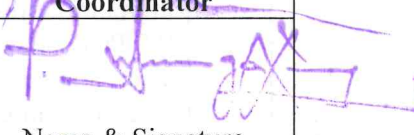
Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.N.Vanitha  Name & Signature of the Staff	Dr. Lali Growther  Name & Signature	 Name & Signature

HEAD
Department of Microbiology
Hindusthan College of Arts & Science
Coimbatore - 641 028

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

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP02	VIROLOGY	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
1.To describe the nomenclature and classification of viruses. 2.To interpret the structure and reproduction of bacterial viruses. 3.To investigate on plant viruses and disease transmission. 4.To investigate on animal viruses and disease transmission. 5.To demonstrate the diagnosis of viral diseases by suitable method.			
Unit	Course Contents	Hours	K Level
I	General virology Discovery of viruses, nomenclature and classification of viruses; (Baltimore) - International Committee on Taxonomy of Viruses (ICTV) code distinctive properties of viruses; <u>morphology and ultrastructure</u> ; capsid and their arrangement; types of envelope and their composition –viral genome, their types and structure; viruses related agents (viroids, prions, virusoids)-purification of viruses and antiviral agents - cultivation of viruses.	13	Up to K5
II	Bacterial viruses Bacteriophage structural organization; life cycle; one step growth curve; transcription ; DNA replication; eclipse phase; phage production; burst size; lysogenic cycle; bacteriophage typing; application in bacterial genetics; M ₁₃ , Mu, T ₃ , T ₄ and lambda P ₁ , ϕ X174, MS ₂ , phage typing and application. Viruses of cyanobacteria, algae, fungi.	13	Up to K5
III	Plant viruses Classification and nomenclature; life cycle, type species of plant viruses like TMV, <u>cauliflower mosaic viruses and potato viruses X</u> , transmission of plant viruses with vectors (insects, nematodes, fungi) and without vectors (Contact, Seed and Pollen); <u>Viral disease of plants - paddy, cotton, tomato and sugarcane. Prevention of crop loss due to virus infection-virus free planting material – vector control.</u>	13	Up to K5
IV	Animal viruses Classification and nomenclature of animal viruses; epidemiology, life cycle, pathogenicity, diagnosis, prevention and treatment of RNA viruses – Rhabdo, Rota, HIV, Ebola, Dengue; Hepatitis (A) , SARS, MERS, Covid 19 and oncogenic viruses; DNA viruses; pox, Adeno viruses, Hepatitis B & Herpes virus. Viral vaccines: conventional vaccine, genetic recombinant vaccine- DNA vaccine with examples-Interferons.	13	Up to K5
V	General methods of Diagnosis and serology Serological methods- haemagglutination and HAI; complement fixation; immunofluorescence methods, ELISA and RIA; Molecular methods-PCR- RT PCR, assay of viruses-physical and chemical methods (protein, nucleic acid, radioactivity tracers)-infectivity assay (plaque method, endpoint method) – infectivity assay of plant viruses-diagnostic technique - seed, seed stocks and diseased plants.	13	Up to K5

***Self Study (Underlined)**

Book for Study

1. Luria S.E. Darnel, J.E Jr. Baltimore. D and Campbell A, "General Virology", Wiley and sons, France.1967

Books for Reference (five books)

1. Nicholas H. Acheson., "Fundamentals of Molecular Virology", Wiley Publications,France.2007
2. Shubhrata.R.Mishra., "Virus and plant diseases", Discovery publishing house, New Delhi.2004
3. Morag C and TiMBPry M.C medical virology-X edition .Churchill Livingstone , London.1994
4. Conrat HF, Kimball PC and Levy JA virology-III edition prentice Hall, Englewood cliff, new Jersey.1994
5. Mathews, RE., functional of plant virology, academic press, san Diago Topley and Wilson's text book on principles of bacteriology,virology and immunology. Edward Arnold, London.1995

Web Resources

<<https://microbenotes.com/?s=Virology>>

<<https://samicrobiology.files.wordpress.com/2018/08/modern-virology.pdf>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPT.

Rationale for Nature of the Course

- This course imparts knowledge from basics to applied diagnostics.

Activities to be given

- Collection of existing statistical data on viral Epidemics and pandemics (Newspaper cuttings)

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Determine taxonomical classification and discriminate the architecture of viruses	Upto K5
CLO2	Distinguish the various structure and replication of bacterial viruses	Upto K5
CLO3	Summarize the life cycle of plant viruses to learn pathogenesis	Upto K5
CLO4	Evaluate animal viruses and their pathogenesis	Upto K5
CLO5	Evaluate the viral diagnostic methods	Upto K5




Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Mrs.C.Ajitha 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

HEAD
Department of Microbiology
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Coimbatore

Co-ordinator
Curriculum Development Cell
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Coimbatore-641 028.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP03	Mycology, Phycology & Parasitology	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
<ol style="list-style-type: none"> To impart knowledge on distribution of algae, fungi and protozoa. To describe the role of fungi in ecosystem and distinguish its various adaptations. To distinguish ecological perspectives of algae. To elaborate the economic significance of algae, fungi and protozoa. To describe the life cycle and clinical significance of parasites 			
Unit	Course Contents	Hours	K Level
I	Fungal Structure and classification Historical introduction to Mycology – Morphology and Classification (Alexopoulos) Division- Chytridiomycota, Zygomycota, Basidiomycota and Deutromycota. Evolutionary tendencies in lower fungi - Cell differentiation. Effect of environment on growth, preservation of fungi – <u>International mycological association.</u>	13	Up to K5
II	Fungal ecosystem Fungal ecosystem- saprophyte, substrate groups and nutritional strategies of fungi and physiological specialization – Lichens- Mycorrhizae- Fungi as an Insect symbiont.	13	Up to K5
III	Phycology Distribution of algae, classification of algae (Fritsch), algal nutrition, algal thallus, algal reproduction, green algae, diatoms, Euglenoid, brown Rhodophyta, Pyrrophyta, algal ecology – <u>spirullina production.</u>	13	Up to K5
IV	Parasitology General concepts and Protozoology; introduction, classification- host parasite relationship, pathogenic mechanism, transmission and life cycle – Leishmania, Trypanosoma, <u>Trichomonas</u> , <u>Balantidium</u> , <u>Toxoplasma</u> and <u>Cryptosporidium</u>	13	Up to K5
V	Life Cycle and Economic Importance Fungi – <u>Aspergillus</u> , <u>Penicillium</u> , <u>Mucor</u> and Yeasts: Algae - <u>Chlamydomonas</u> , <u>Volvox</u> , <u>Chlorella</u> and Diatoms. Protozoa – Entamoeba, Giardia. Helminthes – Ascaris, Taenia.	13	Up to K5

