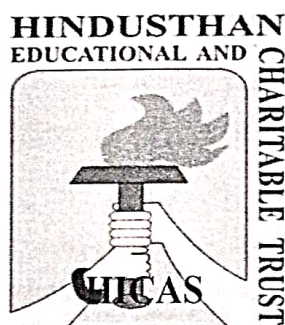


LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

in the

POSTGRADUATE 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

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:** To acquire the appropriate skills of Microbiology so as to perform their duties as Microbiologists.
- PO2:** Students will be able to analyze the problems related to Microbiology and come up with most suitable solutions.
- PO3:** Students should also develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory work and ethics followed for scientific publishing of their research work in future.
- PO4:** Students should be able to use modern tools that will help them acquire interdisciplinary skills.
- PO5:** The students in post graduate Microbiology should develop excellent communication skills and be able to work in teams
- PO6:** Recognize the need for life-long learning in the broadest context of technological change.
- PO7:** Ability to generation new knowledge, innovate and analyze data collected through study and small projects.

PROGRAMME SPECIFIC OUTCOME (PSO)

- PSO1:** Understanding of diverse Microbiological processes
- PSO2:** Acquire advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc
- PSO3:** Ability to innovate so as to generate new knowledge
- PSO4:** Awareness on how some Microbiology processes or products may be developed into enterprise
- PSO5:** Ability to participate in team work through small Microbiology projects

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)

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									
21MBP01	DSC	Bacteriology	4	5	-	3	40	60	100
21MBP02	DSC	Virology	4	5	-	3	40	60	100
21MBP03	DSC	Mycology, Phycology & Parasitology	4	5	-	3	40	60	100
21MBP04	DSC	Biochemistry	4	4	-	3	40	60	100
21MBP05	DSC	Practical I – Bacteriology, Virology, Mycology, Phycology, Parasitology	3	-	5	9	50	50	100
21MBP06	DSC	Practical II – Biochemistry	3	-	5	6	50	50	100
21MBP07	SEC	Internship / Institutional Training / Mini-Project	2	-	-	-	100	-	100
21MBPE01	AEE	Open Elective - I	2	3	-	-	100	-	100
21MBPV01	ACC	JOC/VAC-I	1*	2	-	-	50**	-	50**
21MBPJ01	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		460	340	800
Semester - II									
21MBP08	DSC	Applied Biotechniques	4	5	-	3	40	60	100
21MBP09	DSC	Immunobiology	4	5	-	3	40	60	100
21MBP10	DSC	Genetic Engineering	4	5	-	3	40	60	100
21MBP11	DSC	Medical Microbiology	4	4	-	3	40	60	100
21MBP12	DSC	Practical-III Immunobiology and Medical Microbiology	3	-	5	9	50	50	100
21MBP13	DSC	Practical -IV Applied Biotechniques and Genetic Engineering	3	-	5	9	50	50	100
21MBP14	SEC	Internship / Institutional Training / Mini-Project / Extension Activity	2	-	-	-	100	-	100

21MBPE02	AEE	Open Elective - II	2	3	-	-	100	-	100
21MBPV02	ACC	VAC-II	1*	2	-	-	50**	-	50**
21MBPJ02	SEC	Online Courses	Grade*	-	-	-	-	-	C/NC
21MBPJ03	SEC	Aptitude / Placement Training	Grade*	2	-	-	50**	-	50**
		Total	26	26	10		460	340	800
Semester – III									
21MBP15	DSC	Environmental and Agricultural Microbiology	4	4	-	3	40	60	100
21MBP16	DSC	Bioprocess Technology	4	4	-	3	40	60	100
21MBP17	DSC	Bioinformatics, Biostatistics & Research Methodology	4	4	-	3	40	60	100
21MBP18	DSE	DSE I - Electives –I	3	4	-	3	40	60	100
21MBP19	DSE	DSE II - Electives – II (Practicals)	3	-	5	9	50	50	100
21MBP20	DSC	Practical V – Environmental and Bioprocess technology	3	-	5	9	50	50	100
21MBP21	DSC	Practical VI Bioinformatics and Biostatistics	2		3	3	50	50	100
21MBP22	SEC	Internship / Institutional Training / Mini-Project / Extension Activity	2	-	-	-	100	-	100
21MBPE03	AEE	Open Elective-III	2	3	-	-	100	-	100
21MBPV03	ACC	VAC-III	1*	2	-	-	50**	-	50**
21MBPJ04	SEC	Aptitude / Placement Training	Grade*	2	-	-	50**	-	50**
21MBPJ05	SEC	Online Courses	Grade*	-	-	-	-	-	C/NC
21MBPJ06	SEC	SDR – Student Development Record	2*	-	-	-	-	-	-
		Total	27	23	13		510	390	900
Semester – IV									
21MBP23	DSE	DSE III - Elective III	3	5	-	3	40	60	100
21MBP24	DSE	DSE-IV - Electives IV	3	5	-	3	40	60	100
21MBP25	DSC	Core - XVIII – Self-Study Course Bioethics, IPR and Biosafety	4	-	-	3	40	60	100
21MBP26	SEC	Project Work /Student Research	5	-	-	-	50	150	200
		Total	15	10			170	330	500