*Self Study (Underlined)

Book for Study

1. Fundamentals of Mycology., J.H Burnett, publisher: Edward, Arnold Crane Russak.1968

Books for Reference

1. Mehrotra R.S and K.S Aneja., “An introduction to Mycology”, new age international publishers1990
2. “Fundamentals of the fungi”, E.Moore-Landeekeer, Publisher: prentice Hall.1972
3. Subash Chandra Parija., “Textbook of Medical Parasitology protozoology and Helminthology”, All India

- Publishers and Distributors, New Delhi.2013
4. Sharma OP., "Text book of Algae", TataMcGraw-Hill, New Delhi.1986
 5. Alexopoulos C.J and C.W Mims Mims 1979. "Introduction to Mycology" (3rd edition) ., Wiley Eastern Ltd, new delhi1979

Web Resources

<http://www.sbs.utexas.edu/mycology/bio341/bio341_topic_02.htm>
 <https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/ln_parasitology_final.pdf>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- This course elaborates knowledge on structure, classification of fungi, algae, protozoa and their economical importance.

Activities to be given

- Collection of fungal / algal cultures


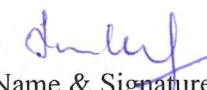
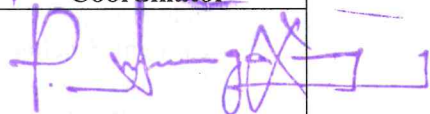
Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Summarize fungal structure, ecosystem and classification	Upto K5
CLO2	Summarize the ecology and classification of algae	Upto K5
CLO3	Assess protozoa and its life cycle	Upto K5
CLO4	Evaluate the economic importance of algae, fungi and protozoa	Upto K5
CLO5	Distinguish the life cycle of algae, fungi and protozoa	Upto K5

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.J.Achuth 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP04	Biochemistry	4	4	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
1. To outline the structure and properties of macromolecules 2. To impart knowledge on the significance of biochemical reactions 3. To categorize the role of various vitamins and minerals 4. To explain the mechanism of enzyme catalysis and their commercial applications 5. To give insights into the in born errors of metabolism			
Unit	Course Contents	Hours	K Level
I	Composition of living matter Structural features and chemistry of macromolecules - Carbohydrates - Monosaccharides, disaccharides and polysaccharides - Aminoacids - Chemical – Nutritional classification – proteins - Lipids - Classification and properties - Nucleic acids – Components and structure of DNA and RNA.	11	Up to K5
II	Bioenergetics Free energy and the laws of thermodynamics; Role of high energy compounds as energy currency of the cell; free energy of hydrolysis of ATP and other organophosphates. The basic metabolic pathways, anabolic, catabolic and amphibolic pathways. Electron transport chain: - Role of respiratory chain in mitochondria; in energy capture; respiratory control. Oxidative phosphorylation- Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation.	11	Up to K5
III	Vitamins and Minerals <u>Classification, properties and physiological functions of vitamins – fat soluble – (A,D,E and K) and water soluble (B and C) – deficiency – causes, manifestations and management – Macroelements – Physiological importance of calcium , phosphorus, magnesium, sodium and potassium – Trace elements – Physiological functions of iron, copper and iodine.</u>	10	Up to K5
IV	Enzymes Classification of enzymes, specificity, active site, activity unit, isoenzyme. Enzyme kinetics: Menton equation for simple enzyme, determination of kinetic parameters, multistep reaction and rate limiting steps, enzyme inhibition, Regulation of enzyme activity, Enzyme purification- Immobilization of enzymes- Microbial enzyme in textile, leather, food industries and detergents.	10	Up to K5
V	Clinical Biochemistry Disorders of carbohydrate metabolism – Hypoglycemia, Hyperglycemia, glycosuria. Disorders of Lipid metabolism- Atherosclerosis, Fatty liver and hyperlipidemia. Disorders of aminoacid metabolism - Cystinuria, phenylketonuria, maple syrup disease, alkaptonuria. Disorders of purine and pyrimidine metabolism - Gout; Xanthinuria and Liathiasis, Orotic acid urea.	10	Up to K5

*Self Study (Underlined)

Book for Study

1. Deb A.C., "Fundamentals of Biochemistry", New Central Book Agency, Calcutta. 2001

Books for Reference

1. Ambika Shanmugam., "Fundamentals of Biochemistry for Medical students" WMC Brown Publishers, NewDelhi.2016
2. Sathyanarayana U., "Biochemistry"., Books and Allied Pvt. Ltd., NewDelhi.2017
3. Lehninger A.L., and Nelson D.I., "Principles of Biochemistry Cox- CBS Publishers, Newdelhi.2013
4. Robert k Murray.Daryl k Granner,Peter A Mayes and victor W.Rodwell Harpers Illustrated Biochemistry 26thedition Lange Mc Graw Hill.2009
5. Lubert Stryer., "Biochemistry", Freeman and Company, NewYork.2002

Web Resources

< https://onlinecourses.swayam2.ac.in/cec20_bt12/preview >

< [Biology \(Singer\)/Bis2A Winter 2019/Lecture 04%3A Biomolecules](#) >

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- This course highlights the chemistry of biomolecules, bioenergetics, disorders of metabolism and the role of industrially used enzymes.