- * 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

Range of marks	Equivalent remarks
80 and above	Exemplary
70 – 79	Very good
60 – 69	Good
50 – 59	Satisfactory
Below 50	Not Satisfactory = Not completed

- Part IV & V not included in total marks and CGPA calculation.
- **I.E**-Internal Exam
- **E.E**-External Exam
- **JOC**-Job Oriented Course

PASSING MINIMUM

- Passing Minimum for PG 50%

Abstract for Scheme of Examination

(For the students admitted during the academic year 2021 - 2022 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*	100	300**
<i>Aptitude / Placement Training/ SEC</i>	3	Grade*	Grade*	100	300**
<i>Online Courses / SEC</i>	2	Grade*	Grade*	-	-
SDR - SEC	1	2*	2*	-	-
Total			94 + (5 Extra Credits)		3000 + (600**)

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	1. Developmental Biology 2. Inheritance Biology 3. System Physiology - Plant 4. System Physiology - Animal 5. Diversity of Life Forms 6. Ecological Principles 7. 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	21MBP18A	A	Pharmaceutical Microbiology
	21MBP18B	B	Microbial Genomics and Proteomics
	21MBP18C	C	Microbial production of Recombinant molecules
Electives/ DSE-II	21MBP19A	A	Practical VI - Pharmaceutical Microbiology
	21MBP19B	B	Practical VI - Microbial Genomics and Proteomics
	21MBP19C	C	Practical VI - Microbial production of Recombinant molecules
Electives/ DSE-III	21MBP23A	A	Food Microbiology and Food Safety
	21MBP23B	B	Entrepreneurial Microbiology
	21MBP23C	C	Organic Chemistry in biology and drug development
Electives/ DSE-IV	21MBP24A	A	Industrial Biotechnology
	21MBP24B	B	Advanced Microbiology
	21MBP24C	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

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


BOS-Chairman/Chairperson
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. To fix the practical marks for PG programme for Internal assessment and External assessment as 50 marks I.E. and 50 marks E.E and to modify the component for Internal assessment as Test-1 = 20, Test-2 = 20 and Observation and concept application = 10.
4. To modify the Internal and External Assessment marks FOR THEORY as 40 and 60 for all the post graduate programme for the Academic year 2021-2022 and onwards. Subsequently, the Internal component is to be modified as Test -1 = 10, Model = 10 and other component = 20. The Components for internal assessment can be of 5 marks for each 4 components out of 10 components (**10 Components can be fixed by the concern boar chairman**) selected by the each subject incharges for their respective courses.
5. To incorporate Online courses as a non-credit skill enhancement course for the III and IV th 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)
6. **Two Elective courses DSE- III & DSE- IV are the subjects which are to be related with NPTEL courses.**

FAST TRACK SYSTEM:

The Students have the options of taking two subjects of the fourth 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 fourth semester, the student can be considered for a fast track programme, and do the project works alone during the fourth 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.

7. **If the students who are all completed the NPTEL courses before semester -III, they can avail exemption from appearing exams of DSE- III & DSE- IV in Fast track scheme.**
8. 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)

PG/MCA Scheme of Evaluation (Internal & External Components)

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

1. Internal Marks

Components	Marks
Test	10
Model Exam	10
Internal Assessment components	20 #
TOTAL	40

List of components for Internal Assessment

S.No	Components
1	Multiple choice questions
2	Quiz
3	Video teach
4	UT - Unannounced test
5	Co-operative or Collaborative Learning
6	Mini Project/Assignment
7	Case study
8	Seminar

(Any four components from the above list with five marks each will be calculated .4x5=20 marks)

2. a) Components for Practical I.E.

Components	Marks
Test -I	20
Test - II	20
Application*	10
Total	50

b) Components for Practical E.E.

Components	Marks
Experiments	40
Record	5
Viva	5
Total	50

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

Internships/Industrial Training (I.E)		Major Project Work		
Component	Marks	Component	Marks	Total Marks
Work diary	25	I.E a)Attendance	20	50
Report	50	b)Review	30	
Viva-voce	25			
Total	100	E.E* a) Final report	120	150
		b)Viva-voce	30	
		Total		200

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

4. Value Added Courses / Aptitude/Placement courses:

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

5. Guidelines for Open Elective

No of Activities	Marks
Two Tests (each 3 hours) of 50 marks each [5 out of 8 descriptive type questions 5 x 10 = 50 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.