Activities to be given

- Poster/Model presentation

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Summarize the structure of macromolecules and their properties	Upto K5
CLO2	Distinguish the metabolic pathways	Upto K5
CLO3	Summarize the properties, physiological functions and deficiency of vitamins and minerals	Upto K5
CLO4	Order the methods of purification of enzymes	Upto K5
CLO5	Assess the disorders of metabolism	Upto K5


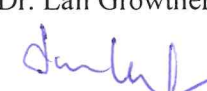

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Ms.T.Krithika  Name & Signature of the Staff	Dr. Lali Growther  Name & Signature	 Name & Signature

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

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP05	Practical I – Bacteriology, Virology, Mycology, Phycology, Parasitology	3	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
<ol style="list-style-type: none"> To impart practical skills on sterilization and pure culture techniques To determine the isolation and enumeration of various microbes To develop practical knowledge on biochemical characterization of microbes To enable students to observe fungi and protozoa microscopically To explain anaerobic cultivation methods and isolation of coliphages 			
Unit	Course Contents	Hours	K Level
1	Isolation and enumeration of microorganism from soil a. Bacteria, b. Fungi c. Actinomycetes	5	Up to K3
2	Staining – Bacteria a. Gram, b. Acid fast, c. Spore, d. Capsule e. Negative f. Fungi (LPCB).	5	Up to K3
3	Micrometry.	5	Up to K3
4	Motility – Hanging drop method & SIM inoculation	5	Up to K4
5	Growth curve – Viable count, Turbidity and Neubauer counting chamber.	5	Up to K5
6	Effect of intrinsic factors on the growth of bacteria – pH, temperature	5	Up to K5
7	Thermal death point / Thermal death time.	5	Up to K5
8	Biochemical Characterization a. IMViC, b. Catalase, c. Oxidase, d. TSI e. Ureases	5	Up to K4
9	Polymer hydrolysis a. Gelatin b. Casein c. Starch	5	Up to K5
10	Study of Algae – Microscopy and culture	5	Up to K4
11	Anaerobic culture technique- a. McIntosh Fildes jar b. Wrights Tube method	5	Up to K4

(1/2/22)

* The information is for reference only
 do not use it for any purpose without the permission of the
 authority concerned *

	c. Roll tube technique		
12	Isolation and titration of Coliphage	5	Up to K3
13	Observation of Protozoa - Hay Infusion broth.	5	Up to K5

Book for Study

1. N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shenpagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, "Microbiological Techniques", 2013, MJP Publisher
2. Lali Growther et al., "Microbiology Lab Manual", 2019, Narain Publications.

Books for Reference

1. James G. Cappuccino, Natalie Sherman, "Microbiology: A Laboratory Manual", 2014: Pearson.
2. S.Rajan & R.Selvi Christy, "Experimental procedures in Life Sciences", 2018.
3. L.P. Awasthi., "Applied Plant Virology: Advances, Detection, and Antiviral Strategies"., Academic Press.,2020.
4. Douglas D Richman and Richard Whitley and Frederick Hayden., "Clinical Virology" 4Th Edition., Taylor and Francis.,2017.
5. Lynne Shore Garcia , "Practical Guide To Diagnostic Parasitology" 3rd Edition , American Society for Microbiology.,2021

Web Resources

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

https://agriflife.org/vetmed/files/2012/10/LS_5_4_sample_lesson.pdf.

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- Hands-on training makes easier to understand and correlate theoretical concepts.

Activities to be given

- Preparation of Winogradsky column

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Identify and evaluate microorganisms from soil.	Upto K5
CLO2	Apply microscopy to observe microorganisms and measure growth	Upto K5
CLO3	Test the biochemical characteristics of bacteria.	Upto K5
CLO4	Analyze the morphology of algae and protozoa.	Upto K5
CLO5	Evaluate anaerobic cultivation methods.	Upto K5

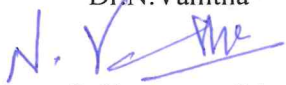

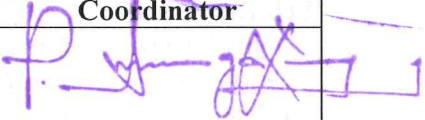
Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.N.Vanitha 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., Microbiology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
I	DSC	22MBP06	PRACTICAL II – BIOCHEMISTRY	3	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
1. To develop practical knowledge on analysis of biomolecules 2. To demonstrate the estimation of biomolecules quantitatively 3. To impart practical knowledge on production, separation and partial purification of enzymes 4. To develop skills on the use of chromatography for the separation of various biomolecules 5. To develop skills on protein separation methodologies			
Unit	Course Contents	Hours	K Level
1	Estimation of Protein by Lowry method	5	Up to K3
2	Estimation of Reducing sugars by DNS method.	5	Up to K3
3	Determination of wavelength of maximum absorbance (λ_{max}) of macromolecules (protein, nucleic acid/ bacterial pigments)	5	Up to K4
4	Separation of amino acids Paper chromatography	5	Up to K5
5	Separation of sugars Thin Layer Chromatography (TLC)	5	Up to K5
6	Microbial production of enzyme (Amylase).	5	Up to K5
7	Study of enzyme activity (Amylase)	6	Up to K5
8	Enzyme purification by salt precipitation and dialysis	6	Up to K5
9	Determination of molecular weight by SDS-PAGE	6	Up to K5
10	Separation of amino acids by Column chromatography	6	Up to K5
11	Immobilization of cells and enzyme using Sodium alginate	6	Up to K3
12	HPLC (Demo/ Workshop)	5	Up to K3

Book for Study

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

Books for Reference

1. Valleys practical clinical biochemistry, Heineman medical books, NewDelhi, 2006.
2. Wilson, E., Walker, J., Practical Biochemistry-Principles and techniques, Cambridge University press (2010).
3. Boyer, R.F., Modern Experimental Biochemistry. Nenjamin/Cummings publishing company Inc. Redwoodcity, California (2012).
4. R.Sowndravally, D.Pooja, Biochemistry Practical Manual, 2019, Elsevier India
5. K Geetha Damodaran., Practical Biochemistry.,., Medical College, Trichur, Kerala, India,2013.

Web Resources

<https://www.researchgate.net/publication/332028407_Biochemistry_A_Practical_Manual>
 <<https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch450-and-ch451-biochemistry-defining-life-at-the-molecular-level/chapter-7-enzyme-kinetics/>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- Hands on training provides knowledge to analyze, estimate and separate biomolecules

Activities to be given

- Model preparation on Bioinstrumentation

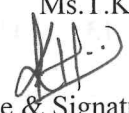

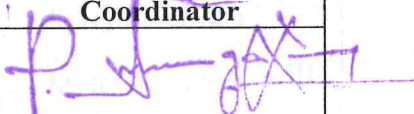
Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Select the methods to estimate macromolecules quantitatively	Upto K5
CLO2	Evaluate the methods of immobilization of microbial cells	Upto K5
CLO3	Assess the separation of macromolecules	Upto K5
CLO4	Distinguish the techniques for protein separation and purification	Upto K5
CLO5	Evaluate the applications of chromatography	Upto K5

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Ms.T.Krithika  Name & Signature of the Staff	Dr. Lali Growther  Name & Signature	 Name & Signature

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Curriculum Development Cell
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Coimbatore-641 028.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP08	Applied Biotechniques	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
<ol style="list-style-type: none"> To impart knowledge on the use and operation of microscopes. To describe the applications of centrifugation To explain the instrumentation and applications of chromatographic techniques To provide knowledge on electrophoresis To demonstrate recombinant DNA techniques. 			
Unit	Course Contents	Hours	K Level
I	Microscopy and Spectroscopy Working principle and applications of light microscopes- Bright field, Dark field, Phase contrast, Fluorescence, Confocal Electron microscope- SEM and TEM. Principles, instrumentation and applications of Colorimetry - spectrophotometry - UV - Visible and IR spectroscopy. Principles and applications of spectrofluometry - Flame photometry- NMR - 3D structure by X-ray diffraction – ESR.	13	Up to K5
II	Centrifugation techniques Principle and instrumentation of centrifuges – RCF & Sedimentation coefficient - design -preparative rotors- analytical samples containers - separation methods in preparative ultracentrifuges – density gradient separations – applications of preparative and analytical ultracentrifuges – safety aspects in the use of centrifuges.	13	Up to K5
III	Chromatography Principles - instrumentation- Paper – TLC – HPLC – GC – MS - LC-MS, UPLC-QTOF Mass spectroscopy - gel filtration - Ion exchange – Column - Immuno adsorption- Affinity chromatography - applications.	13	Up to K5
IV	Electrophoresis and Radioisotopes Principles and applications of Electrophoresis - paper-starch gel-agarose-native and denaturing PAGE – 2D PAGE electrophoresis – iso-electrofocusing – Zymogram preparation, PFGE (Pulse field Gel Electrophoresis) MALDI – TOF. Use of radio isotopes in life sciences-radioactive labeling - principles and applications of tracer techniques-detection and measurement of radioactivity using ionization chamber - Geiger Muller and scintillation counters - autoradiography and its applications – safety guidelines-Biosensors.	13	Up to K5
V	Recombinant DNA Techniques PCR – types (Nested, RT PCR) - Gene transfer methods – protoplast fusion - microinjection – macroinjection - particle bombardment - electroporation, liposome and polyethylene glycol mediated gene transfer. Gene cloning - selection and Analysis of recombinant Clones - Direct screening – Insertional Inactivation and visual screening. Indirect screening – Nucleic acid blotting (Northern, western and Southern), Colony, Plaque and Dot blot hybridization, Immunoscreening.	13	Up to K5

***Self Study (Underlined)**

Book for Study

1. Keith Wilson and John Walker., "Practical Biochemistry", WMC Brown Publishers, New Delhi.1994

Books for Reference

1. Boyer., "Practical Biochemistry", Springer, New York.1993
2. Kathleen Talaro and Arthur Talaro ., "Foundation in Microbiology" WCB Publishers, London.2012
3. Lehninger A.L., and Nelson D.I., "Principles of Biochemistry" Cox- CBS Publishers, Newdelhi.1970
4. David Freifelder., "Physical Biochemistry", Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education NewYork.1994
5. Sudhir U. Meshram., "Applied Biotechnology", I.K. International Publishing House Pvt. Limited.,2013.