For all PG/MBA/MCA Programmes (2021-2022 Regulations)
QUESTION PAPER PATTERN FOR CIA EXAM

Reg.No: _____ Q.P.CODE:
HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
PG/MBA/MCA DEGREE CIA EXAMINATIONS _____20_____

(_____Semester)

BRANCH: _____

Subject Name: _____

Time: Two Hours

Maximum: 50 Marks

Section-A (3 x 4=12 Marks)

Answer ALL Questions

ALL questions carry EQUAL Marks

(Q.No: 1 to 3 Either Or type)

Section-B (2 x 12=24 Marks)

Answer any TWO Questions out of THREE Questions

ALL questions carry EQUAL Marks

(Q.No: 4 to 6)

Section-C (1 x 14=14 Marks)

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

(Q.No: 7)

QUESTION PAPER PATTERN FOR MODEL / END SEMESTER EXAM

Reg.No: _____ Q.P.CODE:
HINDUSTHAN COLLEGE OF ARTS AND 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)

Course Code:	21MBP01	Course Title					Batch:	2021-2022 and Onwards	
		BACTERIOLOGY					Semester:	I	
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

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

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Justify the history of Microbiology and cell structures	K1, K2, K3, K4 & K5
CO2	Order the taxonomical classification of bacteria	K1, K2, K3, K4 & K5
CO3	Summarize the nutritional requirements for bacterial growth	K1, K2, K3, K4 & K5
CO4	Find and analyze microbial respiration and fermentation pathways	K1, K2, K3, K4 & K5
CO5	Evaluate cell signaling and biosynthetic pathways	K1, K2, K3, K4 & K5

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

SYLLABUS:

21MBP01	BACTERIOLOGY	Sem: I
Unit No.	Topics	Hours
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
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- Alcaligens; 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
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</u> - growth kinetics-Batch and continuous cultivation -synchronous	13

	growth -diauxic growth.	
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
V	Biosynthesis and cell signaling Biosynthesis of bacterial cell wall, biosynthesis of aminoacids (Pyruvate family) - bioluminescence. Cell signaling- types-mechanisms-G-protein linked receptors, hormone receptors and second messengers – Quorum sensing	13

***Self study**

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/>>

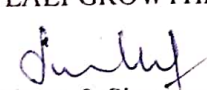
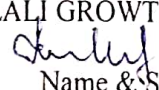
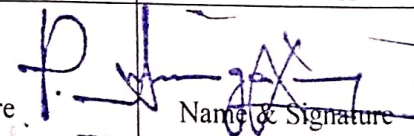
MAPPING WITH PROGRAMME OUTCOMES

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		S	L	S	M	M	S	S
CO2		S	L	S	S	L	S	S
CO3		S	L	S	L	S	S	S
CO4		S	L	L	L	L	S	S
CO5		S	L	S	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 Coordinator
DR. LALI GROWTHER  Name & Signature of the Staff	DR. LALI GROWTHER  Name & Signature	 Name & Signature

Co-ordinator
Curriculum Development Cell
Mandhan College of Arts & Science,
Coimbatore - 642 028.

Course Code:	21MBP02	Course Title						Batch:	2021-2022 and Onwards
		VIROLOGY						Semester:	I
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

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 plant viruses and disease transmission.
- 5.To demonstrate the diagnosis of viral diseases by suitable method.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Determine taxonomical classification and discriminate the architecture of viruses	K1, K2, K3, K4 & K5
CO2	Distinguish the various structure and replication of bacterial viruses	K1, K2, K3, K4 & K5
CO3	Summarize the life cycle of plant viruses to learn pathogenesis	K1, K2, K3, K4 & K5
CO4	Evaluate animal viruses and their pathogenesis	K1, K2, K3, K4 & K5
CO5	Evaluate the viral diagnostic methods	K1, K2, K3, K4 & K5

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

SYLLABUS:

21MBP02	VIROLOGY	Sem: I
Unit No.	Topics	Hours
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
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, MS2, phage typing and application. Viruses of cyanobacteria, algae, fungi.	13
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</u> . <u>Prevention of crop loss due to virus infection-virus free planting material – vector control.</u>	13
IV	Animal viruses Classification and nomenclature of animal viruses; epidemiology, life cycle,	13

	pathogenicity, diagnosis, prevention and treatment of RNA viruses – Rhabdo, Rota, HIV, Ebola, Dengue; Hepatitis, SARS, MERS, Covid 19 and oncogenic viruses; DNA viruses; pox, Adeno viruses. Viral vaccines: conventional vaccine, genetic recombinant vaccine- DNA vaccine with examples-Interferons	
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

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. Luria S.E. Darnel, J.E Jr. Baltimore. D and Campbell A., "General Virology", Wiley and sons, France.1967
2. Dimmock NJ, Primrose SB Introduction to Modern Virology, IV Edition, Blackwell Scieintific Publications Oxford. 1994

REFERENCE 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 DiagoTopley and Wilson's text book on principles of bacteriology, virology and immunology. Edward Arnold, London.1995

WEB RESOURCES

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

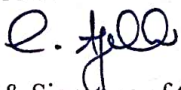
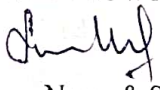
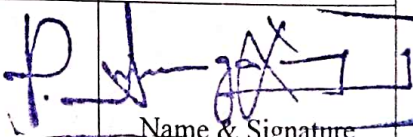
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	L	M	S	S
CO2	S	S	S	S	S	S	S
CO3	S	L	S	L	L	S	S
CO4	S	S	M	L	L	S	S
CO5	S	S	M	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 Coordinator
Mrs.C.AJITHA 	DR. LALI GROWTHER 	
Name & Signature of the Staff	Name & Signature	Name & Signature

Course Code:	21MBP03	Course Title						Batch:	2021-2022 and Onwards
		MYCOLOGY, PHYCOLOGY & PARASITOLOGY						Semester:	I
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

COURSE OBJECTIVES:

1. To impart knowledge of distribution of algae, fungi and protozoa.
2. To describe the role of fungi in ecosystem and distinguish its various adaptations.
3. To distinguish and differentiate different ecological perspectives of algae.
4. To elaborate the economic significance of algae, fungi and protozoa.
5. To describe the life cycle and clinical significance of parasites

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Summarize fungal structure, ecosystem and classification	K1.K2.K3, K4, K5
CO2	Summarize the ecology and classification of algae	K1.K2.K3, K4, K5
CO3	Assess protozoa and its life cycle	K1.K2.K3, K4, K5
CO4	Evaluate the economic importance of algae, fungi and protozoa	K1.K2.K3, K4, K5
CO5	Distinguish the life cycle of algae, fungi and protozoa	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP03	MYCOLOGY, PHYCOLOGY & PARASITOLOGY	Sem: I
Unit No.	Topics	Hours
I	Fungal Structure and classification Historical introduction to fungi – 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
II	Fungal ecosystem Fungal ecosystem- saprophyte, substrate groups and nutritional strategies of fungi and physiological specialization – Lichens- Mycorrhizae- Fungi as an Insect symbiont.	13
III	Phycology Distribution of algae, classification of algae (Fritsch), algal nutrition, algal thallus, algal reproduction, green algae, diatoms, Euglenoid, brown Rhodophyta, Pyrrophyta, algal ecology – spirullina production.	13
IV	Parasitology General concepts and Protozoology; introduction, classification- host parasite relationship, pathogenic mechanism, transmission and life cycle – Leishmania, Trypanosoma, Trichomonas, Balantidium, Toxoplasma and Cryptosporidium	13
V	Life Cycle and Economic Importance Fungi – Aspergillus, Penicillium, Mucor and Yeasts: Algae -	13

Chlamydomonas, Volvox, Chlorella and Diatoms. Protozoa – Entamoeba, Giardia. Helminthes – Ascaris, Taenia.

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. *Fundamentals of Mycology.*, J.H Burnett, publisher: Edward, Arnold Crane Russak.1968
2. Alexopoulos C.J and C.W Mims Mims 1979. *Introduction to Mycology (3rd edition)* ., Wiley Eastern Ltd, new delhi1979

REFERENCE BOOKS

1. Mehrotra R.S and K.S Aneja., *An introduction to Mycology, new age international publishers*1990
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

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>


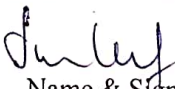
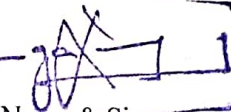
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	S	M	S	S
CO2	S	M	M	S	S	S	S
CO3	S	M	S	L	M	S	S
CO4	S	S	S	M	M	S	S
CO5	S	M	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 Coordinator
DR.J.ACHUTH  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:	21MBP04	Course Title						Batch:	2021-2022 and Onwards
		BIOCHEMISTRY						Semester:	I
Hrs/Week:	4	L	4	T	-	P	-	Credits:	4

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

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Summarize the structure of macromolecules and their properties	K1.K2.K3, K4, K5
CO2	Distinguish the metabolic pathways	K1.K2.K3, K4, K5
CO3	Summarize the properties, physiological functions and deficiency of vitamins and minerals	K1.K2.K3, K4, K5
CO4	Order the methods of purification of enzymes	K1.K2.K3, K4, K5
CO5	Assess the disorders of metabolism	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP04	BIOCHEMISTRY	Sem: I
Unit No.	Topics	Hours
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
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
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 – causes, manifestations and management –Macroelements – Physiological importance of calcium , phosphorus, magnesium, sodium and potassium – Trace elements – Physiological functions of iron, copper and iodine.	10
IV	Enzymes Classification of enzymes, specificity, active site, activity unit, isoenzyme.	10

	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.	
V	Clinical Biochemistry Disorders of carbohydrate metabolism – Hypoglycemia, Hyperglycemia, glycosuria. Disorders of Lipid metabolism- Atherosclerosis, Fatty liver and hyperlipidemia. Disorders of aminoacid metabolism - Cysteinuria, phenylketonuria, maple syrup disease, alkaptonuria. Disorders of purine and pyrimidine metabolism - Gout; Xanthinuria and Liathiasis, Orotic acid urea.	10

***Self study**

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. 2001
2. Lubert Stryer., "Biochemistry", Freeman and Company, NewYork.2002

REFERENCE BOOKS

1. Ambika Shammugam., "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.L., "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 26th edition Lange Mc Graw Hill.2009

WEB RESOURCES

- < https://onlinecourses.swayam2.ac.in/cec20_bt12/preview >
 < [Biology \(Singer\)/Bis2A Winter 2019/Lecture 04%3A Biomolecules](#) >


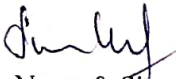
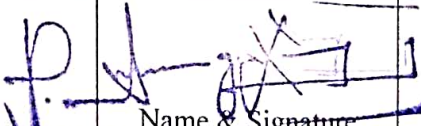
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	L	S	S
CO2	S	S	L	S	S	S	S
CO3	S	L	M	S	L	S	S
CO4	S	L	L	S	M	S	S
CO5	S	M	M	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 Coordinator
Ms.T.KRITHIKA 	DR. LALI GROWTHER 	
Name & Signature of the Staff	Name & Signature	Name & Signature