Web Resources

- <https://www.academia.edu/36365635/Handbook_of_Analytical_Techniques_2_Volume_Set_pdf>
<https://www.academia.edu/5266578/Analytical_Chemistry_Lecture_Notes_>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- A broad knowledge on principles and applications of biotechniques/bioinstrumentations

Activities to be given

- Working model preparation

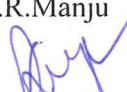

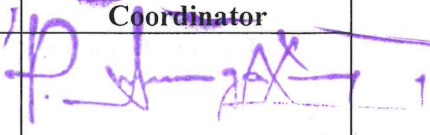
Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Summarize the principle and applications of Microscopy and Spectroscopy	Upto K5
CLO2	Compare the types of Centrifugation	Upto K5
CLO3	Distinguish the types of Chromatography	Upto K5
CLO4	Discriminate the methods of electrophoresis and radio isotopes	Upto K5
CLO5	Evaluate the gene transfer and r DNA techniques	Upto K5

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.R.Manju 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP09	Immunobiology	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
<ol style="list-style-type: none"> To infer on immune system and types of immunity. To describe the different types of antigen, antibody and complement system. To interpret on hypersensitivity reactions, cancer and transplantation immunology. To recognize molecules in antigen presentation, autoimmune and immunodeficiency diseases. To demonstrate antigen-antibody reactions and other techniques involved in immunology. 			
Unit	Course Contents	Hours	K Level
I	Immune system and Immunity History of Immunology; structure and functions of cells and organs involved in immune system; host parasite relationship; microbial infection; virulence and host resistance; immune response- Humoral and cell mediated - immunohaematology - blood groups, blood transfusion and Rh incompatibilities- Programmed cell death- <u>Immunization - Active and Passive. Types of vaccines.</u>	13	Up to K5
II	Antigen, Antibodies and Complement system Antigens – features of antigens – epitopes, cross reactivity, cell surface antigens and auto antigens- haptens- adjuvants and its significance. Immunoglobulin – structure, properties-types- Theories of antibody production - immunoglobulin variation, class switching - <u>monoclonal antibody production - applications.</u> Complement system - classical, alternate, lectine pathway, regulation of the complement system- regulation of Immune system – cytokines- lymphokines. Tolerance - T cell tolerance, B cell tolerance.	13	Up to K5
III	Hypersensitivity, Tumor and Transplantation Immunology Hypersensitivity –Type I, II, III and IV; Tumor immunology: tumor antigens and immune response to tumors- Cancer immunotherapy- gene regulation and Immuno Response (Ir) genes- Detection of tumor marker– α Foetal proteins, Carcino embryonic antigen-Transplantation immunology: (Graft vs Host reaction (GVHR), Host vs Graft reaction (HVGR), MLR, HLA typing. <u>Organ transplantation: Basic concept of Organ transplantation, Kidney – Immunosuppressant (different classes) and immunosuppressive therapy.</u>	13	Up to K5
IV	MHC, Autoimmune and immunodeficiency diseases Major Histocompatibility Complex (MHC) and types – Class I, II and III distribution and function, Antigen recognition and presentation: Activation of B and T Lymphocytes – Cytokines and their role in immune recognition– Immune response during infection. (Bacteria - Tuberculosis, Parasite - Malaria, Virus- HIV). <u>Autoimmune disorders: Organ specific autoimmune diseases and Systemic autoimmune diseases – Hashimoto’s thyroiditis, SLE. Immunodeficiency diseases: SCID and AIDS.</u>	13	Up to K5
V	Immunotechnology Antigen-Antibody interaction – affinity- avidity -Principle and applications of agglutination, precipitation, complement fixation test, Immuno fluorescence, Radio immuno assay, Enzyme immunoassay, Western blotting. Immuno electron microscopy, flow cytometry (FACS) and cell cytotoxicity assay-immunomic	13	Up to K5

microarray- lymphochip. In Situ localization techniques - FISH & GISH		
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***Self Study (Underlined)**

Book for Study

1. Tizard,R.I., "Immunology-An Introduction",Saunder's College publishers, Philadelphia.2012

Books for Reference

1. Roitt,I.M., "Essential of Immunology", Black Well Scientific Publishers, NewYork.2006
2. Ashim K. Chakravarthy., Immunology, TataMcGraw-Hill, New Delhi2006
3. Kuby. J., "Immunology", W.H.Freeman and co., NewYork.1992
4. David Freifelder., "Physical Biochemistry", Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education NewYork.1994
5. Abul K Abbas, Andrew H Lichtman, Shiv Pillai, Mbbs , Basic Immunology: Functions and Disorders of the Immune System, 6e: Sae-E-Book, Elsevier Health Sciences,2019.

Web Resources

- <https://swayam.gov.in/nd1_noc20_bt43/preview>
- <<http://www.helmsberg.at/immunology.pdf>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- This course imparts knowledge on immune system, cells, organs, hypersensitivity, transplantation and diagnosis.

Activities to be given

- Case study analysis of hypersensitivity, auto immune diseases and transplantation (Newspaper cuttings)



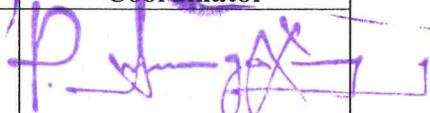
Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Evaluate the immune system and its response and immunization	Upto K5
CLO2	Differentiate the types of antigen, antibody and complement pathways	Upto K5
CLO3	Discriminate hypersensitivity and illustrate transplantation immunology	Upto K5
CLO4	Assess antigen processing, presentation and analyze autoimmune, immunodeficiency diseases	Upto K5
CLO5	Evaluate antigen and antibody reactions and its uses in diagnostics	Upto K5

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
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CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application 2 – Intermediate Level 1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Mrs.C.Ajitha 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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Co-ordinator
Curriculum Development Cell
Hindusthan College of Arts & Science,
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DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP10	Genetic Engineering	4	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives

1. To impart knowledge on the fundamental principles in molecular biology
2. To familiarize with the mutagenic agents and mutations
3. To acquaint with versatile tools and techniques employed in genetic engineering
4. To illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences
5. To expose the application of recombinant DNA technology in research.