Co-ordinator

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

Course Code:	21MBP05	Course Title					Batch:	2021-2022 and Onwards	
		PRACTICAL I – BACTERIOLOGY, VIROLOGY, MYCOLOGY, PHYCOLOGY, PARASITOLOGY					Semester:	I	
Hrs/Week:	5	L	-	T	-	P	5	Credits:	3

COURSE OBJECTIVES:

1. To impart practical skills on sterilization and pure culture techniques
2. To determine the isolation and enumeration of various microbes
3. To develop practical knowledge on biochemical characterization of microbes
4. To enable students to observe fungi and protozoa microscopically
5. To explain anaerobic cultivation methods and isolation of coliphages

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Identify and evaluate microorganisms from soil.	K1.K2.K3, K4, K5
CO2	Apply microscopy to observe microorganisms and measure growth	K1.K2.K3, K4, K5
CO3	Test the biochemical characteristics of bacteria.	K1.K2.K3, K4, K5
CO4	Analyze the predict the morphology of algae and protozoa.	K1.K2.K3, K4, K5
CO5	Evaluate anaerobic cultivation methods.	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP05	PRACTICAL I – BACTERIOLOGY, VIROLOGY, MYCOLOGY, PHYCOLOGY, PARASITOLOGY	Sem: I
LIST OF EXPERIMENTS		Hours
1.	Isolation and enumeration of microorganism from soil – Bacteria, Fungi, Algae, Actinomycetes.	4
2.	Staining – Bacteria (Gram, Acid fast, Spore, Capsule and Negative) / Fungi (LPCB).	4
3.	Micrometry.	4
4.	Motility – Hanging drop method	3
5.	Growth curve – Viable count, Turbidity and Neubauer counting chamber.	4
6.	Effect of intrinsic factors on the growth of bacteria – pH, temperature, carbon and nitrogen.	4
7.	Thermal death point / Thermal death time.	4
8.	Biochemical Characterization – IMViC, Catalase, Oxidase, TSI and Ureases	4
9.	Polymer hydrolysis – Gelatin, Casein and Starch	4
10.	Study of Algae – Microscopy and culture	4
11.	Extraction of Heterocyst from Algae.	4
12.	Anaerobic culture technique- McIntosh Fildes jar and Wrights Tube method.	4

13. Preparation of permanent slide.	4
14. Isolation of Coliphage.	5
15. Titration of Coliphage	5
16. Observation of Protozoa - Hay Infusion broth.	4

Teaching methods:

Hands on experiments

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. S.Rajan & R.Selvi Christy, "Experimental procedures in Life Sciences", 2018.

REFERENCE BOOKS

1. 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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	M	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	M	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 Coordinator
DR.N.VANITHA  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:	21MBP06	Course Title						Batch:	2021-2022 and Onwards
		PRACTICAL PRACTICAL II – BIOCHEMISTRY						Semester:	I
Hrs/Week:	5	L	-	T	-	P	5	Credits:	3

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

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Select the methods to estimate macromolecules quantitatively	K1.K2.K3, K4, K5
CO2	Evaluate the methods of immobilization of microbial cells	K1.K2.K3, K4, K5
CO3	Assess the separation of macromolecules	K1.K2.K3, K4, K5
CO4	Distinguish the techniques for protein separation and purification	K1.K2.K3, K4, K5
CO5	Evaluate the applications of chromatography	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP06	PRACTICAL II - BIOCHEMISTRY	Sem: I
LIST OF EXPERIMENTS		Hours
	1. Estimation of protein by Folin-Lowry method	6
	2. Quantitative estimation of sugars by DNS method.	6
	3. Study of UV absorption spectra of macromolecules (protein, nucleic acid/ bacterial pigments).	6
	4. Separation of amino acids / sugars / by TLC and Paper chromatography.	6
	5. Microbial production of enzyme (Amylase).	6
	6. Study of enzyme activity (Amylase)	6
	7. Enzyme purification by salt precipitation and dialysis.	6
	8. Determination of molecular weight by SDS-PAGE.	6
	9. Column chromatography.	6
	10. Immobilization of cells and enzyme using Sodium alginate.	6
	11. HPLC (Demo/ Workshop)	5

Teaching methods:
Hands on experiments

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. 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).

WEB RESOURCES

<https://www.researchgate.net/publication/332028407_Biochemistry_A_Practical_Manual>


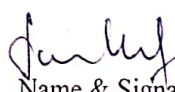
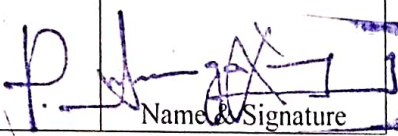
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	S	S	S	L	M	S	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	M	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 Coordinator
Ms. T. KRITHIKA  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:	21MBP08	Course Title						Batch:	2021-2022 and Onwards
		APPLIED BIOTECHNIQUES						Semester:	II
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

COURSE OBJECTIVES:

1. To impart knowledge on the use and operation of microscopes.
2. To apply the bioanalytical techniques like chromatography
3. To understand the chromatographic techniques
4. To provide knowledge on electrophoresis
5. To demonstrate recombinant DNA techniques.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Summarize the principle and applications of Microscopy and Spectroscopy	K1.K2.K3, K4, K5
CO2	Compare the types of Centrifugation	K1.K2.K3, K4, K5
CO3	Distinguish the types of Chromatography	K1.K2.K3, K4, K5
CO4	Discriminate the methods of electrophoresis and radio isotopes	K1.K2.K3, K4, K5
CO5	Evaluate the gene transfer and r DNA techniques	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP08	APPLIED BIOTECHNIQUES	Sem: II
Unit No.	Topics	Hours
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
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
III	Chromatography Principles - instrumentation- Paper - TLC - HPLC - GC - MS - LC-MS gel filtration - Ion exchange - Column - Immuno adsorption- Affinity chromatography - applications.	13
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 -	13

	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.	
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

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. Keith Wilson and John Walker., "Practical Biochemistry", WMC Brown Publishers, New Delhi 1994
2. David Freifelder., "Physical Biochemistry", Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education NewYork 1994

REFERENCE BOOKS

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.L., " Principles of Biochemistry Cox- CBS Publishers, Newdelhi 1970

WEB RESOURCES

<https://www.academia.edu/36365635/Handbook_of_Analytical_Techniques_2_Volume_Set_pdf>

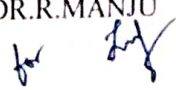
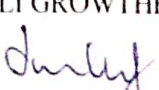
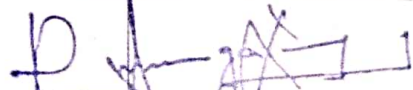
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	L	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	M	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 Coordinator
DR.R.MANJU 	DR. LALI GROWTHER 	
Name & Signature of the Staff	Name & Signature	Name & Signature

Co-ordinator
Curriculum Development Cell

Course Code:	21MBP09	Course Title					Batch:	2021-2022 and Onwards	
		IMMUNOBIOLOGY					Semester:	II	
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

COURSE OBJECTIVES:

1. To infer on immune system and types of immunity.
2. To describe the different types of antigen, antibody and complement system.
3. To interpret on hypersensitivity reactions, cancer and transplantation immunology.
4. To recognize molecules in antigen presentation, autoimmune and immunodeficiency diseases.
5. To demonstrate antigen-antibody reactions and other techniques involved in immunology.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Evaluate the immune system and its response and immunization	K1.K2.K3, K4, K5
CO2	Differentiate the types of antigen, antibody and complement pathways	K1.K2.K3, K4, K5
CO3	Discriminate hypersensitivity and illustrate transplantation immunology	K1.K2.K3, K4, K5
CO4	Assess antigen processing, presentation and analyze autoimmune, immunodeficiency diseases	K1.K2.K3, K4, K5
CO5	Evaluate antigen and antibody reactions and its uses in diagnostics	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP09	IMMUNOBIOLOGY	Sem: II
Unit No.	Topics	Hours
I	Immune system and Immunity History of Immunology; structure, composition and function 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.</u>	13
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
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)</u>	13

	and immunosuppressive therapy.	
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 Bacteria (Tuberculosis, Parasite, Malaria, Virus, HIV. Vaccine types. <u>Autoimmune disorders: Organ specific autoimmune diseases and Systemic autoimmune diseases – Hashimoto’s thyroiditis, SLE. Immunodeficiency diseases: SCID and AIDS.</u>	13
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 microarray- lymphochip. In Situ localization techniques - FISH & GISH	13

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. Tizard, R.I., "Immunology-An Introduction", Saunder's College publishers, Philadelphia. 2012
2. David Freifelder., "Physical Biochemistry", Joanne M. Willey, Linda Sherwood, Christopher J. Woolverton. McGraw-Hill Higher Education NewYork. 1994

REFERENCE BOOKS

1. Roitt, I.M., "Essential of Immunology", Black Well Scientific Publishers, NewYork. 2006
2. Ashim K. Chakravarthy., Immunology, TataMcGraw-Hill, New Delhi 2006
3. Kuby. J., "Immunology", W.H. Freeman and co., NewYork. 1992

WEB RESOURCES

<https://swayam.gov.in/nd1_noc20_bt43/preview>

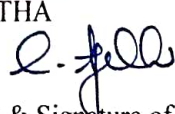
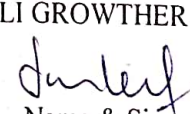
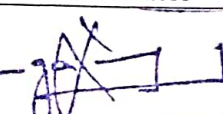
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	L	S	S
CO2	S	M	M	L	S	S	S
CO3	S	S	S	M	M	S	S
CO4	S	M	L	M	S	S	S
CO5	S	S	M	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 Coordinator
Mrs.C.AJITHA 	DR. LALI GROWTHER 	
Name & Signature of the Staff	Name & Signature	Name & Signature

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

Course Code:	21MBP10	Course Title					Batch:	2021-2022 and Onwards	
								GENETIC ENGINEERING	
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