Unit	Course Contents	Hours	K Level
I	Gene expression and regulation <u>Genetics – Pre Mendelian genetics, Mendelian principles, Segregation, Independent Assortment, Dominance –DNA replication – Differences in Prokaryotes and Eukaryotic replication- Transcription in prokaryotes and eukaryotes-RNA polymerases (RNAP I, II & III) - inhibitors of RNAP- Post transcriptional modifications (for all types of RNA) - Capping, polyadenylation and splicing mechanism, Transcriptional control of gene expression (promoters, enhancers, CpG islands and epigenetics)- Non-coding RNA – Small, long and circular -Genetic code –Features- Translation in prokaryotes and eukaryotes (initiation, elongation and termination & factors responsible)- post-translational modifications- Regulation of gene expression (<i>lac</i> and <i>trp</i> operon).</u>	14	Up to K5
II	Site directed mutagenesis <u>Mutation – Spontaneous and Induced mutations- Physical and chemical mutagens- Site specific mutagenesis- methods, screening of recombinants for SDM by SSCP and heteroduplex analysis, DNA foot printing and finger printing, Nucleic acid micro arrays- DNA repair- mechanism of repair- light and dark mechanism, SOS- Gene therapy- types, strategies and applications.</u>	12	Up to K5
III	Enzymes and Vectors in Cloning <u>Enzymes used in gene manipulation - Restriction enzymes, Reverse transcriptase, End modifying enzymes, Methylases, Ligation- DNA ligases, use of linkers & adaptors- Prokaryotic vectors- Plasmid as cloning vectors – Features, pET, pUC19, pBR322, pUC, Bacteriophage vectors-λ (insertional and replacement vectors), M13, Cosmids, Phagemids, Phasmids and BAC- Eukaryotic vectors- Yeast Vectors- YAC <i>Pichia pastoris</i> and <i>Saccharomyces cerevisiae</i>. Animal vectors-SV40, Retroviral vectors, Plant vectors- Ti Plasmid- Expression vectors and Shuttle vectors.</u>	13	Up to K5
IV	Genetic Engineering <u>Construction of Genomic and cDNA Libraries- Strategies and applications- Mapping techniques- Chromosome walking and jumping, Restriction mapping- DNA sequencing- Next generation sequencing-. Genome Editing - CRISPR/Cas9 technology-therapeutic and diagnostic applications.</u>	12	Up to K5
V	Applications of Genetic Engineering <u>Engineering microbes - Insulin production in <i>E. coli</i>, Production of Vaccines for Hepatitis B Virus using yeast- Engineering plants - insect, virus, herbicide</u>	14	Up to K5

resistant plants– microbial insecticides- Delayed ripening - Engineering animals - Tissue plasminogen activator production, transgenic mice – retroviral method – DNA Microinjection method – Embryonic stem cell method - <u>Applications of Transgenesis - Transgenic cattle - Increased milk production, Transgenic fish - Improving growth rate, Transgenic sheep - Enhanced wool production.</u>		
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***Self Study (Underlined)**

Book for Study

1. David Freifelder., “Molecular biology”, Narosa publishing house, New Delhi.1983

Books for Reference

1. Lewin.B., Genes XII”, Oxford University Press, New York. 2017
2. Gardner EJ., “Principles of Genetics - V”, Hardcover – 1.1975
3. Klug .W.S. & Cummings, MR.,”Essentials of Genetics”, Mentics Hail,NewJersey.2016
4. Gardner, E. J,Simmons, M J&D P Snustard., “Principles of Genetics”, John Wiley & Sons, New York.2006
5. Preeti Joshi . “Genetic Engineering and Its Applications”., Agrobios (India), Cornell University. 2003

Web Resources

<<https://www.coursera.org/lecture/dna-decoded/genetic-engineering-KIRoE>>

<<https://www2.nau.edu/fpm/bio205/Sp-10/chapter-10.pdf>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- The techniques employed in Genetic Engineering, Site directed mutagenesis, genome editing technologies and the applications are elaborated in this course.

Activities to be given

- Report on the history of transgenesis
- Debate on Genetically modified organisms

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Evaluate the importance of the central dogma of Molecular biology	Upto K5
CLO2	Differentiate the types of mutations and repair mechanisms	Upto K5
CLO3	Justify the concepts of genetic recombination	Upto K5
CLO4	Assess the enzymes and vectors in genetic engineering	Upto K5
CLO5	Justify the development of transgenic plants and animals	Upto K5



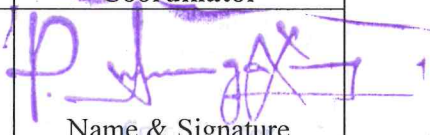
Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
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CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.T.Vinotha  Name & Signature of the Staff	Dr. Lali Growther  Name & Signature	 Name & Signature

HEAD
Department of Microbiology
Hindusthan College of Arts & Science
Coimbatore- 641 028

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

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP11	Medical Microbiology	4	4	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives

1. To recognize, identify and differentiate the sources, methods of transmission and infectious disease cycle of human pathogens
2. To explain the morphology, virulence factors and pathogenesis of Gram positive and Gram negative organisms.
3. To describe the morphologies, pathogenesis and diseases caused by fungal pathogens.
4. To describe the mechanisms of antibiotic resistance in microorganisms.
5. To explain the conventional and advanced rapid diagnostic tests for identification of organisms in clinical samples.