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.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Evaluate the importance of the central dogma of Molecular biology	K1.K2.K3, K4, K5
CO2	Differentiate the types of mutations and repair mechanisms	K1.K2.K3, K4, K5
CO3	Justify the concepts of genetic recombination	K1.K2.K3, K4, K5
CO4	Assess the enzymes and vectors in genetic engineering	K1.K2.K3, K4, K5
CO5	Justify the development of transgenic plants and animals	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP10	GENETIC ENGINEERING	Sem: II
Unit No.	Topics	Hours
I	Gene expression and regulation 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).	14
II	Site directed mutagenesis 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.	12
III	Enzymes and Vectors in Cloning 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, pBR322, pUC, Bacteriophage vectors-λ (insertional and replacement vectors), M13, Cosmids, Phagemids, Phasmids and BAC- Eukaryotic vectors- Yeast Vectors- YAC. Animal	13

	vectors-SV40, Retroviral vectors, Plant vectors- Ti Plasmid- Expression vectors and Shuttle vectors.	
IV	Genetic Engineering 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.	12
V	Applications of Genetic Engineering Engineering microbes - Insulin production in <i>E. coli</i> , Production of Vaccines for Hepatitis B Virus using yeast- Engineering plants - insect, virus, herbicide 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>	14

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. David Freifelder., "Molecular biology", Narosa publishing house, New Delhi.1983
2. Gardner, E. J, Simmons, M J&D P Snustard., "Principles of Genetics", John Wiley & Sons, New York.2006

REFERENCE BOOKS

1. Robert H. Tamarin., "Principles of Genetics", WmC Brown Publishers, NewYork.1981
2. Lewin.B., *Genes XII*", Oxford University Press, New York2017
3. Klug .W.S. & Cummings, MR., "Essentials of Genetics", Mentics Hail, NewJersey.2016

WEB RESOURCES

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



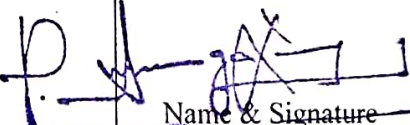
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	S	M	S	S	M	S	S
CO3	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S
CO5	M	M	S	M	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 Coordinator
Dr.T.VINOTHA 	DR. LALI GROWTHER 	
Name & Signature of the Staff	Name & Signature	Name & Signature

Co-ordinator
Curriculum Development Cell
Hindusthan College of Arts & Science.

Course Code:	21MBP11	Course Title					Batch:	2021-2022 and Onwards	
		MEDICAL MICROBIOLOGY					Semester:	II	
Hrs/Week:	4	L	4	T	-	P	-	Credits:	4

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.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Differentiate the types, sources and methods of transmission of infection	K1.K2.K3, K4, K5
CO2	Assess the pathogenicity and lab diagnosis of Gram positive bacteria	K1.K2.K3, K4, K5
CO3	Compare the pathogenicity and lab diagnosis of Gram negative organisms	K1.K2.K3, K4, K5
CO4	Discriminate the types of fungal infections	K1.K2.K3, K4, K5
CO5	Summarize the rapid diagnostic tests	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP11	MEDICAL MICROBIOLOGY	Sem: II
Unit No.	Topics	Hours
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, Skin infections, Nosocomial infections, Pyrexia of unknown origin.	11
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
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</i>	10

	<i>cholerae, Bordetella pertussis, Yersinia pestis, Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> .	
IV	Mycology Mycoses – superficial, subcutaneous and systemic infections – <i>Dermatophytoses, Madura mycosis, Cryptococcosis, Histoplasmosis, Blastomycosis</i> - opportunistic mycoses- <i>Candidiasis, Mucor mycoses</i> and <i>Aspergillosis</i>	10
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

***Self study**

Teaching methods:

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

TEXT BOOKS:

1. Ananthanarayan and Jayaram Paniker., "Textbook of Microbiology", (2020)University Press India Pvt ltd. New Delhi. 11th ed.
2. Jawetz E Melnic JL and Adelberg EA , review of Medical Microbiology Lange Medical Publications, USA. 1963

REFERENCE BOOKS

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

WEB RESOURCES

<<https://www.pdfdrive.com/medical-microbiology-e18737002.html>>
< <http://www.freebookcentre.net/Biology/Mycology-Books.html>>

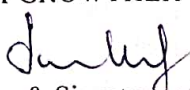
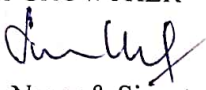
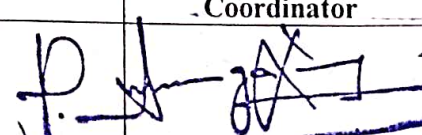
MAPPING WITH PROGRAMME OUTCOMES

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		S	S	M	L	M	S	S
CO2		S	S	M	S	L	S	S
CO3		S	S	M	S	S	S	S
CO4		S	S	M	S	S	S	S
CO5		S	S	S	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 Coordinator
DR. LALI GROWTHER  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:	21MBP12	Course Title						Batch:	2021-2022 and Onwards
		PRACTICAL III - IMMUNOBIOLOGY AND MEDICAL MICROBIOLOGY						Semester:	II
Hrs/Week:	5	L	-	T	-	P	5	Credits:	3