Unit	Course Contents	Hours	K Level
I	Infection Infection- types - sources and methods of transmission – normal microbial flora of human body- Mechanism of bacterial adhesion and colonization- Infectious disease cycle – sample collection, transport and examination of clinical specimens-blood, Sputum, CSF, urine, stool. Sytemic Infections Urinary tract infections, Respiratory tract infections, Sexually transmitted infections, <u>Skin infections</u> , <u>Nosocomial infections</u> , Pyrexia of unknown origin.	11	Up to K5
II	Gram positive organisms Bacteriology: Gram positive organisms - morphology, pathogenicity, laboratory diagnosis, prophylaxis and treatment of <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Clostridium tetani</i> , <i>Mycobacterium tuberculosis</i> , <i>Mycobacterium leprae</i> . <i>Spirochaetes</i> – <i>Treponema pallidum</i> , and <i>Leptospira icterohaemorrhagiae</i> .	11	Up to K5
III	Gram negative organisms Bacteriology: Gram negative organisms - Morphology, pathogenicity, laboratory diagnosis, prophylaxis and treatment of <i>E. coli</i> , <i>Klebsiella pneumoniae</i> , <i>Salmonella typhi</i> , <i>Shigella dysenteriae</i> , <i>Pseudomonas aeruginosa</i> , <i>Vibrio cholerae</i> , <i>Bordetella pertussis</i> , <i>Yersinia pestis</i> , <i>Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> .	10	Up to K5
IV	Mycology Mycoses – superficial, subcutaneous and systemic infections – <i>Dermatophytoses</i> , <i>Madura mycosis</i> , <i>Cryptococcosis</i> , <i>Histoplasmosis</i> , <i>Blastomycosis</i> - opportunistic mycoses- <i>Candidiasis</i> , <i>Mucor mycoses</i> and <i>Aspergillosis</i>	10	Up to K5
V	Sensitivity testing and Diagnostic methods Antibiotic susceptibility testing- antibiotic resistance- MRSA, VISA -Serological and molecular methods for diagnosis- Modern diagnostic methods- advanced rapid tests- Poly stainer automatic system for Gram staining- BacT ALERT Blood culture system- API System, Bio Merieux Vitek MS system-proteomics technologies- mass spectrometry-MALDI-TOF-MS.	10	Up to K5

CLASS
 DEPARTMENT OF MICROBIOLOGY
 UNIVERSITY OF CALicut
 KERALA

***Self Study (Underlined)**

Book for Study

1. Ananthanarayan and Jayaram Paniker., "Textbook of Microbiology", (2020)University Press India Pvt ltd. New Delhi.11th ed.

Books for Reference

1. Mackie and Mc catney, , Medical Microbiology No I and II. Churchill Livingston, USA. 1996
2. Bailey and Scotts "Diagnostic Microbiology", 9th edition, Baron and Finegold CV MosbyPublications, USA. 1970
3. David Greenwood "Medical Microbiology", ChurchillLivingstone,2012
4. Jawetz E Melnic JL and Adelberg EA , review of Medical Microbiology Lange Medical Publications, USA.1963
5. Patrick R. Murray, Ken S. Rosenthal and Michael A. Pfaller., Medical Microbiology, 7th Edition. Elsvser publisher,2014.

Web Resources

<<https://www.pdfdrive.com/medical-microbiology-e18737002.html>>

<<http://www.freebookcentre.net/Biology/Mycology-Books.html>>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- The emerging threat of drug resistance, emerging pathogenic organisms and the use of these organisms as bio-weapons are analyzed in this course. The oppurtunities in diagnostics and the use of automated techniques are included to make students aware of the industrial needs.

Activities to be given

- Poster presentation on Antibiotic resistance (team work)

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Differentiate the types, sources and methods of transmission of infection	Upto K5
CLO2	Assess the pathogenicity and lab diagnosis of Gram positive bacteria	Upto K5
CLO3	Compare the pathogenicity and lab diagnosis of Gram negative organisms	Upto K5
CLO4	Discriminate the types of fungal infections	Upto K5
CLO5	Summarize the rapid diagnostic tests	Upto K5

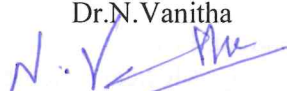
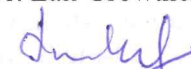
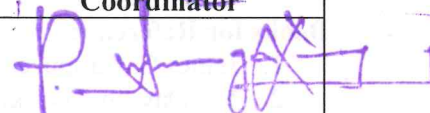
Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
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CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.N.Vanitha 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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Curriculum Development Cell
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Coimbatore-641 028.

DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP12	Practical III - Immunobiology and Medical Microbiology	3	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives			
1. To develop the skill to isolate and identify pathogens from clinical specimens 2. To check the sensitivity pattern of antibiotics 3. To understand the antigen antibody reactions 4. To identify the blood cells and to enumerate the leucocytes 5. To provide practical knowledge to check the efficiency of disinfectants			
Unit	Course Contents	Hours	K Level
1	Diagnostic Microbiology: Isolation and identification of pathogens from clinical specimens a) Throat swab b) Urine c) Pus d) Faeces e) Blood f) Sputum	10	Up to K3
2	Isolation and identification of clinically important fungi a) <i>Candida albicans</i> b) <i>Aspergillus niger</i> c) <i>Cryptococcus neoformans</i>	5	Up to K3
3	Antibiotic susceptibility test - Kirby Bauer technique/Stokes method	5	Up to K4
4	Examination of blood smear study for <i>Plasmodium</i> sp.,	5	Up to K4
5	Agglutination reaction - Blood grouping & Rh Typing.	5	Up to K3
6	Immunodiffusion – ODD Test.	5	Up to K3
7	Diagnostic Tests – WIDAL (Slide & Tube Test), RA, ASO, CRP, RPR.	6	Up to K3
8	Identification and enumeration of Leucocytes	6	Up to K4
9	Immuno electrophoresis – Counter Current & Rocket Immuno electrophoresis.	6	Up to K3
10	ELISA.	6	Up to K5
11	Phenol co-efficient test.	6	Up to K3

Book for Study

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

Books for Reference

1. James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual, Pearson 2014
2. M. Daw A. Daeki K. Taweel K. El-Figih M. ELLABIB A. Al-Tubuly Medical Microbiology Laboratory Manual Second Edition. Edition: Second Edition Publisher: Mohamed A Daw, 2009.

DEPARTMENT OF MICROBIOLOGY
 UNIVERSITY OF AL-QADISIYA
 AL-QADISIYA, IRAQ

- Patricia Tille .,Bailey & Scott's Diagnostic Microbiology 14th Edition, Elvisier publisher, 2014.
- C. P. Baveja and V. Baveja., Text and Practical Microbiology for MLT, 2021
- Frank C Hay, Olwyn M.R westwood.,Practical Immunology .,4th edition., John Wiley and Sons Ltd publisher.

Web Resources

<<https://www.urmc.rochester.edu/medialibraries/urmcmedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf>>

<https://mountainscholar.org/bitstream/handle/20.500.11919/4774/OERW_MOLB_2021_20190101_Spring%202019%20Micro%20Lab%20Manual.pdf?sequence=1>

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- Hands-on training and demonstrations promotes team work and improves critical thinking and problem solving abilities.

Activities to be given

- Case study on infectious diseases

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Justify the methods to identify pathogens from clinical specimens	Upto K5
CLO2	Evaluate antibiotic sensitivity testing and interpretation	Upto K5
CLO3	Measure antigen, antibody reactions by various tests	Upto K5
CLO4	Test and identify the blood cells	Upto K5
CLO5	Assess the efficiency of disinfectants	Upto K5

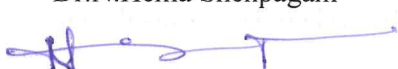
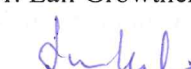
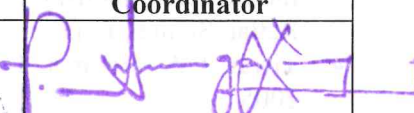
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CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
Dr.N.Hema Shenpagam 	Dr. Lali Growther 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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DEPARTMENT OF MICROBIOLOGY				CLASS: I M.Sc., MICROBIOLOGY				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours / Week	CIA	Ext	Total
II	DSC	22MBP13	Practical IV - Applied Biotechniques and Genetic Engineering	3	5	50	50	100

Nature of Course		
Knowledge and Skill Oriented	Employability Oriented	✓
	Entrepreneurship Oriented	✓
	Skill Development	✓

Course Objectives
<ol style="list-style-type: none"> To develop practical knowledge on isolation and separation of biomolecules. The students will receive hands-on training in DNA and RNA isolation methods. The students will be acquainted with a variety of mutant isolating techniques. The students will get practical training in transformation and conjugation methods. They will gain expertise in detecting carcinogens.

Course Contents	Hours	K Level
1. Separation of serum protein by gel electrophoresis.	6	Up to K3
2. Isolation of chromosomal DNA –(Phenol chloroform method)	6	Up to K3
3. Isolation of chromosomal DNA (Using magnetic beads)	6	Up to K3
4. Isolation of plasmid DNA.	6	Up to K3
5. Quantification of DNA by diphenylamine test.	6	Up to K4
6. Isolation of mutants by physical (UV) and chemical agents (EMS)	6	Up to K4
7. Isolation of antibiotic resistant mutants by gradient plate technique.	6	Up to K5
8. Study of conjugation in <i>Escherichia coli</i> .	6	Up to K5
9. Transformation in <i>Escherichia coli</i> .	6	Up to K5
10. Detection of carcinogens- AMES test.	6	Up to K5
11. Extraction of RNA from <i>Saccharomyces cerevisiae</i> .- (Demo)	5	Up to K5

Book for Study

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

Books for Reference

- James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual, Pearson 2014
- Supriya Dash & Swagat Kumar Das H N Thatoi ., Practical Biotechnology: Principles and Protocols, I K International Publishing House; 0 edition 2017.
- Rattan Sunita., Experiments in Applied Chemistry, S.K. Kataria & Sons publishers, 2011.
- Tiwari, G.S. Hoondal Laboratory Techniques in Microbiology & Biotechnology, Swastik publishers. 2005.
- Nagini., Genetic Engineering, scitech publications (india) pvt. Ltd, 2013.

Web Resources

- < <http://vlab.amrita.edu/?sub=3&brch=77> >
- < <http://site.iugaza.edu.ps/mwhindi/files/BIOTECHNOLOGY-PROCEDURES-AND-EXPERIMENTS-HANDBOOK.pdf> >

Pedagogy : Chalk & Talk, Exercise, Assignments & PPTs.

Rationale for Nature of the Course

- Hands-on training and demonstrations promotes team work and improves critical thinking and problem solving abilities.

Activities to be given

- Workshop on RNA isolation

Course Learning Outcomes

CLOs	On Completion of the Course, the students should be able to	K - Level
CLO1	Summarize methods to separate biomolecules	Upto K5
CLO2	Compare the methods to identify mutants	Upto K5
CLO3	Compare gene transfer techniques	Upto K5
CLO4	Assess mutants using physical and chemical methods	Upto K5
CLO5	Evaluate the carcinogenicity by AMES test	Upto K5



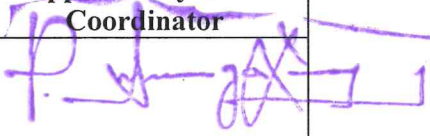
Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs)

CLOs	Programme Outcomes						
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CLO1	3	2	3	3	3	3	2
CLO2	2	2	3	3	3	3	3
CLO3	2	3	2	3	3	3	2
CLO4	2	2	3	3	3	3	3
CLO5	3	3	2	3	3	3	3

3 – Advance Application

2 – Intermediate Level

1 – Basic Level

Course Designed by	Verified by HOD	Approved by CDC Coordinator
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