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

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Justify the methods to identify pathogens from clinical specimens	K1.K2.K3, K4, K5
CO2	Evaluate antibiotic sensitivity testing and interpretation	K1.K2.K3, K4, K5
CO3	Measure antigen, antibody reactions by various tests	K1.K2.K3, K4, K5
CO4	Test and identify the blood cells	K1.K2.K3, K4, K5
CO5	Assess the efficiency of disinfectants	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP12	PRACTICAL III - IMMUNOBIOLOGY AND MEDICAL MICROBIOLOGY	Sem: II
LIST OF EXPERIMENTS		Hours
1) Diagnostic Microbiology: Isolation and identification of pathogens from clinical specimens a) Throat swab b) Urine c) Pus d) Faeces e) Blood.		10
2. Isolation and identification of clinically important fungi a) <i>Candida albicans</i> b) <i>Aspergillus niger</i> c) <i>Cryptococcus neoformans</i>		5
3. Antibiotic susceptibility test - Kirby Bauer technique		5
4. Examination of blood smear study for <i>Plasmodium</i> sp.,		5
5. Agglutination reaction - Blood grouping & Rh Typing.		5
6. Immunodiffusion - ODD Test.		5
7. Diagnostic Tests - WIDAL (Slide & Tube Test), RA, ASO, CRP, RPR.		6

8. Identification and enumeration of Leucocytes	6
9. Immuno electrophoresis – Counter Current & Rocket Immuno electrophoresis.	6
10. ELISA.	6
11. Phenol co-efficient test.	6

Teaching methods:

Hands on experiments

TEXT BOOKS:

1. N. Murugalatha, Lali Growther, J. Vimalin Hena, N. Hema Shempagam, R. Anitha, D. Kanchana Devi, G. Rajalakshmi, *Microbiological Techniques*, 2013, MJP Publisher.
2. M. Daw A. Daeki K. Taweel K. El-Figih M. ELLABIB A. Al-Tubuly *Medical Microbiology Laboratory Manual Second Edition 2009. Edition: Second Edition Publisher: Mohamed A Daw*

REFERENCE BOOKS

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

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>


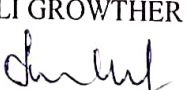
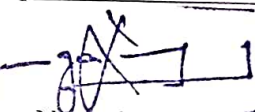
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	M	S	M	S	L	S	S
CO4	S	S	L	M	S	S	S
CO5	S	S	S	M	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 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:	21MBP13	Course Title					Batch:	2021-2022 and Onwards	
		PRACTICAL IV - APPLIED BIOTECHNIQUES AND GENETIC ENGINEERING					Semester:	II	
Hrs/Week:	5	L	-	T	-	P	5	Credits:	3

COURSE OBJECTIVES:

1. To develop practical knowledge on isolation and separation of biomolecules.
2. The students will receive hands-on training in DNA and RNA isolation methods.
3. The students will be acquainted with a variety of mutant isolating techniques.
4. The students will get practical training in transformation and conjugation methods.
5. They will gain expertise in detecting carcinogens.

COURSE OUTCOMES:

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Summarize methods to separate biomolecules	K1.K2.K3, K4, K5
CO2	Compare the methods to identify mutants	K1.K2.K3, K4, K5
CO3	Compare gene transfer techniques	K1.K2.K3, K4, K5
CO4	Assess mutants using physical and chemical methods	K1.K2.K3, K4, K5
CO5	Evaluate the carcinogenicity by AMES test	K1.K2.K3, K4, K5

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

SYLLABUS:

21MBP13	PRACTICAL IV APPLIED BIOTECHNIQUES AND GENETICS ENGINEERING	Sem: II
LIST OF EXPERIMENTS		Hours
	1. Separation of serum protein by gel electrophoresis.	6
	2. Isolation of chromosomal DNA –(Phenol chloroform method)	6
	3. Isolation of chromosomal DNA (Using magnetic beads)	6
	4. Isolation of plasmid DNA.	6
	5. Quantification of DNA by diphenylamine test.	6
	6. Isolation of mutants by physical and chemical agent (EMS)	7
	7. Isolation of antibiotic resistant mutants by gradient plate technique.	7
	8. Study of conjugation in <i>Escherichia coli</i> .	7
	9. Transformation in <i>Escherichia coli</i> .	7
	10. Detection of carcinogens- AMES test.	7
	11. Extraction of RNA from <i>Saccharomyces cerevisiae</i> .- (Demo)	7

Teaching methods:
Hands on experiments

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. Tiwar, G.S. Hoondal Laboratory Techniques in Microbiology & Biotechnology, Swastik publishers. 2005.

REFERENCE BOOKS

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

WEB RESOURCES

< <http://vlab.amrita.edu/?sub=3&brch=77> >

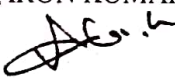
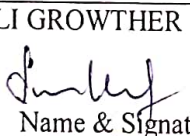
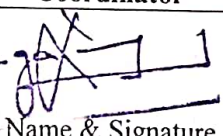
MAPPING WITH PROGRAMME OUTCOMES

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	S	S
CO2	S	L	S	S	S	S	S
CO3	S	S	M	S	M	S	S
CO4	S	S	M	S	M	S	S
CO5	S	L	M	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 Coordinator
DR. G.ARUN KUMAR  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.